Urban attraction policies for science and technology talent:

Case studies of Chinese cities

Miss Yuxuan Shan

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นโยบายระดับเมืองเพื่อการดึงดูดแรงงานทักษะสูง
ด้านวิทยาศาสตร์และเทคโนโลยี กรณีศึกษา เมืองในประเทศจีน

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By   Miss Yuxuan Shan
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Thesis Advisor   Sutee Anantsuksomsri

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.... Dean of the FACULTY OF
                                         ARCHITECTURE
        (PINRAJ KHANJANUSTHITI)

THESIS COMMITTEE
.... Chairman
        (APIWAT RATANAWARAHA)
.... Thesis Advisor
        (Sutee Anantsuksomsri)
.... External Examiner
        (Suwadee Thongsukplang Hansasooksin)

ยู่ชวน ชาน : นโยบายระดับเมืองเพื่อการดึงดูดแรงงานทักษะสูงด้านวิทยาศาสตร์และเทคโนโลยี กรณีศึกษา เมืองในประเทศจีน.
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ในยุคสมัยปัจจุบันที่มีการเปลี่ยนแปลงทางสังคมและเศรษฐกิจอย่างรวดเร็ว ทรัพยากรมนุษย์ที่มีทักษะสูง โดยเฉพาะคนเก่งในด้านวิทยาศาสตร์และเทคโนโลยี (science and technology talents) ที่เป็นส่วนสำคัญอย่างยิ่งในการพัฒนาเมือง ในช่วงหลายทศวรรตที่ผ่านมา รัฐบาลท้องถิ่นในประเทศจีนมีการแข่งขันกันอย่างสูง ในการกำหนดนโยบายเพื่อดึงคนเก่งเข้าไปอาศัยและทำงานในเมือง ในฐานะเมืองชั้นที่หนึ่งในประเทศจีน กรุงปักกิ่ง นครเซี่ยงไฮ้ เมืองกวางโจว และเมืองเซินเจิ้น มีความพยายามในการเป็นศูนย์กลางทางด้านวิทยาศาสตร์และนวัตกรรมของโลก ดังนั้นเมืองเหล่านี้จึงมีนโยบายระดับท้องถิ่นของตนเองในการดึงดูดคนเก่งในด้านวิทยาศาสตร์และเทคโนโลยี

งานวิจัยนี้ใช้ระเบียบวิธีวิจัยแบบกรณีศึกษาในการวิเคราะห์บริบทของนโยบายระดับท้องถิ่นในการดึงดูดคนเก่งในด้านวิทยาศาสตร์และเทคโนโลยี ในลักษณะของสิ่งแวดล้อมทางเศรษฐกิจ สถานการณ์ด้านวิทยาศาสตร์และเทคโนโลยี เครื่องมือเชิงนโยบาย และระดับของการพัฒนาคนเก่ง โดยวิเคราะห์นโยบายที่เริ่มต้นในระดับท้องถิ่นที่เกี่ยวข้องของรัฐบาลท้องถิ่นของกรุงปักกิ่ง นครเซี่ยงไฮ้ เมืองกวางโจว และเมืองเซินเจิ้น ในช่วง พ.ศ. 2554 ถึง 2563 ด้วยการวิเคราะห์เชิงเปรียบเทียบ (comparative analysis) เมืองทั้งสี่เมือง ในแง่ของข้อได้เปรียบและข้อเสียเปรียบของนโยบายต่าง ๆ ในแต่ละเมือง

ผลวิจัยแสดงให้เห็นว่า การแข่งขันในการดึงดูดคนเก่งของเมืองทั้งสี่ถูกขับเคลื่อนโดยปัจจัยหลายปัจจัย เช่น ทิศทางของนโยบายระดับชาติ และอุปสงค์ของการพัฒนาเมืองที่มีคุณภาพสูง โดยการดึงดูดคนเก่ง ในด้านวิทยาศาสตร์และเทคโนโลยีของเมืองในระดับหนึ่งนั้น มีวิธีการจำนวนมากและความหลากหลายที่สูง ผลการศึกษายังแสดงให้เห็นว่า การขาดความร่วมมือของรัฐบาลท้องถิ่นของเมืองกวางโจวและเมืองเซินเจิ้น ส่งผลให้ประสิทธิภาพของการดึงดูดคนเก่ง สู่ทั้งสองเมืองต่ำกว่ากรุงปักกิ่งและนครเซี่ยงไฮ้ นอกจากนี้ ผลการศึกษาแสดงให้เห็นว่า เครื่องมือเชิงนโยบายที่มีพื้นฐานการพัฒนาอุปทานด้านวิทยาศาสตร์และเทคโนโลยีมีประสิทธิภาพ ที่ค่อนข้างดีในเมืองทั้งสี่เมือง แต่ทว่าเครื่องมือเชิงนโยบายที่มีพื้นฐานการพัฒนาอุปสงค์ และด้านสิ่งแวดล้อมมีประสิทธิภาพที่ไม่ค่อยเพียงพอ

โดยสรุป นอกเหนือจากนโยบายระดับชาติแล้ว นโยบายที่ถูกริเริ่มจากรัฐบาลท้องถิ่นของเมืองระดับหนึ่งของประเทศจีน ในการดึงดูดคนเก่งในด้านวิทยาศาสตร์และเทคโนโลยีนั้นค่อนข้างประสบความสำเร็จในดึงดูดทรัพยากรมนุษย์ที่มีทักษะสูงเข้าสู่เมือง งานวิจัยนี้ยังได้เสนอแนะยุทธศาสตร์เมืองที่เกี่ยวข้องในการพัฒนานโยบายด้วยการเพิ่มความร่วมมือระหว่างเมือง เพื่อการพัฒนาประสิทธิภาพของนโยบายในการดึงดูดคนเก่ง ที่จะส่งผลให้เกิดความเร่งในการพัฒนาอุตสาหกรรม และนำไปสู่การพัฒนาเมืองที่ยั่งยืน

สาขาวิชา	ยุทธศาสตร์เมือง	ลายมือชื่อนิสิต ....
ปีการศึกษา	2564	ลายมือชื่อ อ.ที่ปรึกษาหลัก ....

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In the modern era of rapid socio-economic development, high-skill human resources, especially science and technology talents, have become pivotal to promoting urban development. For decades, there has been fierce competition among local governments in China to issue more competitive policies to attract talents to live and work in the cities. As China's first-tier cities, Beijing, Shanghai, Guangzhou, and Shenzhen have tried to achieve the goal of becoming a scientific and technological innovation center with global influence. Thus, these cities have implemented their local policies on talents.

This study adopts a case study research method to analyze the contexts of local government policies on the attraction of science and technology talents through the economic environment, science and technology situation, policy instruments, and talent development stages. Taking the relevant local initiative policies issued by Beijing, Shanghai, Guangzhou, and Shenzhen from 2011 to 2020, a comparative analysis of the four cities is carried out to find out the advantages and disadvantages of the implementation of the policies in each city.

The research findings show that the talent attraction competitions between the four cities are driven by various factors such as national policy orientation and the demands for high-quality urban developments. The attraction of science and technology talents of first-tier cities has shown various approaches and high diversity. The result also shows that the lack of cooperation between Guangzhou and Shenzhen causes the talent attraction in these two cities to be inferior to Beijing and Shanghai. In addition, the result shows that the supply-based policy instruments in the science and technology policies are likely to be adequate in these cities; however, the supply of demand-based policy instruments and environment-based policy instruments seems insufficient.

In conclusion, in addition to the national policies, the Chinese first-tier cities initiated policies on science and technology talent attraction are relatively successful in drawing high-skill human resources to the cities. The study also suggests relevant urban strategies for improving the policies by increasing more collaboration among the cities to improve the efficiency of the talent attraction policy resulting in accelerating industrial upgrading and sustainable urban development.

Field of Study:	Urban Strategies	Student's Signature	
Academic Year:	2021	Advisor's Signature	

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CHAPTER 1: INTRODUCTION

1.1 Background

Talent is the first resource, Chinese President Xi Jinping (2013) addressed, competition in overall national strength is ultimately competition for human resources. Talent resource as the first resource of economic and social development features and functions more obvious talent competition has become the core of comprehensive national strength competition. Whoever can cultivate and attract more talented people will have an advantage in the competition." In recent years, some countries, even cities have launched fierce competition in the attraction of talents. A series of social problems are reflected behind the talent war. The country's economic structure and development are transforming now. As a core element of economic development, talents play an increasingly prominent role in transformation and development.

The city is facing a serious talent crisis, and the aging population is getting worse. For cities, attracting and retaining talent is an effective way to alleviate the aging of the population. Competition between cities is becoming increasingly fierce. Talents are the basic resources and backbone of urban development, and they play an important role in the development of cities. Talent policy is the main approach for the government to attract talents Therefore, the issue of talent attraction has become a research hotspot.

1.1.1 Global background

In today's world, the competition for comprehensive national strength is ultimately the competition for talents. The successful introduction of high-level talents is one of the key factors affecting the rapid economic development of a region and even a country. Policies guide and promote the introduction of science and technology talents (Mcclelland, 1973). The world has entered a new era of competition in technological innovation. Technological innovation and its application drive economic and social development, while science and technology talents drive technological innovation. Putting people first, respecting science, and maximizing people's enthusiasm and initiative are important reasons why developed countries are directing the world in science and technology (Wang, 2019).

Countries all over the world have deployed talent strategies to seize the strategic high ground of technology and the economy. Governments and other organizations are also paying more and more attention to the evaluation and measurement of talent levels to cope with the battle for talent resources under the globalization situation in the 21st century. The Global Competitiveness Report (GCR) issued by the World Economic Forum, the Global Innovation Index (GII) report jointly issued by the World Intellectual Property Organization (WIPO), INSEAD, and Cornell University. The "IMD World Competitiveness Yearbook" (WCY), "IMD World Talent Ranking" reports were issued by the International Institute for Management Development (IMD). The national competitiveness or innovation capability evaluation reports with important international influence all regard talent, training, and reserve capabilities as

important evaluation indicators.

Through the Global Talent Competitiveness Index Report (INSEAD, 2020), New York tops the ranking this year, followed by London, Singapore, San Francisco, and Boston. This report finds that the gap between high-income, talent-rich nations and the rest of the world is widening; more than half of the population in the developing world lack basic digital skills.

Longitudinal analyses of talent competitiveness reveal that some developing countries such as China, Costa Rica, and Malaysia possess the potential to become 'talent champions' in their respective regions.

In this context, human resources have become an important factor of production that countries and regions compete for, and they are also the main source of power to promote the urban economy. The policy of science and technology talents helps to introduce and retain science and technology talents, pay attention to the cultivation and exchange of science and technology talents after the introduction, and help to improve the independent innovation ability of the scientific and technological talent system (Hiltrop, 1999).

In the field of scientific and technological innovation, the key role of talent resources is becoming more and more obvious, and the extensive competition for talents will become more intense; the construction and development of scientific and technological personnel are an inevitable requirement for the development of urban internationalization and modernization. The development and construction of a city's

science and technology talent team play a vital role in the development process.

1.1.2 Chinese background

Building an innovative country is a development strategy in China, and science, technology, and talents have become the most important strategic resources for strong national strength. According to the "China Scientific and Technological Talent Development Report 2018" (Literature Research Office of the Central Committee of the Communist Party of China, 2018), in 2017, China's scientific and technological human resources reached 87.05 million, and the full-time equivalent of research and development (R&D) personnel in the whole society reached 4.034 million person-years. The scientific and technological talent team and quality have been significantly improved.

The driving force of scientific and technological innovation lies in talents, and science and technology talent resources reflect the development potential of a city and even a country. However, at present, China's research foundation is still weak, which is reflected in the lack of independent research and development capabilities for core and key technologies, the lack of the world's top science and technology talents and technical leaders, the lack of senior skilled personnel, the disconnection between higher education and actual innovation practices, and the lack of attention to vocational and technical education. At the same time, with the prosperity of the Internet industry, traditional manufacturing has been left out, basic industrial technology research and development are slow, and scientific theoretical research

lacks sufficient talents. (Li, 2017).

In 2010, the Central Committee of the Communist Party of China and the State Council issued the "National Medium and Long-term Talent Development Plan Outline (2010-2020)", which proposed that by 2020, the total human resources of China should reach 180 million people, and the proportion of skilled workers in high-skilled personnel should reach 28%. , The proportion of human capital investment in GDP should reach 15%, and the average talent contribution rate from 2008 to 2020 should reach 35%.

Xi Jinping pointed out that development is the top priority, talent is the top resource, and innovation is the top driving force. "Promoting the free flow of human resources" was included in the 2018 government work report as an important part of the reform to deepen the system of human resources development.

In this context, Chinese cities have introduced various preferential policies to attract talents to get a head start in the "competition for talents".

In recent years, a lot of cities have introduced policies to attract and support talents, and the "grabbing battle" has become more and more fierce.

"City Talents Eco-index Report of China 2020" (WeChain et al., 2020) announced, Shanghai, Beijing, and Shenzhen rank in the top 3 for the science and technology index in the report. Guangzhou, Hangzhou, Nanjing, Chengdu, Jinan, Suzhou, and Tianjin are among the top ten. A large number of talents are gathered in the four first-tier cities of Beijing, Shanghai, Guangzhou, and Shenzhen.

According to the GDP ranking of Chinese cities in 2020, first-tier cities have a better economy than other cities and are international science and innovation centers and all have high-tech industrial development zones,

Through the release of national policies, such as Suggestions on Promoting high-quality Development of National High-tech Industrial Development Zones (The State Council, 2020), and General Plan on Promoting the Construction of National Technology Innovation Center (Interim) (Ministry of Science and Technology, 2020) it can be shown that the state supports the implementation of the development of science and technology innovation centers, which increases the demand for science and technology talents and promotes the competition for science and technology talents

1.2 Talent attraction policy review

In the wave of globalization, talent policy plays an important role in weakening market dominance and playing a powerful role in promoting the change of talent flow pattern and talent resource concentration. Studies show that talent mobility is driven by the economy from the 1960s (Comay, 1971; Creehan, 2001; Sani, 2000; Tinguy & Wenden, 1993) towards pluralistic environment drive (Florida, 2002; Shapiro, 2006; Buch et al., 2013), policy-driven (Huang Hai Gang, 2017). A study using CV (curriculum vitae) analysis tool shows that the current phenomenon of "talent flow and attraction" is the result of the talent attraction policy that the country has planned to carry out in the past years to promote economic development (Jonkers & Tijssen,

2008).

1.2.1 Global attraction policy

Table 1 lists the talent policies of major developed countries in the 21st century. The policies of various countries mainly target talents with several characteristics: overseas talents, young talents, scientific and technological talents, and outstanding students (including foreign students). The policy system covers science and technology talent policies education policies, and immigration policy, etc.

Table 1*: Developed countries' main sci-tech talent policies in the 21st century*

Country	Talent attraction policy	Target group
US	● 2007 America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act[1]; ● 2017 American Innovation and Competitiveness Act[2];	Innovative talents, global outstanding talents (students, scientists, engineers), national science and technology talents
Japan[3]	● The Basic Plan for Science and Technology (issued every five years) ● The Comprehensive Strategy for Science and Technology Innovation (issued annually)	International top high-end talents, young outstanding talents, young scholars, foreign scholars

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[1] Source: https://www.congress.gov/bill/110th-congress/senate-bill/761/cosponsors
[2] Source: https://www.congress.gov/bill/114th-congress/senate-bill/3084
[3] Souce: https://www8.cao.go.jp/cstp/tougosenryaku/index.html

	• 2017 A comprehensive strategy for scientific and technological innovation • 2020 Integrated innovation strategies	
Germany	• Pact for Research and Innovation[4] • Internationalization of education, science, and research[5] • High-Tech Strategy 2025[6]	Non-german talents, outstanding scientific and technological talents, young scientists, overseas research talents, overseas German talents
UK	• 2002 Highly Skilled Migrants Program[7] • 2004 Science and Innovation Investment Framework 2004-2014[8] • 2021 The points-based immigration system: The Graduate immigration route[9];	Scientists, engineers, technicians, high school teachers, graduate students

From an international perspective, the talent policy has formed three typical systems:

The first is to exchange knowledge for citizens, represented by developed

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[4] Source: https://www.bmbf.de/bmbf/de/forschung/das-wissenschaftssystem/pakt-fuer-forschung-und-innovation/pakt-fuer-forschung-und-innovation.html

[5] Source: https://www.bmbf.de/SharedDocs/Publikationen/de/bmbf/pdf/internationalisierung-von-bildung-wissenschaft-und-forschung.html

[6] Source: https://www.bmbf.de/bmbf/en/research/hightech-and-innovation/high-tech-strategy-2025/high-tech-strategy-2025_node.html

[7] Source: https://workpermit.com/immigration/united-kingdom/highly-skilled-migrants-program

[8] Source: Science and Innovation Investment CORE View metadata, citation and similar papers at core.ac.uk provided by Digital Education Resource Archive. (2007)

[9] Source: https://www.bmbf.de/bmbf/de/forschung/das-wissenschaftssystem/pakt-fuer-forschung-und-innovation/pakt-fuer-forschung-und-innovation.html

countries, which is embodied in the point threshold policy based on skills, academic qualifications, and knowledge levels. For example, the Ministry of Justice of Japan formulated the "Senior Talent Points System" in 2012 to attract senior talents in three fields: senior academic researchers, senior professional and technical personnel, and senior business management personnel. This is also a prioritized way to obtain the right of the citizen. France formally implemented the "New Immigration Law" in May 2016 and issued a "talent passport" long-term residence visa since November of the same year, aiming to attract talents from all over the world in the fields of economy, science, art, and sports.

The second is to exchange capital for talents, represented by emerging countries, which is embodied as an attractive policy based on economic incentives; the British government has established the Newton International Talent Program, the Wolfson Research Value Award, the Queen Elizabeth Engineering Award, and other awards to attract foreign talents to the UK Receiving higher education or engaging in academic research, encouraging innovative talents who have made contributions in scientific research and production, education and research. The entire plan covers the entire process of supporting the development of innovative talents.

The United States has established "National Science Award", "National Technology Award", "Fermi Award", "Young Scientist Presidential Award" and other national awards (Pei et al, 2014) to reward innovative talents who have made outstanding contributions to the development of science and technology and

encourage young scholars Pioneering and innovative, cultivating innovative talents.

The third is to provide a platform to gather talent, relying on the carrier to attract talents, carry out international exchanges and cooperation on a larger scale, broader field, and higher levels, build a platform to attract talents, and form a mutually beneficial and win-win network of cooperation. The platform policies of developed countries mainly focus on the creation of platform carriers. By supporting platform carriers, attract and utilize global high-end talents, form an "ecosystem" of talent gathering, and produce a strong magnetic field effect of "gathering talents with talents" (Yi, 2016).

For example, the United States, Europe, etc. have initiated world-class scientific projects to bring together scientists from all over the world to overcome human scientific research difficulties. CERN launched an international cooperation program in September, 2008-the Large Hadron Collider (LHC) project. More than 7,000 scientists from nearly 80 countries and regions participated in the project. The International Space Station program was initiated by the United States, and 16 countries and regional organizations including Russia, Canada, and Japan participated. So far, more than 2,400 scientists from 83 countries around the world have participated in more than 1,700 research on space stations.

Specifically, countries will use and adjust policy strategies and tools according to their institutional advantages and historical foundations. The talent policies of developed countries have a long history. Recently, talent policies of various countries

are closely embedded with their economic development, especially science and technology development plans.

Most developed countries try to attract researchers from all over the world through favorable financial conditions and a high degree of technological advantage, providing conditions for researchers to encourage them to emigrate to their home countries. Attracting talents is a long-term and complex social system project, which creates a complete system for the developed country to introduce talents into the industry, academia, research, and politics, which is the reason why the developed country attracts scholars and successful people from all over the world.

1.2.3 Chinese attraction policy

Over the past 40 years, China's socio-economic and historical development has shown that economic development and scientific and technological achievements that have attracted worldwide attention are inseparable from the party and the state's high attention to the work of science and technology talents, as well as the effective support of a series of scientific and technological talent policies. As early as the 1970s, prime minister Deng Xiaoping put forward the famous thesis of "respecting knowledge and respecting talents" in 1977 and "Science and technology are the primary productive forces" in 1988.

China restored the national college entrance examination system in 1978, and put forward the strategy of "rejuvenating the country through science and education" in 1995, taking education and science and technology as the basic policy of national

development. Since then, China has successively promulgated relevant policies and specific measures to promote talent training, vigorously introduce overseas high-level talents, and follow the international standards to learn from the talent training policies of advanced Western countries.

From the perspective of the talent development stage, basic policy categories, policy targets, and policy vertical structure, we can summarize the content of China's talent policy.

1) According to the human resource management link, the talent policy is the sum of a series of intervention measures in various development stages such as the introduction, encouragement, training, and management of talents formulated by the government as the main body (Huang, 2017; Liu & Li, 2016; Zhao & Liu, 2016).

2) In terms of policy targets, in recent years, China's talent policy has gradually incorporated overseas students, high-level talents, scientific and technological talents, overseas scientific and technological talents, entrepreneurial and innovative talent plans, etc. into the policy system.

3) Taking the gradient of talent demand as the policy category basis, talent policies can be divided into welfare policies and development policies (Chen & Li, 2009). Welfare policies include household registration, housing, children's enrollment, etc. related to the satisfaction of basic survival needs. Guarantee-oriented policies and developmental policies include project

funding, achievement transformation rewards, and other incentive policies that improve performance in the professional field.

4) Regarding the relationship between the central and local governments, the national-level talent policy is characterized by a macro and strategic nature, with the scientific development concept as the guiding ideology, the party's management of talents as the fundamental principle, and the national strategy to strengthen the country with talents, "party and government coexistence" organizational structure and "guidance, collaboration, and division of labor" practice mechanism (Zheng, 2012),

The local-level science and technology talent attraction policy embody the compatibility with the national strategy, the coordination with the local science and technology development, and the operational characteristics of emphasizing detailed rules (Gu, 2015).

At the same time, play the unique role of intermediary organizations in opening up channels for introducing talents, implementing talent introduction projects, and promoting the achievements of talent introductions, and making full use of the advantages of talent exchange institutions such as associations to establish a talent introduction support system.

In general, China's talent policy has formed a competitive relationship with other countries in terms of target coverage, degree of openness, and system construction. High-level talents, scientific and technological talents on a global scale are the

competition targets for talent policies of various countries.

1.3 Research questions

The science and technology talent policies are an effective means to promote technological innovation and attract science and technology talents. A sound science and technology talent policy is a key element to realize talent-driven technological development.

As international metropolises, Shanghai, Beijing, Guangzhou, and Shenzhen have good social and economic development, and talents play a vital role in them. Their government has formulated a large number of science and technology talent policies to attract high-level talents and gradually formed a policy system with a wide range of fields, complete categories, and rich instruments.

It should be affirmed that the construction of a policy system for science and technology talents in China's first-tier cities has achieved remarkable results.

This study attempts to explore the following questions:

● What is the development situation of science and technology talent policy in China?

● What are the factors to attract science and technology talents in Chinese first-tier cities?

● What are the strengths and weaknesses in Chinese first-tier cities?

1.4 Research objectives

The research content mainly includes the following aspects:

Firstly, through a large amount of literature reading and policy collection and review, know more about science and technology talent, and the importance of science and technology talent policy. Understand the development of talent policy in China, and put forward a solid theoretical basis for the later research.

Secondly, carry out case studies. Beijing, Shanghai, Shenzhen, and Guangzhou are first-tier cities in China, and they have relatively complete policy support and institutional guarantees in the work of science and technology talents, which are of reference significance for the construction of science and technology talents in other cities in China and other developing cities. So this study takes science and technology talent policies during 2011-2020 issued at the city-level in Beijing, Shanghai, Shenzhen, and Guangzhou as the main research objects. Through policy review and content analysis, make a comprehensive summary, comparative analysis, and quantitative research on the talent policies in Beijing, Shanghai, Shenzhen, and Guangzhou, to provide a reasonable direction for the formulation and improvement of the policies for science and technology talents.

Finally, based on comparative analysis results, combined with the national development situation, propose policy improvement opinions and urban development strategies to further strengthen the attraction and reserve of urban science and technology talents.

According to the above research content, this study attempts to achieve the following objectives.

- To further understand the policy for science and technology talent in China.

- To explore the factors in the policies on talent attraction.

- To evaluate talent policies through the strengths and weaknesses, differences, and similarities of first-tier cities in China.

- To suggest other cities on the formulation of talent policies and urban strategies.

1.5 Contributions

This study analyzes science and technology talent policies in China from the perspective of policy development and policy instruments, which is conducive to the scientific division of science and technology talent policies and studies the implementation approaches and functions of different types of policy instruments in science and technology talent policies.

Although scholars have studied and analyzed the science and technology talent policy in detail, this study combines previous research to create a new analysis framework from the dual perspectives of talent development stage and policy instrument and takes the science and technology talent policy of first-tier cities in China as case study objective, trying to construct the science and technology talent policy system framework from the two dimensions of "environment-content". Hope it can provide a new theoretical perspective and reference for other researchers to discuss the construction of scientific and technological innovation systems.

Through case studies, combining quantitative and qualitative research, let them

complement each other's strengths and make the data in this study more effective. It not only makes up for the defect of "only data and quantitative standards are supreme" through quantitative research but also makes up for the defect of lack of data support through qualitative research.

In a practical sense, the science and technology policy system of China's first-tier cities is representative of both the central government and other local governments. The analysis of the policy system of first-tier cities and the summary of successful experiences and lessons from failures are of great inspiration to the construction of the science and technology talent system of other cities.

At the same time, exploring the development situation in China's leading cities, providing reasonable and effective suggestions for the future policy system layout of other developing cities, which have strong practical significance and exploration value in promoting the implementation of talent-driven development strategy.

1.6 Limitations of the study

First, this study uses policy instruments and corresponding talent development stages to verify the rationality and deficiencies of the talent policy. It does not combine interview surveys, policy makers, and audiences to analyze the policy. The research may have a certain defect.

Second, like Beijing, Shanghai, Shenzhen, and Guangzhou have promulgated many policies related to talents, there is not yet a relatively complete system for combing these policies. Therefore, the author did not have relevant information to

refer to when collecting these policy texts, and there may be omissions in the collected policies.

Third, when using analysis software to encode policy texts in this study, there are subjective judgments on the distinction between policy instruments and talent development stages, which may make the research results inaccurate.

Finally, this study does not evaluate the effect of the policy and hopes to explore it in future research. Other limitations are added in Chapter 6.

1.7 Structure of the thesis
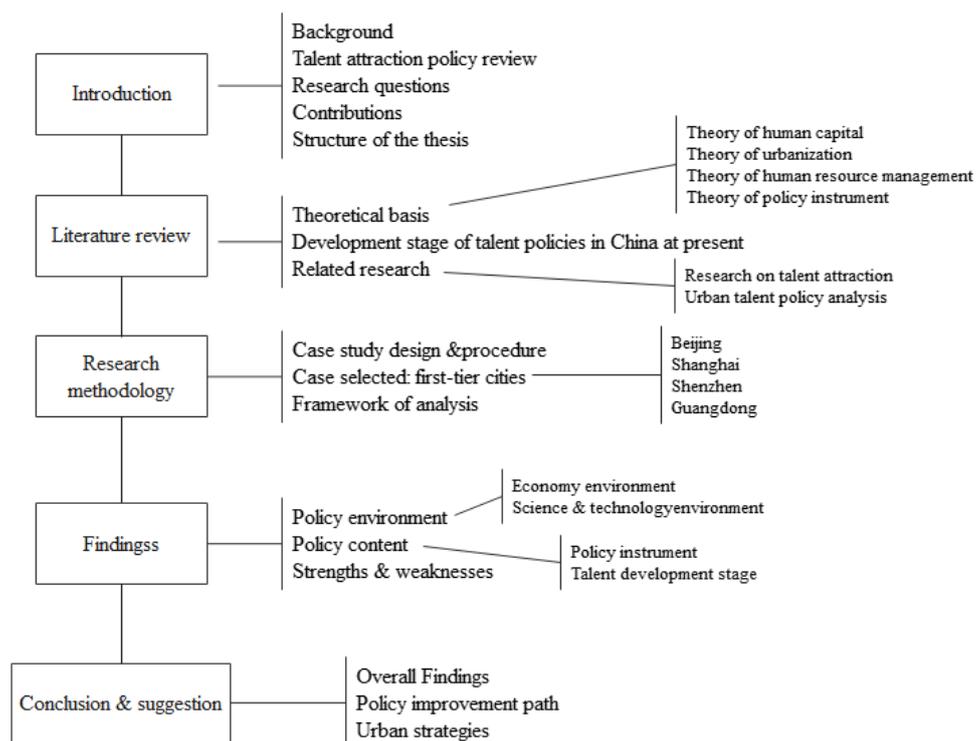
Figure 1: Research design

As is shown in Figure 1, The paper structure of this study is as follows:

Chapter 1 is the introduction. This chapter mainly introduces the research background, talent attraction policy review, research questions, contributions, and the

structure of the thesis.

Chapter 2 is the literature review. This chapter briefly describes four theses theoretical basis: human capital, urbanization, human resource management, and policy instrument, followed by related research.

Chapter 3 is the methodology of science and technology talent policy research. This chapter specifically elaborates the method, process, and basis of the case study, and proposes an analytical framework for the content of the talent policy, as well as the analysis process.

Chapter 4 is an analysis and comparison of the content of talent policy in 4 first-tier cities in China. This chapter analyzes and compares the environment and content of the talent policy. Based on the analysis results, it summarizes the strengths and weaknesses of science and technology talents in China's first-tier cities.

Chapter 6 is the conclusion and suggestion. This chapter summarizes the conclusions drawn from the science and technology talent policies of four first-tier cities in China and puts forward policy improvement paths and specific urban strategies. Then, based on the entire research, explore the limitations and of the study, and propose directions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Theoretical basis

2.1.1 Theory of human capital

Fisher (1906) put forward the concept of human capital for the first time in The Nature of Capital and Income and incorporated it into the analytical framework of economic theory. Schulz (1978) proposed the influence and function of human capital investment on economic growth. He addressed that human capital is the skills, abilities, and knowledge condensed on workers, and the accumulation of human capital is the main source of economic growth.

The most important form of productive capital is human capital with knowledge and skills.

Becker (1964) promoted the theory of human capital, proving that high-quality people with specialized knowledge and skills are the source of economic growth and social development. Different countries in the world today differ in the accumulation of human capital. The more talent there is, the more social and economic development there is.

The core point of the human capital theory is that human resource is the most important resource in all resources and the role of human capital is greater than that of material capital in economic growth.

The key point of human capital is to improve the quality of the population, and education investment is the main part of human capital investment (Ji & Chunyu, 2007). The return on investment of human capital is far greater than that of physical capital, and the main means of human capital investment is education. The economic output brought by highly skilled and knowledgeable people is higher than that brought by low-skilled people.

2.1.2 Theory of urbanization

Kuznets (1971) pointed out that urbanization is the product of economic growth and technological change. Clark (1940) regarded urbanization as "a process in which the population in the primary industry keeps decreasing and the population in the secondary and tertiary industries keeps increasing". Urbanization is a process in which population and social productive forces are gradually transferred and concentrated in cities. (Barton, 1984)

Demography regards cities as highly populated areas, and population size and density become the criteria for judging cities (Chen, 1987).

It is emphasized that urbanization is the migration of population from rural areas into large cities and the concentration of population in cities (Hertzler, 1963), in short, the phenomenon of the increasing proportion of people living in urban areas (Wilson, 1999) ". Economists see cities as the result of a high concentration of industrial and service economic activity (Barton, 1984)

With the increase of population, the industrial structure of the city has been

adjusted, and the secondary and tertiary industries have gathered and developed. The development of the secondary and tertiary industries has brought about the gathering of the population and strengthened the socialization and specialization of production.

Modern cities are the product of industrialization, and when industrialization reaches a certain stage, there will be an urbanization process with the tertiary industry as the main driving force (He, 2006). The tertiary industry is the product of industrial development. The higher the degree of industrial modernization is, the more active tertiary industry is. The tertiary industry occupies less urban land and consumes fewer resources than the primary and secondary industries, provides more jobs than them, and is more attractive to the laborers than others. Therefore, the development of the tertiary industry broadens the urban economic field and increases new employment positions.

On the one hand, the development of urban modern industry has put forward new requirements for the productive services of cities, such as the assistance of scientific research institutions, communications, finance and transportation, the cooperation of commercial wholesale and retail, advertising, and other industries, legal protection and the services of various economic affairs and management organizations (Ding et al., 2011).

On the other hand, with the rapid development of the social economy, the quality and level of people's lives have been continuously improved, and the demands of urban residents have been diversified (Wang, 2008). Therefore, urban services have

emerged, such as social insurance, culture and entertainment, medical and health care, sports and health care, culture and education, and life services. The productive service industry and the life service industry constitute the tertiary industry in the city.

2.1.3 Theory of policy instrument

Policy instrument theory has a wide range of applications (Carley, 2011; Bennear & Stavins, 2007) and has strong applicability. Therefore, there are many basic research results of policy instrument theory.

The book " Public management and administration" (Hughes, 1998) points out that policy instrument theory is a mechanism by which the government adopts certain behavioral means or uses certain methods to regulate and regulate government behavior. Salamon and Eliot (2002) gave their explanation of policy instruments, that is, policy instruments, which can also be called public action instruments, are a guiding way of organizing collective actions and solving public problems. Huang (2010) defined policy instrument as that the so-called policy instrument theory is to transform policy objectives into specific implementation plans.

As mentioned above, the definitions all have common points, that is, policy instruments are specific measures to achieve policy intent. Different measures are adopted to achieve different policy objectives, and the corresponding policy effects of adopting different measures will not be the same. So, how to formulate different policy instruments according to the policy objectives to be solved, that is, how to classify policy instruments, is also an important issue.

Schneider and Ingram (1990) divided policy instruments into five types: learning, incentive, symbolic, authoritative, and competence instruments from the way the government guides the behavior of target groups. Howlett and Ramish (2009) distinguished them into three categories: mandatory, voluntary, and mixed policy instruments.

Rothwell and Zegveld (1981) in "Industrial Innovation and Public Policy: Preparing for the 1980s and the 1990s" divided policy instruments into three categories: supply-based, environmental-based, and demand-based policy instruments. This classification method simplifies the complicated policy system from the perspective of measures, but at the same time strengthens the clarity of policy
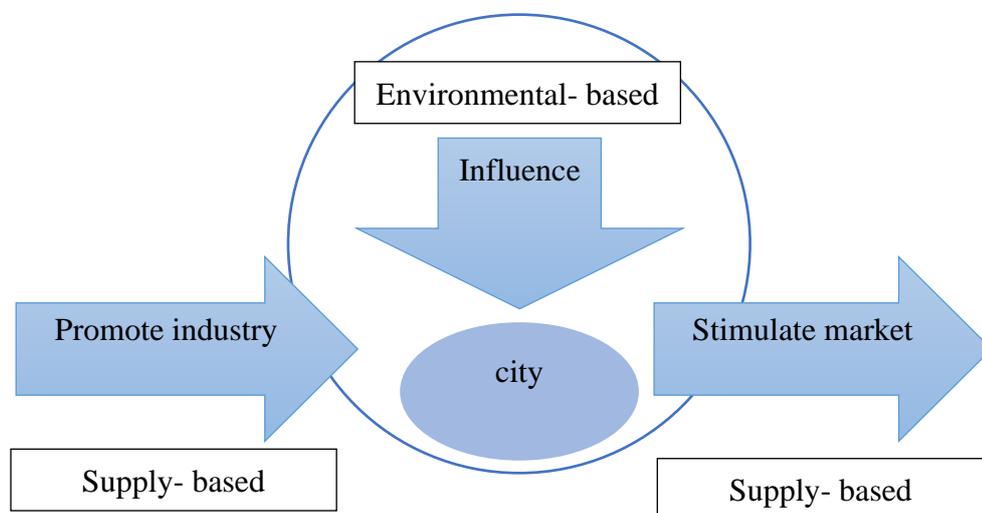
objectives.

Figure 2: Roadmap of the role of policy instrument

Source: Draw by the author

2.1.4 Theory of human resource management

With the continuous development of the times, the importance of talents has

gradually emerged, and competition between enterprises has gradually evolved into the competition between talents. For a developing company, the most important resource is not the number of fixed assets, but the quality of human resource management. Human resource management determines the future development direction of the company (Zhou, 2017).

For human resource management, it is mainly divided into six management modules. When the academic field defines the six human resources modules, they mainly include recruitment and allocation, training and development, performance management, salary and welfare management, labor relationship management, and human resources planning (Wang, 2020).

Human resource planning, which is the long-term plan and target requirements for human resource management.

Recruitment and allocation, according to the actual development of enterprises and institutions and the needs of human resources, formulate recruitment arrangements and other maintenance of employees.

Training and development, mainly involving the re-education and skill training of employees of enterprises and institutions to improve the quality of human resource management.

Performance management, the main work is the preparation, implementation, evaluation, summary, reflection, and work improvement of performance management.

Salary and welfare management, the main content is the welfare treatment of

enterprises, institutions, and employees and the construction of the salary system.

Labor relationship management is to determine the rights and obligations of people involved in labor incidents (Qin, 2016).

2.2 Related concepts and explanations

2.2.1 Science and technology talent

Feng (2007), based on literature review and analysis of the composition and quantity of scientific and technological personnel across the country, proposed that scientific and technological talents have deep scientific and cultural knowledge, strong professional and technical capabilities, and have made great contributions in their fields.

Luo and Li (2008) pointed out that scientific and technological talents are individuals or groups who should have extensive scientific and cultural knowledge, profound professional and technical capabilities, and should also recreate, disseminate and apply scientific and technological knowledge.

Xu, Zhang, and Zhan (2015) pointed out that science and technology talents are a type of group that has high creative ability and use their scientific and technological expertise to contribute their strength in scientific research activities.

The "Thirteenth Five-Year" National Science and Technology Talent Development Plan (2017) gives a clearer definition: science and technology talents are specialized in scientific research and development activities, are creative and professional, and use their rich scientific and cultural knowledge and comparative

knowledge. A group of groups with strong scientific research capabilities that contribute to scientific research and the construction of an innovative country.

This research defines science and technology talents as a group of people who are engaged in scientific research and development activities, have a strong professional background and scientific research capabilities, and have noble academic ethics, who can contribute their strength to the development of scientific research.

2.2.2 Policy for science and technology talent

The policy is one of the commonly used concepts in modern political life. James Anderson (1990) finds that a policy is a process of activities with a clear purpose, which is an action taken by a government agency or government official to deal with a certain thing or a certain project. Pan (1999) points out that policy is the action code issued by the country's ruler to achieve goals and tasks, and it is mainly used to adjust the corresponding social interest relations. Policies are closely related to the value orientation of those in power, include many objects, such as economy, diplomacy, education, and so on.

Regarding the concept of the talent policy, Xiao and Han (2009) find that talent policy refers to a series of policies and regulations related to the use of human talents and roles. It is the government's development, training, and utilization of talents to play the role of talents. The regulations and measures and actions were taken by the activities mainly include education policies, employment policies, and incentive policies. Chen and Zhu. (2009) believe that the talent policy is a system of policies,

measures, and rules formulated for the scientific and reasonable development, utilization, and allocation of human resources and human capital to achieve economic and social development goals. There is a consensus among the above scholars that talent policy is a lever for governments at all levels to cultivate, attract and make full use of talents, as well as an important means to allocate, optimize the structure and improve the quality of talents.

As to science and technology talent policy, Lou (2005) says that science and technology talent policy refers to a series of management measures and decrees formulated to promote the development of science and technology talents. And sometimes does not directly and solely target the science and technology talents. Liu, Zhao, and Wang (2018) point out that the science and technology talent policy is a code of conduct and institutional measures adopted by the government in a specific context to promote the development of science and technology talents and enhance the efficiency of science and technology talents in driving the development of economy, technology, and culture. Including measures such as laws and regulations, planning plans, and methods involving the training, introduction, use, and management of scientific and technological talents.

The scientific and technological talent policy defined in this paper refers to the political behavior or prescribed code of conduct adopted by the national party and government organs in a specific period to achieve or serve a certain goal of scientific and technological talents. It is a general term for a series of measures and methods.

2.3 Development stage of talent policies in China at present

The central government focuses on the deepening reform of innovation-driven and talent development systems and mechanisms.

Figure 3 shows a timeline of some of China's key policies. In 2011, the central government promulgated the National Medium- and Long-term Scientific and Technological Talent Development Plan (2010-2020), which stipulates more clearly the development goals of scientific and technological talents, the task of talent team building is more specific, and the reform measures of the talent management system and mechanism are more targeted.

In 2012, the 18th National Congress of the Communist Party of China put forward the "implementation of an innovation-driven development strategy", emphasizing the need to adhere to the path of independent innovation with Chinese characteristics and implement an innovation-driven development strategy (Chen et al., 2018).

Talents are the foundation of innovation, innovation-driven is essentially talent-driven, and science and technology talents have become the core element of innovation-driven.

In March 2016, the central government issued the "Opinions on Deepening the Reform of the Talent Development System and Mechanism", aiming to remove obstacles restricting the development of talents. In terms of cultivating, attracting, and using science and technology talents, highlight the orientation of "high-quality,

high-tech and short-cut", implement a more active, open, and effective talent introduction policy, and emphasize "gather the talents of the world to use them"; in terms of talent evaluation, emphasize Innovate the talent evaluation mechanism, optimize the role of the "baton" of talent evaluation, and continuously improve the scientific and pertinence of talent evaluation; in terms of talent incentives, strengthen the talent incentive mechanism and highlight the orientation of innovation and entrepreneurship, in the same year, the Outline of the National Innovation-Driven Development Strategy issued by the CPC Central Committee and The State Council pointed out that innovation-driven development is, in essence, talent-driven. The system for scientific and technological personnel has been improved through the implementation of a series of major plans for improving and deepening reform.

The "Thirteenth Five-Year" National Science and Technology Talent Development Plan has further made comprehensive and detailed arrangements for the work objectives, key tasks, and organizational measures of science and technology talents in the new era.

Based on the new requirements of socialism with Chinese characteristics entering

the new era, the 19th National Congress of the Communist Party of China proposed to

Figure 3: Part of science and technology talent policy development timeline

(2011-2020)

"train and cultivate a large number of international-level strategic science and

technology talents, leading science and technology talents, young science and

technology talents and high-level innovative teams." It points out the direction for the

future work of science and technology talents.

The science and technology talent policy is increasingly in line with the national strategic development needs, and strongly demonstrates the effectiveness and role of science and technology talents in promoting economic and social development. There is a certain degree of closeness between the science and technology talent policy and the specific historical background and economic and social development conditions of the policy.

The main points are as follows:

1) The central government (national leaders), as the main force to promote the change of China's talent policy, especially the emergence of key nodes, is determined by the nature of the socialist country and political system.

Each historical development stage of science and technology talent policy is divided by landmark events, and typical policies of landmark events are generally issued by the most authoritative departments of the country such as the CPC Central Committee or The State Council. The government can adjust and influence the development trajectory of scientific and technological talent policy through administrative instructions, education allocation, or education legislation. It should be noted that after the reform and opening up, the gradual improvement of the market economic system and the arrival of the era of economic globalization not only give universities and market-related interest groups more independent rights to

participate in the formulation of scientific and technological talent policies but also stimulate their enthusiasm to participate in the formulation of scientific and technological talent policies from the inside.

2) The policy for science and technology talents mainly serves the needs of China's socialist construction.

With the change of the focus of China's socialist market economy construction and social contradictions, the demand structure, level, and category of scientific and technological talents will change in each stage. For example, according to the needs of social development, China has carried out four large-scale adjustments of major and revision of subject catalog in 1987, 1993, 1998, and 2012, which is essentially the active strategic choice of The Chinese government to adjust the structure and specifications of talent training under the background of industrial structure transformation and upgrading.

3) The target population of the policy is becoming more and more diversified and refined, from the initial focus on scientific research institution personnel, professional technicians, and technology management personnel to technology leaders, scientific research personnel, strategic emerging industry professionals, engineering designers, and technology development personnel. The extension of science and technology talents, including personnel, science, and technology service personnel, science and technology

management personnel, and science and technology entrepreneurs, etc., along with the transmission, innovation, and diffusion of science and technology talent policies at various stages, the policy system has been deeply reformed and improved.

2.4 Related research

2.4.1 Talent attraction

Refiner (2006) compared the two highly developed cities in central Europe's academic talent attraction policy, established a framework, to analyze policy actions designed to attract international academic talents, and points out that although attract policy is very popular in politics, they are likely to bring some part of the urban social welfare results.

Geddie (2015), the research director of the International Forestry Research Center, analyzed the introduction of international student policies in Canada and the United Kingdom in the past 10 years, showing that the policy development path is the result of a competitive process. Chen and Li (2018) analyzed the talent wars in different parts of China and their characteristics, discussed the possible problems and the causes of this phenomenon, and finally put forward countermeasures to promote orderly talent competition and flow.

Liao (2016), focused on the talent aggregation effect, selected the relevant data of Beijing, Shanghai, and Guangzhou from1982 to 2013 as the analysis object, in-depth analysis of the relationship between talent aggregation and local economic

growth, research results show that the higher the degree of talent aggregation, the greater the contribution to local economic growth. Therefore, local governments have introduced various talent policies to attract and compete for talents.

Li and Gao (2018) put forward that in the increasingly fierce competition for talents, local governments should focus on the realization of talents' self-value, create a perfect employment environment, avoid the phenomenon of focusing on the introduction and underusing, and make full use of talents.

Yang (2019) studied the characteristics and evolution trend of Shanghai's science and technology talent policies in the past 10 years and proposed that future talent policies urgently need to promote talent reserve and training and pay more attention to the linkage between talent and innovation.

It can be found that most scholars have affirmed the existence significance of talent competition policy, but also pointed out the possible problems, and put forward the need for government orderly guidance to maximize the use of China's talent resources.

2.4.2 Talent policy analysis

Multi-dimensional comparative analysis based on policy instruments is used in policy for talents research. Li and Yu (2018) constructed a three-dimensional analysis framework from the process of talent development, policy instruments, and technology life cycle, comparing the policy for talents in Guangdong Province vertically.

Li and Zhang (2015) analyzed Tianjin talent policy based on the multi-dimensional comparison of policy-making subjects, policy objectives, policy content, and policy instruments, and Yang et al. (2018) formulated quantitative models from policy objectives, policy instruments, and policy strength to compare and analyze the talent policy in Shanghai. Ning and Zhang (2014) from the two dimensions of basic policy instruments and the value of talent power, this paper analyzes the problems existing in talent policy, such as deficiency and conflict.

Most studies analyze strategies by constructing multiple dimensions. Few researchers analyze a certain type of city and do not combine the macro environment with urban development.

2.5 Concluding remark

Science and technology talents are playing an increasingly important role in economic and social development. Scholars at home and abroad pay more and more attention to talent policy, and more and more scholars devote themselves to the research of scientific and technological talents. Through the analysis of relevant research, it can be seen that the current talent competition is very exciting, and the research direction is more and more.

As can be seen from the literature review, scholars analyze the text of talent policy mainly by constructing multidimensional dimensions. From the perspective of research dimension, text analysis and model analysis is mostly used for two-dimensional and three-dimensional analysis of policies, and the research objects

are mostly policy tools, policy effects, and policy objectives. Few analyses combine macro environment and urban development. Few researchers have analyzed a particular type of city.

Although the existing policy research on scientific and technological talents has two methods: qualitative research represented by policy sorting and policy text analysis and quantitative research represented by policy implementation effect evaluation. Most scholars at home and abroad choose certain methods to conduct comprehensive research on the policy of scientific and technological talents, and the research results are not comprehensive and systematic. They use a single research method, a text-only comparative analysis of talent policy, or an analytical framework that can be constructed from the basic elements contained in the policy.

Therefore, in combination with the policy environment, namely the talent development stage, and based on the policy tools of urban development, this study formulated the framework of "policy environment-policy content", and conducted targeted horizontal and vertical comparison of the policies of scientific and technological talents in various cities to explore the implementation of the policies.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Overall approach: case study

Case studies focus on understanding the dynamic process in a certain situation, and the research can have multiple levels (Cao et al., 2012). Zhang and Holzer (2002) described that a case study is a research method that uses historical data, archives, observations, and interviews to collect data, and uses reliable technology to analyze an event, and then draw general conclusions. According to Su & Cui (2011), the case study is a method that follows the steps of "theoretical review-case study design-data collection-data analysis-case study report writing", focusing on qualitative data collection and analysis, supplemented by quantitative data collection and analysis, and it is an empirical research method that answers based on specific situational characteristics and for theoretical testing or construction.

Therefore, the case study is a qualitative research method aimed at forming a general theory. Based on existing theories, it systematically describes and analyzes the background and process of a single or a group of typical events in a specific situation and generalizes universal conclusions with interpretation and prediction. This study mainly uses the case study method proposed by Yin (2018).

3.2 Case study procedure

Yin (2018) pointed out that case studies follow the positivist approach, and the

assumption behind it is "believe that there is a high degree of connection between the context of the event and the research object." From a technical perspective, multiple aspects of case study design, including research design, data collection, data analysis, etc., are a comprehensive research approach.

This study involves 4 cases, select type 4 in figure 4: context is the talent policy of each city, the case is Guangzhou, Beijing, Shanghai, and Shenzhen, Embedded unit is the analysis dimensions.
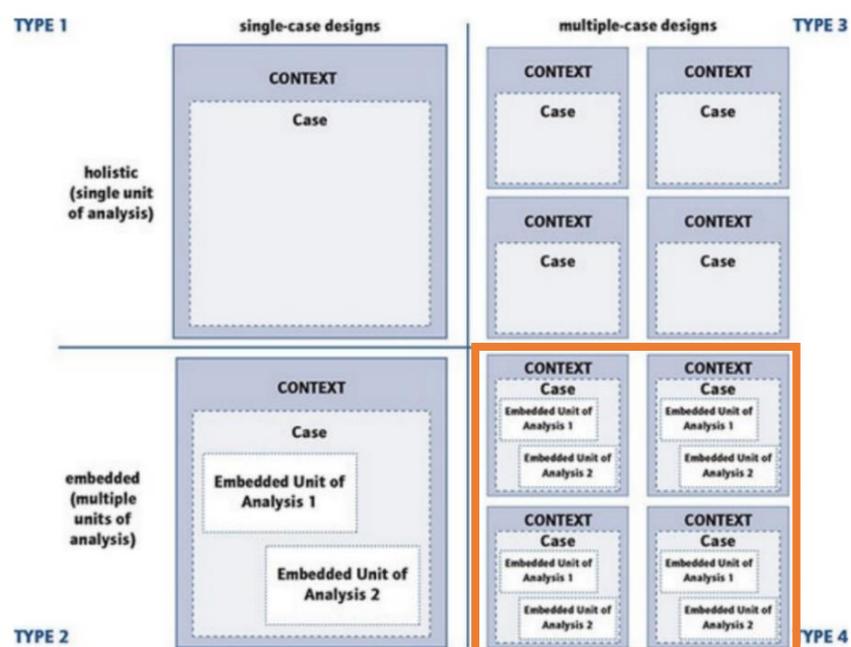
Source: COSMOS Corporation.

Figure 4: Case study design type

Source: Yin, R. K. (2018). Case Study Research and Applications. Sixth Edition.

According to Yin's multi-case study design procedure in figure 5, this study can also be divided into three processes to analyze these four cases:(1) Define and Design, (2) Prepare, collect, and analyze, (3) Analyze and conclude.
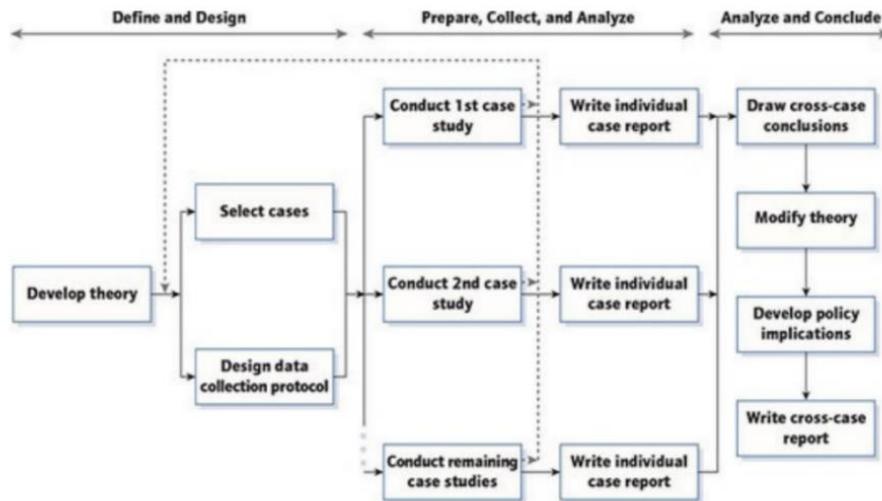
Source: Cosmos Corporation.

Figure 5*: Case study procedure*

Source: Yin, R. K. (2018). Case Study Research and Applications. Sixth Edition.

3.3 Case selected and policy collection

Beijing, Shanghai, Guangzhou, and Shenzhen are metropolises that play an important role in the country's political, economic, and other social activities and have a leading role and the ability to radiate and drive. It is mainly reflected in the level of urban development, comprehensive economic strength, radiation driving ability, attractiveness to talents, information exchange ability, international competitiveness, technological innovation ability, and transportation accessibility.

First-tier cities play a leading role in leading and radiating national social activities such as production, service, finance, and innovation.

This study takes the science and technology talent policy of Shanghai, Beijing, Guangzhou, Shenzhen from 2011 to 2020 as the research object.

Mainly based on keywords such as "science and technology", "talent", the

website of Shanghai, Beijing, Guangzhou, Shenzhen People's government and the website of relevant functional departments (website of science and technology department, website of human resources and social security department, website of finance department and other relevant websites), including the forwarding of policies issued by the central government by local governments, eventually re-issued by relevant departments at the city level, with official document numbers.

Then, according to the definition of the previous analysis dimensions and key information, the text is sorted and classified from the promulgate date, promulgate department, policy instrument, and talent development stage of the S&T talent policy.

3.4 Framework of analysis

Through talent competition between cities, attract talent inflow, and ultimately act on the competitiveness of cities and improve the level of urban development. With the progress of inter-city talent work, not only the talent attraction policy is considered, but also the talent policy environment. The city's economic and social development level and investment in talent also play an important role in talent attraction.

This research takes the 2011-2020 talent policy of China's first-tier cities as the research object and conducts a systematic study.

First, conduct a comparative analysis of the overall policy environment of the two cities from the macro-level; second, conduct a comparative analysis of China's first-tier talent policy content from the micro-level, combine the problems found in

the analysis, and finally put forward corresponding recommendations.

3.4.1 Comparison of policy environment dimensions

The policy environment will affect the effect of the implementation of the talent policy in a region. The policy environment can be regarded as the sum of various external factors outside the system that can directly or indirectly affect the existence, operation, and development of the system outside the boundaries of a specific public policy system (Wang & Li).

This study analyzes the policy environment of China's first-tier cities based on the economic environment and the scientific and technological innovation environment.

3.4.1.1 Economic environment

From the economic environment, the level of economic development represents the comprehensive strength of a city, which means that it has achieved great success in economic, social, technological, and environmental aspects. The economy also determines the development of urban construction, environmental optimization, and life welfare. It also means more opportunities, more information, and more enterprise agglomeration.

The economic environment is mainly inspected from the aspects of economic level, industrial economic scale, and structure.

GDP represents the overall economic development scale of the city. Higher GDP means more developed related industries, more jobs, and higher economic value

creation;

The industrial structure of the three industries reflects the main components of the urban economy. Among them, high-tech industries are mainly concentrated in the tertiary industry, and a good industrial structure represents the sustainable development of the economy. And this study mainly selects the proportion of tertiary industry in GDP as an indicator.

3.4.1.2 Science and technology development

From the scientific and educational environment, the competition for talents is mainly focused on the investment of R&D, urban financial expenditures, and the related supporting infrastructures.

Science and technology expenditure reflects the importance of cities on high-tech. More research expenditures by enterprises and institutions drive the progress of science and technology, which can bring sustained vitality to economic development;

Education expenditures and R&D are the reserve force of urban talents, as well as the front line of science and technology research and development, and education expenditure represents the investment and cultivation of these talents.

3.4.2 Comparison of policy content dimensions

3.4.2.1 Policy instrument

Regarding Rothwell & Zegvel's (1988) classification method, the policy instruments are divided into three types: supply-based, demand-based, and environment-based.

Table 2: *Policy instrument Classification*

Heading	Content	Objective	Main approaches
Supply	Provision of financial, manpower, and technical assistance, including the establishment of scientific and technological infrastructure.	Through the investment to meet the talent, to gather talent.	• Education & Training • Funding • Infrastructure construction • Public Service • Talent information support
Demand	Central and local government purchases and contracts, notably for innovative products, processes, and services.	Promote the stability of talent market operation and order.	• Management of Overseas institutions • Public technology procurement • Service outsourcing • Talent Regulation • Trade control
Environment	Taxation policy, patent policy, and regulations	Create a high-quality	• Financial support • Goal

	(economic, worker health and safety, and environmental), that are those measures that establish the legal and fiscal framework in which industry operates.	environment for talents and encourage them to engage in scientific and technological innovation activities.	programming • Legal regulation • Strategic measures • Tax incentives

Source: Sort out by the author

Supply-based policy instruments mainly refer to the government's supply of financial resources, manpower, technology, information, etc., and the government plays a role in promoting the industry through investment in these aspects; Demand-based policy instruments refer to the government's role in stimulating the market through procurement, trade control, etc.; Environmental-based policy instruments refer to optimizing the development of the industrial environment through legal regulations, taxation, strategic measures, such as Industry-university-research cooperation, a transformation of scientific and technological achievements, etc. and financial support. This kind of classification of policy instruments is widely recognized and applied and is more implementable. This study also uses their classification method. See Table 2 for details.

3.4.2.2 Talent development stage

The appropriate use and management of human resources is the key to formulating talent policies (Chen A, Chen B & Zhu, 2021). Based on the six modules of human resource management, combined with drawing lessons from Liu et al. (2018) and Zhou & Hui (2014) division of talent development stages, this study divides talent development stages into four stages: introduction, training, motivation, and management. Figure 6 shows their relationship in detail.

The talent introduction stage corresponds to the human resource planning, recruitment, and allocation of human resource process management, which is mainly reflected in the introduction of high-skilled talents, domestic high-level talents introduction, overseas high-level talent introduction policies, etc.;

The talent training stage corresponds to training and development, which is reflected in the talent selection policy, use policy, adjustment policy, etc.;

Talent motivation policy corresponds to performance management, which is embodied as a policy of additional rewards or subsidies for talents with outstanding contributions and outstanding performance;

The talent management stage mainly focuses on the salary and welfare management corresponding to the security policy, labor relationship management, which is mainly reflected in the policies related to the life, work, and development of talents, including government, entrepreneurial and legal environmental policies, as well as regulations on the inflow and outflow of talents.
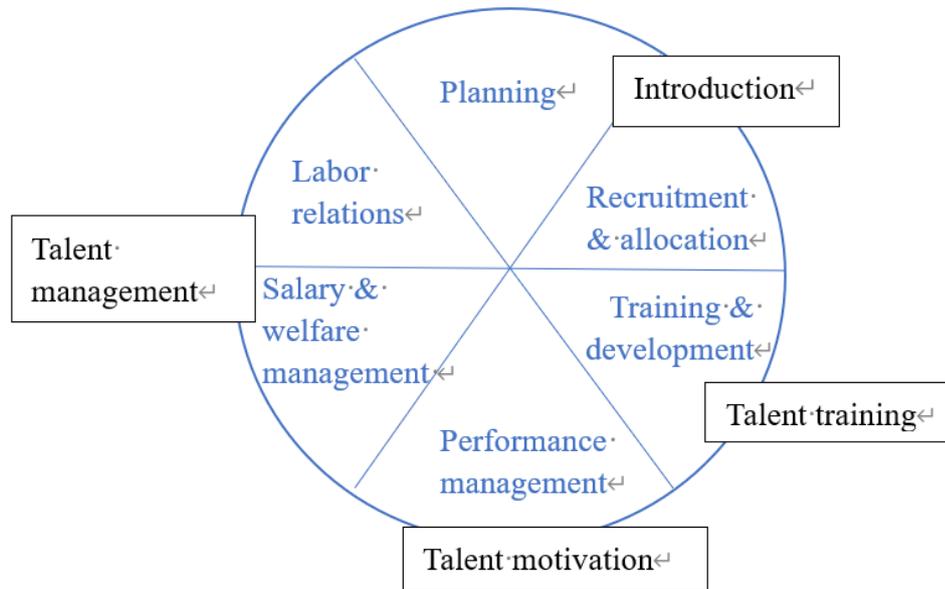
Figure 6: *Relationship between six human resource management modules and four*

talent stages

3.5 Code of science and technology talent policy

Through the collection method in the second subsection of this chapter, this study collected a total of 234 policies, including 65 in Beijing, 81 in Shanghai, 43 in Shenzhen, and 45 in Guangzhou. Table 3 shows only some of the collected talent policies, all policies Listed in Appendix 1.

Table 3: *Part of the collection of talent policies*

No.	City name	Policy name [Chinese]	Policy name [English]	Issuing department [Chinese]	Issuing department [English]
1	Beijing	《北京技术创新行动计	Beijing Technology	北京市人民政府	Beijing Municipal

		划（2014－2017年)》	Innovation Action Plan (2014-2017)		People's Government
2	Beijing	《北京市促进金融科技发展规划（2018年－2022年)》	Plan for Promoting fintech Development in Beijing (2018-2022)	北京中关村科技园区管理委员会、北京市金融工作局、北京市科学技术委员会	Beijing Municipal Financial Work Bureau, Beijing Municipal Science and Technology Commission, Beijing Zhongguancun Science and Technology Park Management Committee
…	…	…	…	…	…
237	Shenzhen	关于努力建设国家自主	The decision on striving to build	中共深圳市委、深圳市	Shenzhen Municipal Party

		创新示范区实现创新驱动发展的决定	national innovation demonstration zones to achieve innovation-driven development	人民政府	Committee and Shenzhen Municipal People's Government
238	Shenzhen	深圳市人才发展"十二五"规划	Shenzhen talent development "12th Five-Year plan"	深圳市人民政府	Shenzhen Municipal People's Government
239	Shenzhen	深圳经济特区科技创新条例	Regulations on Science and Technology Innovation of Shenzhen Special Economic Zone	深圳市人民代表大会常务委员会	Standing Committee of Shenzhen Municipal People's Congress

3.5.1 Nvivo

NVivo is the most intuitive quantitative data analysis, software. NVivo help discovers more from qualitative and mixed methods data. Uncover richer insights and produce clearly articulated, defensible findings backed by rigorous evidence.

This research uses Nvivo to analyze the science and technology talent policy.

Nvivo software can organize and analyze disordered data information, and import data in a variety of formats, including Microsoft Word, RTF format, text format, etc. After using Nvivo software for data analysis, after preparing the original data and adjusting the data format, you can import the Nvivo software and enter the encoding stage. Nvivo provides powerful encoding functions.

According to the characteristics of the data, it can be coded manually, or automatically by software, and create nodes. Then enter the qualitative analysis stage, analyze according to the nodes, including tree node analysis and matrix node analysis, etc., and integrate the establishment of the model, and finally complete the analysis.

3.5.1 Encoding process

The main process is to import materials, create cases, create nodes, code, and query. Figure 7 shows a screenshot of the imported Beijing talent policy.

Figure 7: *Imported Beijing Science and Technology Talent Policy Document*

According to the research framework, this study sets the analysis scope of the science and technology talent policy, as well as the node into two dimensions: policy instrument dimension, which contains supply-oriented instruments, demand-oriented instruments, and environment-oriented instruments, and talent development stage dimension.

This study divides the policies into different categories and defines them according to the above classification.

Use Nvivo 12 coding function to code the keyword nodes and reference points for the collected talent policies. The specific classification is described in Figure 8. Figure 9 is an example of a policy code from Shanghai.
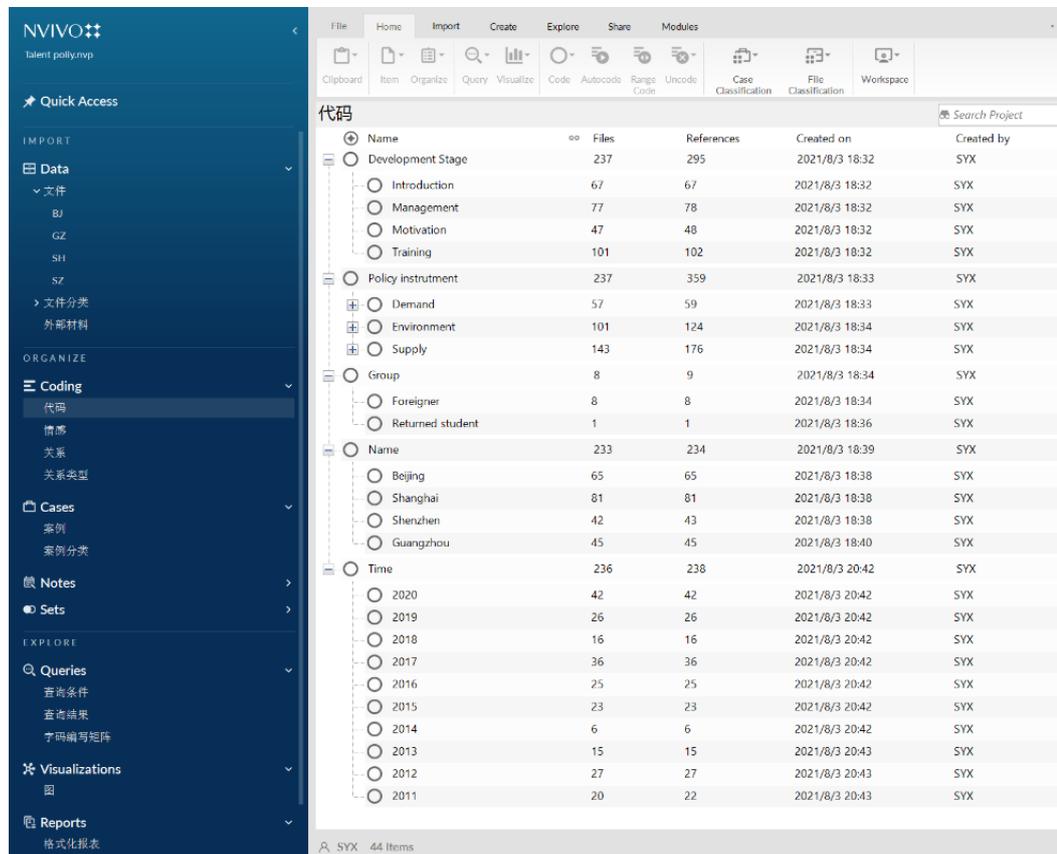
Figure 8*: Author's software interface screenshot(node)*

The analysis part mainly involves the coding search query function: Create coding queries, set query conditions, and further explore the data analysis; in this process, accurately find the "points" to be digging deeper.

Figure 9: An example of policy coding

CHAPTER 4: ANALYSIS OF SCIENCE AND TECHNOLOGY TALENT

POLICY

After following the data processing method introduced in Chapter 3, this study obtained a total of 232 policies containing "science and technology talent", including 82 in Shanghai, 63 in Beijing, 45 in Guangzhou, and 42 in Shenzhen. These policies are coded to facilitate subsequent dimensional analysis.

The data in the comparison of policy environment are from the statistical yearbook of each city. Since the current statistical yearbook is the 2020 edition and the data is up to 2019, the data in this part are mainly selected from 2011 to 2019.

4.1 Fist-tier cities in China

4.1.1 Beijing

Beijing, as figure 10 shows, is the capital of the People's Republic of China, municipalities directly under the Central Government, international metropolis, national central city, megacities, national political center, cultural center, international exchange center, scientific and technological innovation center, economic and financial management center and decision-making center, is the Central Committee of the Communist Party of China The office of the Central People's Government of the People's Republic of China and the National People's Congress of the People's Republic of China.

Beijing City Map

Figure 10: Information of Beijing

Map source: Beijing platform for Common geospatial information services

Data source: Beijing Municipal Bureau of Statistics

4.1.1.1 Urban plan

Beijing officially released the "Beijing City Master Plan (2016-2035)", clarifying that Beijing's urban strategic positioning is the national political center, cultural center, international exchange center, and scientific and technological innovation center. The overall development goal of 2035 is to initially build an international center, a first-class harmonious, and livable city.

4.1.1.2 Population

In 2020, the permanent population of Beijing is 21.89 million, which is an

increase of 2.28 million in ten years compared with 19.61 million in 2010 (the data of the sixth national census, the same below).

An average annual increase of 228,000 people, an average annual growth of 1.1%. This is 2.7% lower than the average annual growth rate of 3.8% from 2000 to 2010. The data shows that the growth of the city's permanent population has slowed down.

Among the permanent population, the population from other provinces and cities in Beijing is 8.4 million, accounting for 38.5% of the permanent population. Compared with 2010, an increase of 1.4 million people, an increase of 19.5%, an average annual increase of 1.8%, the proportion of the permanent population increased by 2.6%; 4.3 million people aged 60 and above, accounting for 19.6%, of which 2.9 million people aged 65 and above, accounting for 13.3%. Compared with 2010, the proportion of the population aged 60 and above has increased by 7.1%, of which the proportion of the population aged 65 and above has increased by 4.6%, and the population aging has further deepened; the population living in cities and towns is 19.2 million, accounting for 87.5%. Compared with 2010, the urban population increased by 2.3 million, the rural population decreased by 27,000, the proportion of the urban population increased by 1.5%, and the level of urbanization was further improved.

4.1.1.3 Economy

In 2020, Beijing's annual GDP will reach 3610.26 billion yuan, an increase of

1.2% over the previous year.

In terms of industries, the primary industry achieved an added value of 10.76 billion yuan, a decrease of 8.5%; the secondary industry achieved an added value of 571.64 billion yuan, an increase of 2.1%; the tertiary industry achieved an added value of 3027.86 billion yuan, an increase of 1.0%. The composition of the three industries is 0.4:15.8:83.8.

Data from the Beijing Municipal Bureau of Statistics show that in the first half of the year, Beijing's technology service industry, information service industry, financial industry, and other advantageous industries continued to play an important supporting role, contributing a total of 59.1% to the city's economic growth. Among them, the scientific research and technical service industry achieved an added value of 108.68 billion yuan, an increase of 12.2%; the information transmission, software, and information technology service industry achieved an added value of 118.52 billion yuan, an increase of 11.2%;

4.1.1.4 Hi-tech industrial development zone

Zhongguancun Science Park, which originated from the "Zhongguancun Electronics Street" in the early 1980s, is China's first state-level high-tech industrial development Zone, the first national independent innovation demonstration zone, the first state-level talent special Zone, and the core of the Beijing-Tianjin-Shi High-tech Industrial Belt. Zhongguancun Science Park is the experimental field of system and mechanism innovation in China, known as the "Silicon Valley of China".

President Xi has pointed out that Zhongguancun has become a banner of China's innovation and development. Facing the future, it is necessary to speed up its march into a science and technology innovation center with global influence (Li,2019).

Zhongguancun Science and Technology Park is the zone with the most intensive scientific and educational intelligence and human resources in China, with nearly 41 institutions of higher learning represented by Peking University, Renmin University of China and Tsinghua University, and 206 national (municipal) research institutes represented by Chinese Academy of Sciences and Chinese Academy of Engineering. There are 67 state key laboratories, 27 national engineering research centers, and 28 National engineering technology research centers. There are 26 university science and technology parks and 34 innovation parks for overseas students.

4.1.1.5 Policy review

From the perspective of the intensity of talent attraction: Beijing extends the talent policy to all links and considers the vital value of talents in a stepwise manner. Table 1 briefly summarizes the target group and approaches of talent policies in Beijing.

Table 4: Talent policy review in Beijing

Talent category	Attraction approaches
Major teams	Emphasis is placed on obtaining an equity cash financing indicator. The higher the financing is, the higher the reward will be. The maximum one-time reward will be 10 million yuan;

Outstanding talents	Pay more attention to development performance, formulate rewards for outstanding talents, and establish a reward mechanism linked to personal performance contributions.
Young talents	Adopt continuous training method; for example, the "Young Beijing Scholars Program" was established to encourage outstanding young talents to engage in cutting-edge scientific research and original innovation actively, and selected talents can enjoy periodic funding support;
Private innovators	While people are encouraged to make suggestions for the development of the innovative economy, a reward fund for suggestions has been set up to encourage all sectors of the society to put forward opinions and suggestions on the development of the city's high-tech industries.

Source: Beijing Municipal Human Resource and Social Security Bureau

4.1.2 Shanghai

Shanghai is a municipality directly under the Central Government of the People's Republic of China, as figure 11 shows, a megacity, an international metropolis, a national central city in China, China's economic center, trade center, and shipping center. The first batch of coastal open cities.

It is one of China's economic, transportation, technology, industrial, financial, exhibition, and shipping centers, and one of the largest metropolitan areas in the world

in terms of scale and area. Shanghai GDP is a good riverside and coastal international port, and it is also the location of the "China (Shanghai) Pilot Free Trade Zone", the first free trade zone in mainland China.

Shanghai City Map

Figure 11: Information of Shanghai

Map source: Shanghai platform for Common geospatial information services

Data source: hai Municipal Bureau of Statistics

4.1.2.1 Urban plan

In 2018, Shanghai officially released the "Shanghai City Master Plan (2017-2035)". The proposed city nature and target vision are: Shanghai is one of the municipalities directly under the central government in China, the core city of the

world-class city cluster in the Yangtze River Delta, and the international economy and finance, trade, shipping, scientific, and technological innovation center, and cultural metropolis, a national historical and cultural city, and will be built into an outstanding global city and a socialist modern international metropolis with world influence.

4.1.2.2 Population

The city's permanent population is 24.87 million. Compared with 2010, a total of 1.8 million people have increased in ten years, an increase of 8.0%, and an average annual growth rate of 0.8%, which is 2.6 percentage points lower than the average annual growth rate of 3.4% from 2000 to 2010. The permanent population of other provinces and cities in Shanghai is 10.4 million, accounting for 42.1%. Compared with 2010, the average annual growth rate is 1.6%.

The population aged 60 and above was 5.8 million, accounting for 23.4%, an increase of 8.3% over 2010. Among them, the population aged 65 and above was 4.0 million, accounting for 16.3%, an increase of 6.2% over 2010. The aging of the population has further deepened.

The population living in urban areas is 22.2 million, accounting for 89.3%; the population living in rural areas is 2.6 million, accounting for 10.7%.

4.1.2.3 Economy

In 2020, Shanghai's regional GDP was 3,870.06 billion yuan, an increase of 1.7% over the previous year.

In terms of industries, the added value of the primary industry was 10.5 billion

yuan, a decrease of 8.2%; the added value of the secondary industry was 1,028.9 billion yuan, an increase of 1.3%; the added value of the tertiary industry was 2,830.8 billion yuan, an increase of 1.8%. The added value of the tertiary industry accounted for 73.1% of the city's gross product, an increase of 0.2% over the previous year.

Data show that the added value of Shanghai's tertiary industry was 917.57 billion yuan, an increase of 11.6%. The added value of the tertiary industry accounted for 70.8% of the city's GDP, an increase of 3.7 percentage points year on year.

4.1.2.4 Hi-tech industrial development zone

In March 2006, the State Council approved the Shanghai Zhangjiang High-tech Industrial Development Zone. To implement the "Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening the Reform of the Science and Technology System and Accelerating the Construction of the National Innovation System" (2012) and "The State Council's Approval to Support the Construction of Shanghai Zhangjiang High-tech Industrial Development Zone as a National Independent Innovation Demonstration Zone" (2011) deployment, trying to build the Zhangjiang Demonstration Zone into a demonstration zone for innovation-driven and scientific development.

Zhangjiang High-tech Park has become a gathering place for various high-tech enterprises. As of the end of 2018, the park had 4,313 high-tech enterprises; 973 listed companies of various types, an increase of 58% over the previous year.

Speed up the construction of the results transfer and transformation system. To

expand and strengthen Fudan, Jiaotong University, Tongji, and other university science and technology parks, and build them into an important platform to support source innovation and high-tech industrialization. Support the development and growth of socialized technology transfer service institutions, with a total of 21 national technology transfer demonstration institutions, and accelerate the construction of trading markets such as the Shanghai Technology Exchange and the National Technology Transfer Eastern Center. Optimize the construction of innovation and entrepreneurship carriers.

Promote the landing of internationally renowned entrepreneurial incubators such as XNodes, WeWork and Intel Incubator. In 2018, the demonstration zone has 13 national-level university science parks, and 39 national-level technology business incubators.

4.1.2.5 Policy review

From the perspective of attraction approaches: Table 2 briefly summarizes the target group and talent policies in Shanghai.

Table 5: *Talent policy review in Shanghai*

Talent category	Attraction approaches
Local innovative and entrepreneurial talents	Divide talents into four categories: scientific research and development talents, enterprise innovation and entrepreneurship talents, social sciences talents, and special urgent needs talents;

Overseas students (talents and enterprises starting businesses in Shanghai)	Those selected for national projects can receive up to 1 million yuan in financial support according to regulations;
Fresh college graduates	In the latest settlement management measures released in 2020, Shanghai's "world-class universities" include Shanghai Jiaotong University, Fudan University, Tongji University, and East China Normal University. These four universities' undergraduate, master, and doctoral graduates can directly settle down if they meet the application requirements. They were considering the scarcity of Shanghai's citizenship resources. These measures will significantly stimulate graduates from well-known universities to stay in Shanghai for innovation and entrepreneurship, contribute youth talents to Shanghai's economic development, and promote high-quality economic development.
Talent introduction organizations	For those who recommend and hire the first-level type of talents (Scientific research and development talents), each person will be rewarded with a one-time award of 500,000 yuan;

Source: Shanghai Municipal Human Resource and Social Security Bureau

4.1.3 Guangzhou

Guangzhou is the provincial capital of Guangdong Province and a super-large city. Figure 8 shows the basic information of Guangzhou. It is an international metropolis, an international trade center, an international comprehensive transportation hub, a national central city, a national comprehensive gateway city, a national historical and cultural city, and the third-largest city in China positioned by the State Council.

Guangzhou City Map

广州市地图

Size
7434.40 sqkm
Including 11 districts

Location
South of China
The pearl River estuary and the pearl River Delta
center

Population 2020
Number of permanent residents: 18,676,605
Urbanization rate: 80.49%
Degree of aging (over 60 years old): 11.41%

GDP 2020
2.767024 trillion yuan
134000 yuan per capital
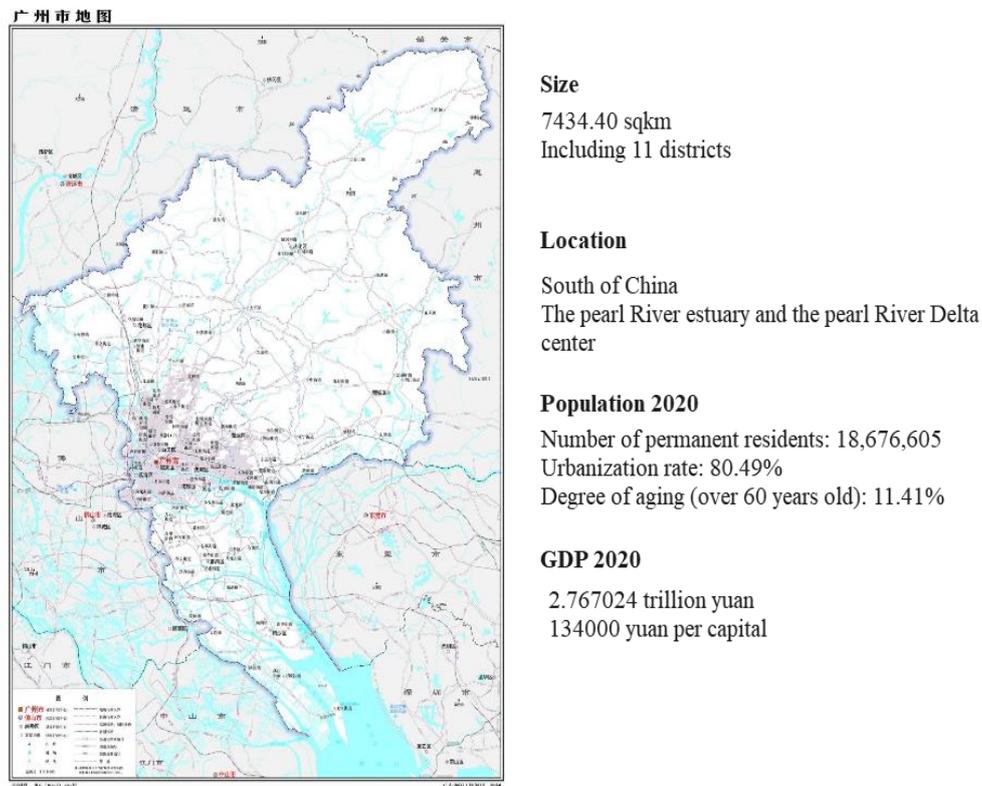
Figure 12*: Information of Guangzhou*

Map source: Guangzhou platform for Common geospatial information service s

Data source: Guangzhou Municipal Bureau of Statistics

4.1.3.1 Urban plan

In 2018, Guangzhou announced the "Guangzhou City Master Plan (2017-2035)" (draft) and solicited public opinions.

The plan puts forward the goal and vision of Guangzhou as a beautiful and livable flower city, a vibrant global city. The designated function of the city is the capital of Guangdong Province, the main national center city, a famous historical and cultural city, an international comprehensive transportation hub, a business center, a

communication center, and a technological industry innovation center. To become a leading global city with Chinese characteristics socialism.

4.1.3.2 Population

The permanent population of Guangzhou is 18.7 million. Compared with the 12.708 million in the sixth national census in 2010, it has increased by 5.9 million in 10 years, an increase of 47.05%, and the average annual growth rate is 3.93%, which is higher than that of 2000-2010. The average annual growth rate was 2.48% and accelerated by 1.45 percentage points. The non-registered permanent population was 9.3 million, an increase of 97% over 2010 and an average annual increase of 7%, accounting for 50% of the city's permanent population, an increase of more than 12 percentage points over 2010. The permanent population of Guangzhou has maintained rapid growth.

The aging population is emerging. Among the permanent population in Guangzhou, the proportion of people aged 60 and above is 11.41%, of which the proportion of people aged 65 and above has reached 7.82%. Compared with 2010, the proportion of the population aged 60 and above increased by 1.67 %; the proportion of the population aged 65 and above increased by 1.15 %. According to the United Nations standard of "over 10% of the population aged 60 and over or over 7% of the population aged 65 and over, which means that Guangzhou has entered an aging society.

4.1.3.3 Economy

In 2020, Guangzhou will achieve a GDP of 2501.91 billion yuan, which is an increase of 2.7% over the previous year at comparable prices. Among them, the added value of the primary industry was 28.808 billion yuan, an increase of 9.8%; the added value of the secondary industry was 659.04 billion yuan, an increase of 3.3%; the added value of the tertiary industry was 1,814.064 billion yuan, an increase of 2.3%. The ratio of the added value of the primary, secondary and tertiary industries is 1.15:26.34:72.51.

4.1.3.4 Hi-tech industrial development zone

Guangzhou High-tech Industrial Development Zone is located at the intersection of Guangzhou's central city cluster and the southeast cluster. It is knowledge-intensive and talented. There are 12 institutions of higher learning in the zone, including Huagong, Huashi, Ji University, etc., as well as the Guangzhou Branch of the Chinese Academy of Sciences and Guangdong. There are 44 scientific research institutions such as the Academy of Agricultural Sciences and 3 national key laboratories, providing good technical talent support for the development of high-tech enterprises.

The joint office of Guangzhou Economic and Technological Development Zone and Guangzhou High-tech Zone is an innovation of regional economic resource sharing, complementary advantages, and linkage development;

It is the mechanism innovation that realizes the organic integration of new economic growth points and the commanding heights of economic development; it is the institutional innovation that promotes the government's promotion of economic

development under the conditions of the market economy.

4.1.3.5 Policy review

From the point of view of talent attraction: Table 4 briefly summarizes the target group and approaches of talent policies in Guangzhou.

Table 6: *Talent policy review in Guangzhou*

Talent category	Attraction approaches
High-level talents	Housing subsidies or rent-free apartments;
Newly - introduced doctoral students or associate-senior and above professional and technical titles who have worked in enterprises in the district for an entire year	The housing subsidy of 50,000 yuan;
Scientific research	Guide relevant structures to increase investment in research and transform investment in real estate into reserves for high-end scientific research instruments;
Science and technology personnel	Support the transformation of scientific and technological achievements, and no less than 70% of the net income from the transformation may be awarded to talents;

High-level talents	Establish a "talent service bank" to provide with up to 20 million mortgage-free and guarantee-free talent credit loans for entrepreneurship;
Recommendation and evaluation	Explore the implementation of the "talent recommendation system" and form a comprehensive evaluation system of "recognition + evaluation + recommendation" together with the existing model, and excavate and support urgently needed talents
Scientists team	"Team leader full responsibility system", grant leader employment rights, capital control rights, fixed asset use rights, technical route decision rights, internal organization setting rights, and talent recommendation rights, the priority is given to guaranteeing financial support and working conditions, building a global high-level talent development system and scientific research operation mechanism.

Source: Guangzhou Municipal Human Resource and Social Security Bureau

4.1.4 Shenzhen

Shenzhen, a city under the jurisdiction of Guangdong Province, an international

metropolis, as figure 9shows, is located in the southern part of Guangdong Province and is a city of immigrants. Today, 15 million of Shenzhen's 20 million population are migrants. Shenzhen is the first special economic zone established by China's reform and opening up. It is a window of China's reform and opening up. It has developed into an influential international city and is known as the "Window of China".

Shenzhen is a national economic center designated by the State Council. Its

Beijing City Map

Figure 13: *Information of Shenzhen*

Map source: Shenzhen platform for Common geospatial information services

Data source: Shenzhen Municipal Bureau of Statistics

economic aggregate has long ranked fourth among cities in mainland China, and it is one of the cities with the best economic benefits in mainland China.

4.1.4.1 Urban plan

In January 2017, the Shenzhen Municipal Government announced that Shenzhen is fully embarking on a pilot project for the preparation of the "Shenzhen City Master Plan (2016-2035)". According to the report of the Sixth Plenary Session of the Shenzhen Municipal Party Committee, Shenzhen's master plan for 2035 is positioned to build a sustainable global innovation capital and realize socialist modernization. By the middle of this century, a national special economic zone will be built to represent a powerful modern socialist country, and it will become an innovation-leading global city with outstanding competitiveness and influence.

4.1.4.2 Population

In 2020, Shenzhen has a permanent population of 17.6 million, which is an increase of 7.1 million, an increase of 68.46%, and an average annual increase of 5.35% compared with 10.4 million in 2010.

Among the permanent population in Shenzhen, the population of 60 years and over is 940.7 thousand, accounting for 5.36%, and the population of 65 and over is 565.2 thousand, accounting for 3.22%. The proportion of the population aged 60 and above increased by 2.36 percentage points, and the proportion of the population aged 65 years and above increased by 1.39 percentage points. The population of Shenzhen is still "young" and is still in a period of vigorous "demographic dividend".

Shenzhen's greater innovation vitality is related to the low local age structure. In addition to the population that has flowed into Shenzhen, many of them are engaged in the information industry and software industry. They usually go to Shenzhen to

look for work after graduating from university. Therefore, more people who flow into the local area are young (Hu, 2021).

4.1.4.3 Economy

In 2020, Shenzhen will achieve a regional GDP of 2,767.02 billion yuan, an increase of 3.1% over the previous year. Among them, the added value of the primary industry was 2.58 billion yuan, a decrease of 3.1%; the added value of the secondary industry was 1,045.4 billion yuan, an increase of 1.9%; the added value of the tertiary industry was 1,719.04 billion yuan, an increase of 3.9%. The added value of the primary industry accounts for 0.1% of the city's regional GDP, the added value of the secondary industry accounts for 37.8%, and the added value of the tertiary industry accounts for 62.1%.

4.1.4.4 Hi-tech industrial development zone

The construction of the Shenzhen National High-tech Industrial Development Zone reached a new level. The Ministry of Science and Technology supports Shenzhen, guided by its positioning as an innovation-driven development demonstration zone and a high-quality development pioneer zone, to accelerate breakthroughs in key core technologies, cultivate first-class enterprises, and create innovative industrial clusters with international competitiveness.

As of 2020, Shenzhen has more than 18,000 national high-tech enterprises and more than 50,000 high-tech small and medium-sized enterprises, ranking among the top cities in the country, and 8 companies have been selected as the world's top 500;

The high-tech industry achieved an output value of 2.7 trillion yuan and an added value of 974.7-billion-yuan, accounting for more than 35% of GDP, becoming the first pillar industry and a major economic growth point.

4.1.4.5 Policy review

From the perspective of the intensity of talent attraction: Shenzhen's financial investment is no less than 1 billion yuan every year to cultivate and introduce high-level talents and teams at home and abroad. Table 3 briefly summarizes the target group and approaches of talent policies in Shenzhen.

Table 7: Talent policy review in Shenzhen

Talent category	Attraction approaches
Academicians and outstanding talents of the Chinese Academy of Sciences and the Chinese Academy of Sciences	The subsidy standard is 6 million yuan;
National leading talents and A-class talents	The subsidy standard is 3 million yuan;
Local leading talents and B-type talents	The subsidy standard is 2 million yuan;
Reserve talents and C-type talents	The subsidy standard is 1.6 million yuan;

Introduction or education organizations	Every time an academician of the Chinese Academy of Sciences or the Chinese Academy of Sciences is cultivated by the training organization, the government will award the organization 5 million yuan. For legally compliant organizations and support enterprises and institutions to set up academician (scientist, expert) studios, and assist in cultivating innovative talents, grant funding of 500,000 yuan to 1 million yuan;
Fresh college graduates	On-the-job talents and returned overseas students introduced by Shenzhen human resources department can enjoy the rent and living subsidies for the newly introduced talents if they meet the requirements. The subsidy standard is 15, 000 yuan for undergraduates, 25, 000 yuan for masters and 30, 000 yuan for doctors.

Source: Shenzhen Municipal Human Resource and Social Security Bureau

A-type, B-type, and C-type talents are classified as high-level overseas talents in Shenzhen (Peacock Project).

4.2 Comparison analysis between first-tier cities

4.2.1 Economic environment

Comprehensive economic strength is the most important indicator of becoming a first-tier city, and also the most important sign of a city (Tete, 2021). The

comprehensive economic situation of the four cities has almost always been among

the top 5 Chinese cities. Shanghai has always been the largest economic center in

China, and Beijing is the largest economic center in northern China and the

second-largest economic center in the country. With its special economic zone,

Shenzhen was the first to open up and its economy was developed, and it has long

been among the ranks of the national.
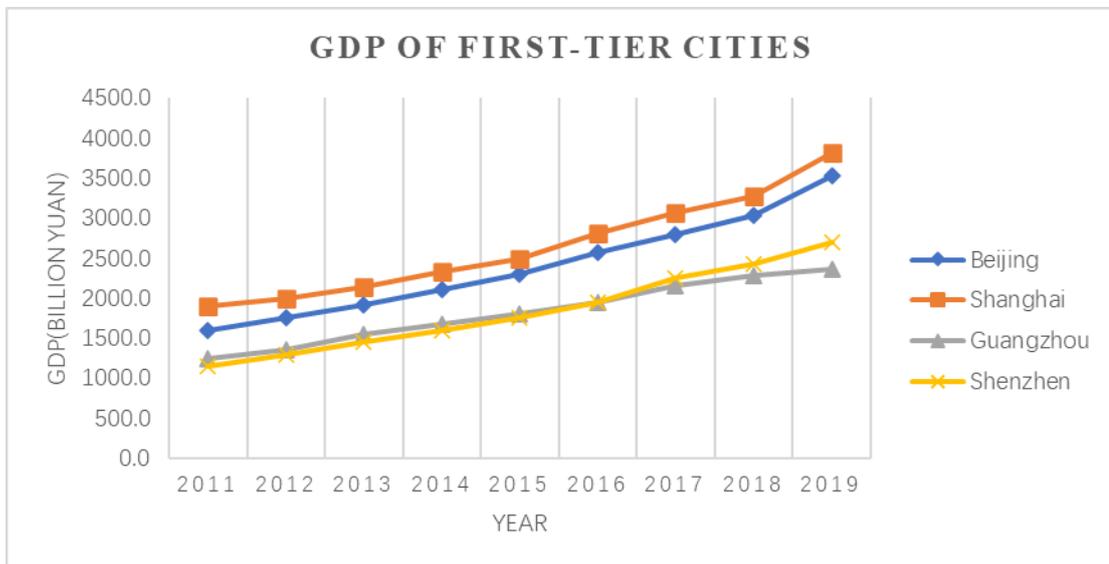
Figure 14: GDP of first-tier cities (2011-2019)

From an economic point of view, according to the GDP data in 2019, shown in

figure 14, Shanghai's total GDP is as high as 3,815.5 billion yuan, ranking first among

major cities in mainland China. Beijing ranks second in the country with a GDP of

3,537.1 billion yuan, although there is a gap between Shanghai and Beijing. More

than 200 billion yuan, but still showing strong economic strength; Shenzhen is

26,927.09 billion yuan, and Guangzhou is 2,362.86 billion yuan.

It can be seen that the economic strength of Shanghai and Beijing is the strongest

and there is little difference. Compared with Beijing and Shanghai, the gap between Shenzhen and Guangzhou is relatively large. Shenzhen has only 70.57% of Shanghai and only 76.13% of Beijing. In the short term, there is still a huge gap between Shenzhen and Guangzhou to surpass Beijing and Shanghai in terms of the economic scale.
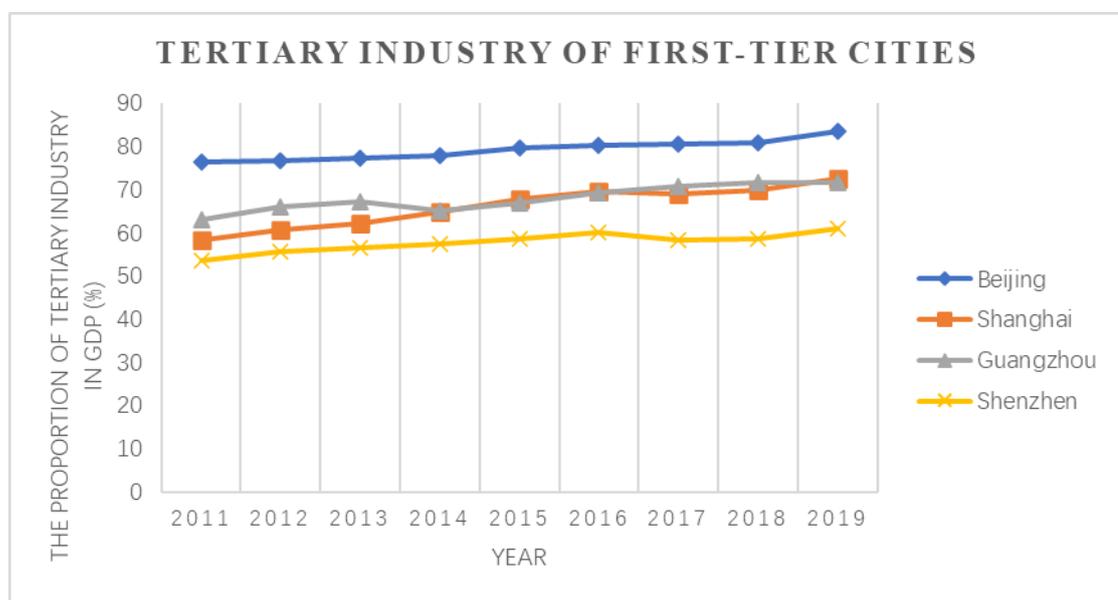
Figure 15: Tertiary industry proportion of first-tier cities (2011-2019)

From the figure 15, Beijing's tertiary industry accounted for 83.5%, Shanghai's tertiary industry accounted for 72.7%, Guangzhou's 71.62%, and Shenzhen's 60.9%. The tertiary industry accounts for more than 60%

The major international cities also account for a very high proportion of tertiary industries, with New York, Tokyo, London, and Paris accounting for about 90% of the tertiary industries.

The high proportion of the tertiary industry in big cities is due to its strong radiation capabilities. Its strong service industry not only serves the local area but also

serves the surrounding areas and even the whole country. And their secondary industries are often high-tech manufacturing industries.

Through a large number of high-tech R&D industrial chains in the city, large cities maintain resonance in the supply chain and industrial chain with the manufacturing industry in other cities and maintain the balance between the secondary and tertiary industries.

The tertiary industry accounts for a relatively high proportion, reflecting the relatively large radiation power and a high degree of openness of the city. Among the first-tier cities, the proportion of tertiary industries in Beijing, Shanghai, Guangzhou, and Shenzhen is relatively high, reflecting their national radiation and international influence. In addition, the high-end service industry has always required a large number of outsiders to support it.

Shenzhen's secondary industry accounts for the highest proportion of the first-tier industries, and it is reasonable. Shenzhen is indeed a city with developed industries and manufacturing industries.

4.2.2 Science and technology

The scientific research investment of a city determines the sustainable development of the city, and it also represents the scientific and technological strength and development potential of the city to a certain extent. Figure 16 illustrates the education expenditure of first-tier cities from 2011 to 2019.
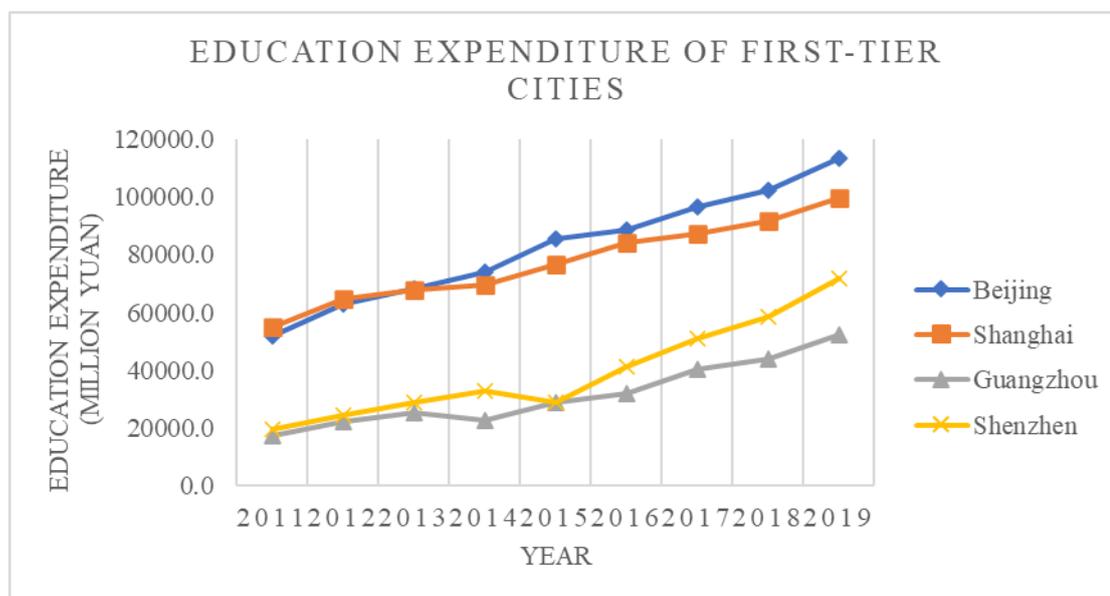
Figure 16: Education expenditure of first-tier cities (2011-2019)

Education expenditures in Beijing and Shanghai are significantly higher than those in Guangzhou and Shenzhen, and continue to rise, while Shenzhen and Guangzhou have declined to varying degrees. In 2015 and 2014, respectively, the increase in education expenditure in Shenzhen has increased significantly.

In addition, the State Council issued the "Opinions on Further Adjusting and Optimizing the Structure and Improving the Use of Educational Funds" in 2018, which pointed out that it is necessary to continue to ensure financial investment, establish a per-student allocation system in an all-round way, and ensure that the national financial education expenditures account for a large proportion of GDP. At 4%, to ensure that the general public budget for education expenditure only increases year by year and that the general public budget for education expenditure based on the average number of students in school only increases year by year. Shows the importance of education.

From the perspective of R&D development, Beijing ranks first in the latest ranking of China's scientific research investment cities. After all, Beijing has the largest number of 211 schools and scientific research institutions in China. Shanghai ranks second in the country with a research investment of more than 150 billion yuan, while Shenzhen and Guangzhou rank third and fourth.

Table 8: Ranking of China's R&D Investment Cities in 2019

City	R&D investment in 2019 (100 million yuan)	R&D investment as a percentage of GDP in 2019	Number of universities	Number of high-tech enterprises
Beijing	2233.6	6.31%	67	28750
Shanghai	1524.6	4.00%	38	12848
Shenzhen	1328.28	4.93%	7	17001
Guangzhou	677.74	2.87%	36	12174

Data source: Zhangqiao Science Research, local city statistics bureaus, science and technology bureaus and public reports

In 2019, the total R&D investment of Beijing, Shanghai, Guangzhou, and Shenzhen was 576.4-billion-yuan, accounting for 26% of the country, which is enough to confirm its leading role in the national innovation pattern.

In terms of R&D investment, the ratio of Beijing's R&D expenditure to GDP is 6%, the highest in China. The research output is especially concentrated in the Haidian District where Peking University, Tsinghua University, Beijing Normal

University, and the Chinese Academy of Sciences are located. In the statistical system, R&D statistical objects are mainly scientific research institutions, institutions of higher learning, and regulatory enterprises. Many of the first two are gathered in Beijing, so Beijing has undertaken a larger task of basic research.

Looking at the situation in 2018, Beijing's basic research funding accounted for as much as 25.5% of the country. Shanghai is also a city that pays great attention to science and technology. Among them, Shanghai Jiaotong University is the world's largest shipbuilding professional, and aviation manufacturing, medicine, and chemistry are all in the world's leading position. Companies in Shanghai such as SAIC and Fosun also invest large sums of money in scientific research every year. Shanghai's strong scientific research investment promotes the better development of Shanghai's economy and technology.

Since Shenzhen has many industry-leading technology companies, such as Huawei, ZTE, Tencent, BYD, DJI, Goodix, etc., it is far ahead in terms of R&D investment.

The R&D funding in Chinese cities mainly comes from scientific research institutions, state-owned enterprises, and private enterprises. Among them, Beijing and Shanghai have unparalleled resources of higher education institutions and state-owned enterprises in other cities, both of which are powerful tools for R&D expenditure.

Statistics show that about 80% of Beijing's R&D funding comes from scientific

research institutions, while more than 90% of Shenzhen's R&D funding comes from enterprises, showing the difference in R&D temperament between the two cities. Take Shenzhen's leading company Huawei as an example. The company's R&D expenditure in 2015 was 59.6 billion yuan, which is higher than the R&D expenditure of other cities that year.

Guangzhou's urban background is foreign trade, with strong service industry and a weak manufacturing industry situation. Although there are many colleges and universities, they lack the resources of high-quality leading institutions of higher learning and central enterprises in Beijing and Shanghai, as well as large industrial enterprises like Shenzhen, so relatively little investment in scientific research.
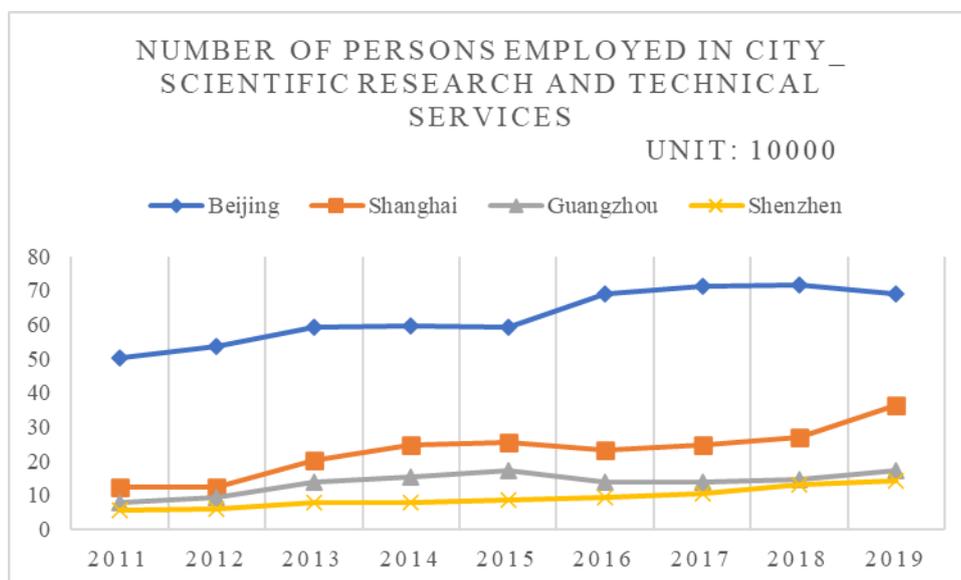
Figure 17: *Number of persons employed in city_ Scientific research and technical*

services

According to figure 17, the number of people engaged in science and technology services in Beijing is significantly higher than that in other cities, mainly due to a

large number of scientific research institutions and universities in Beijing. Although it has declined in 2018, it is due to the implementation of Beijing's population restriction policy.
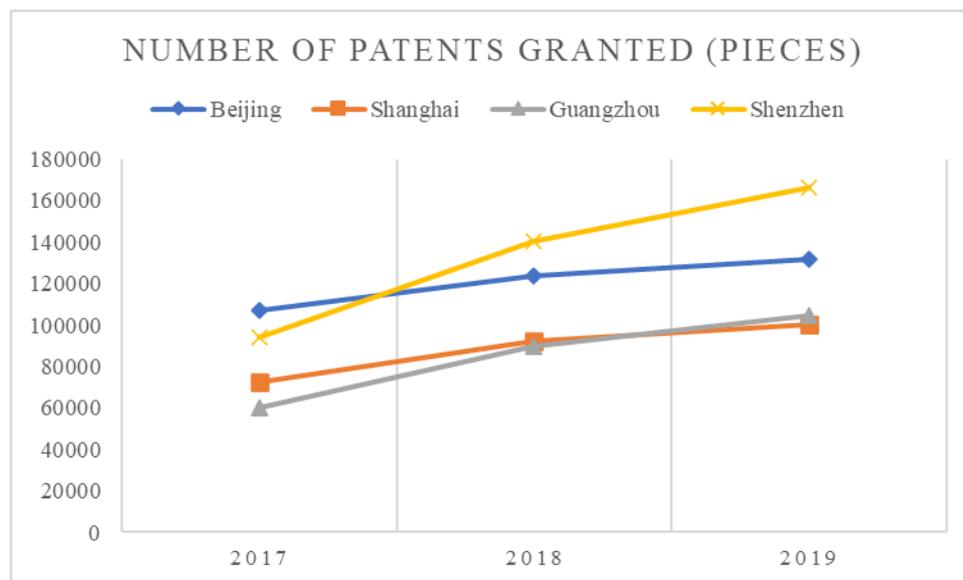
Figure 18*: Number of patents granted*

Figure 18 shows the continuous improvement of Shenzhen's intellectual property creation level, demonstrating the acceleration of high-quality development. Shenzhen's domestic patent applications have grown rapidly, with an average annual growth rate far exceeding that of other cities.

The main reason is that Shenzhen has a large number of enterprises and the government has issued corresponding laws and regulations.

On the one hand, organize law enforcement forces to continuously strengthen the administrative enforcement of intellectual property rights; on the other hand, with the help of professional technical institutions, create a legal environment that supports innovation

4.2.3 Policy instrument
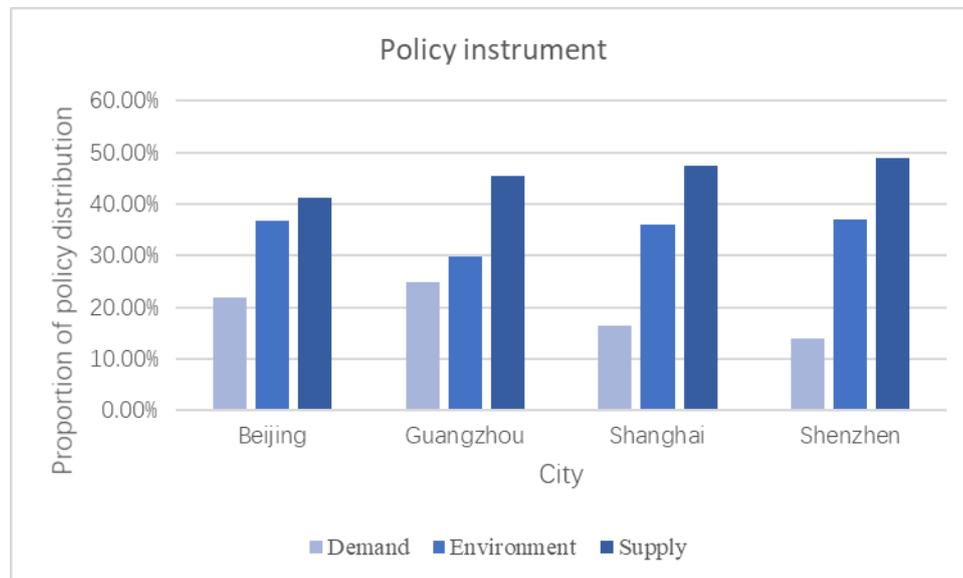
Figure 19: *Basic situation of policy instrument in China's first-tier cities*

It can be seen from the figure 19 that in the application of the three types of policy instruments, the distribution patterns of China's first-tier cities are relatively similar, and they all show a preference for supply-oriented policy instruments and the least demand-oriented policy instruments.

Among the four cities, Shanghai and Shenzhen are more inclined to use policy instruments. The number of supply-oriented policy instruments in Shanghai reached 52, accounting for 47.41% of the total policy instruments; 36 environmental policy instruments, accounting for 26.11%; only 14 demand-oriented policy instruments, accounting for 16.48%.

There are 66 supply-oriented policy instruments in Shenzhen, which is the largest number among the four cities, accounting for 48.86%;44 environmental policy instruments, accounting for 37.08%; And 20 demand instruments, only accounting for

14.06%.
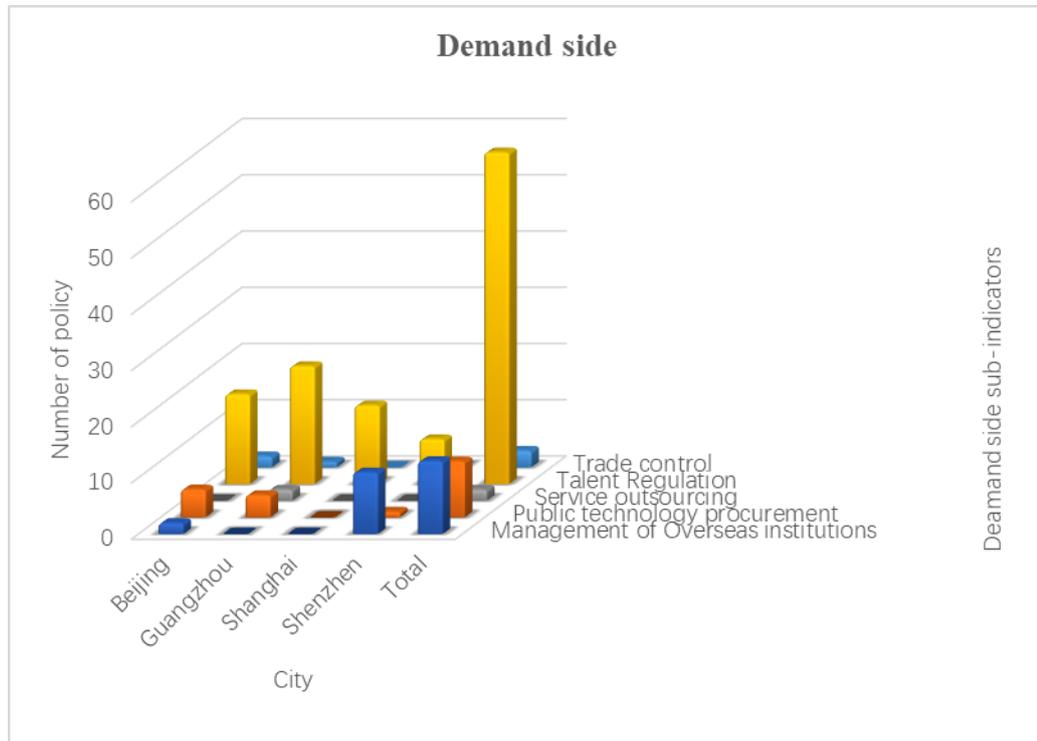
Figure 20: Demand-based policy instrument distribution

Generally speaking, demand-side policy instruments are relatively weakly used in the science and technology talent policy instrument system.

From the perspective of sub-indicators of demand-side policy instruments, talent management policy instruments are used more, for example, through job title evaluation, setting talent thresholds to stimulate demand Guangzhou issues new standards for talent recognition every year; Public procurement policy instruments and overseas institution management are followed, and service outsourcing policy instruments; And trade control policy instruments are used less.

This situation may cause the government to be unable to effectively balance the role of the market and the government and stabilize the talent market. Diversified use

of talent demand-pull methods should be used to prevent the absence of government entities.
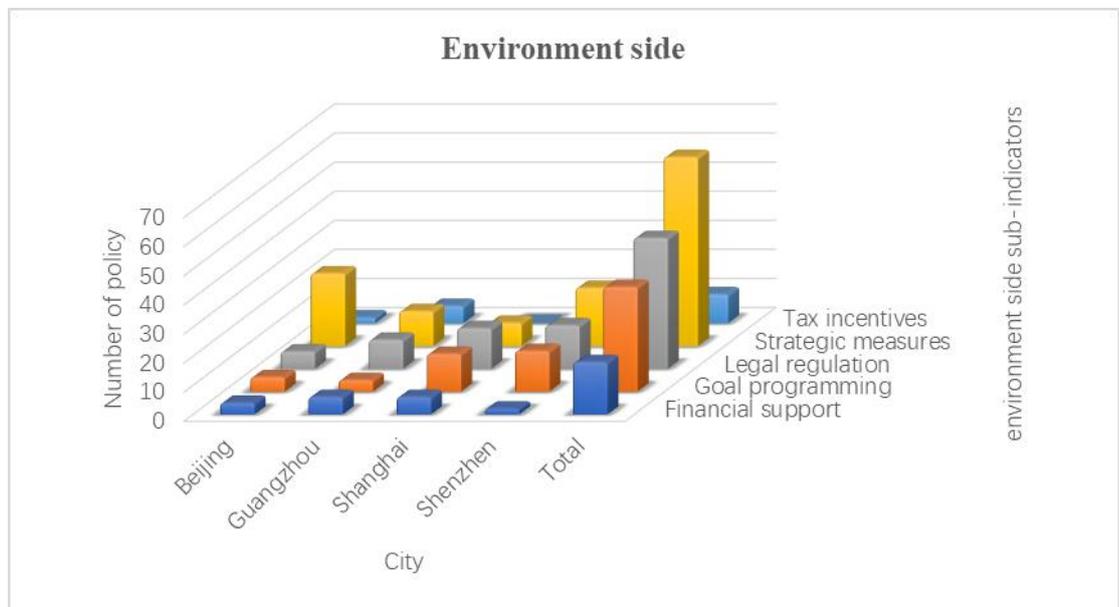
Figure 21: Environment-based policy instrument distribution

Judging from the secondary indicators of environmental policy instruments, regulatory control, and strategic measures are used most frequently.

Among them, strategic measures account for the highest proportion, which is mainly reflected in the establishment of industry-university-research platforms. It reflects that the government attaches importance to responding to the risks of the talent market through industry introduction and attaches importance to enhancing the city's talent attraction through the effect of industry agglomeration, and talent development needs to be built on a sound industrial basis.

The performance of industrial agglomeration can effectively derive the demand for talents, and the professionalism of industrial agglomeration can also introduce

talents in related fields in a targeted manner.

The widespread use of these two types of policy instruments reflects the government's expectation to restrict and regulate scientific and technological innovation behaviors through setting standards and mechanism reforms and to improve the industrial environment of innovative entities and attracting diversified capital investment through multi-party cooperation. In addition, the use of strategic planning and atmosphere-building instruments is relatively balanced, while tax incentives and intellectual property policy measures are less supported. So, the environmental policy instruments are not highly synergistic.
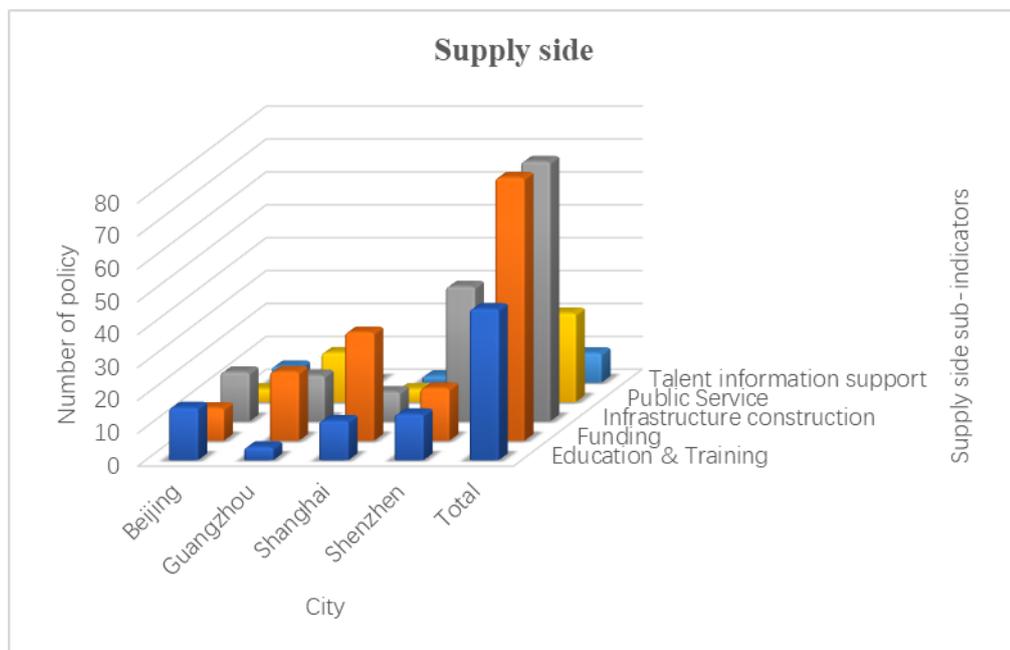
Figure 22: Supply-based policy instrument distribution

As shown in the figure, supply-based policy instruments are the most used of all policies. Among them, the two methods of infrastructure construction and capital investment are the most used, and the talent information support instruments are

lacking.

The frequent use of infrastructure construction reflects the government's emphasis on urban construction and scientific research carriers, such as the construction of crowd-creation space.

Among the supply-oriented policy instruments in first-tier cities, capital investment policy measures account for a certain proportion of each city. Financial support measures are the highest among the supply-oriented policy instruments in Shanghai. This shows that first-tier cities pay more attention to the attraction of capital to talents, and implement strong material guarantees in the development of talent work. Most of the documents related to science and technology talents mention financial support for science and technology talents.

For example, the development of high-tech industrial parks is inseparable from science and technology talents and financial support, and financial support is the most fundamental guarantee for the development of science and technology talents. Financial support can guarantee the smooth implementation of the talent policy, and good economic conditions play a major role in attracting talents and affecting the flow of talents.

When analyzing the policy text, it is found that the funding measures are mainly used to meet the needs of the self-growth and development of science and technology talents. These funds mainly involve "funding for scientific research projects", "fundamental research funding", and "renovation fees for incubation houses". ",

"Scientific research personnel and team funding", "Science and Technology Achievement Transformation Award", "Special Funds for Talent Development" and other aspects.

In addition, first-tier cities have fewer policy documents involved in talent information support, and talent information support policy instruments have not yet been fully utilized. There is still room for improvement, and talent information support instruments need to be developed.

Although the supply-oriented policy instruments account for a relatively high proportion, there is still an insufficient internal imbalance, which to a certain extent is also a key point worthy of attention in the formulation and promulgation of science and technology talent policies in cities in the future.

4.2.4 Talent development stage

According to the picture, based on the current 10-year total of the four cities, Beijing, Shanghai, Guangzhou, and Shenzhen are all paying more attention to the training and management of talents.
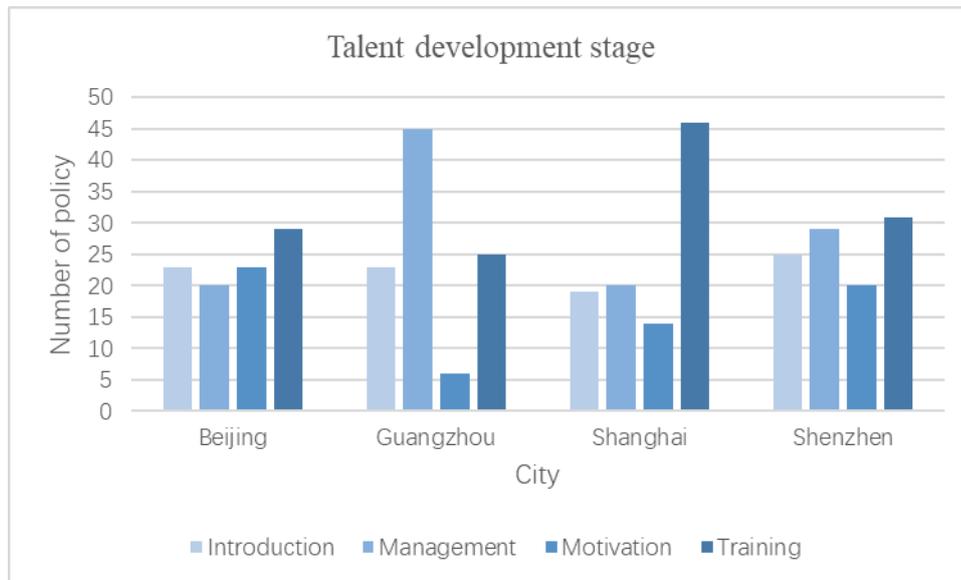
Figure 23*: Basic situation of talent development stage in China's first-tier cities*

In terms of training, this is inseparable from China's strategy of rejuvenating the country through science and education. Beijing, Shanghai, Guangzhou, and Shenzhen have the country's leading education and teaching resources, which provide basic and convenient conditions for the cultivation of science and technology talents. Therefore, first-tier cities have relatively complete guarantees and support in terms of talent training.
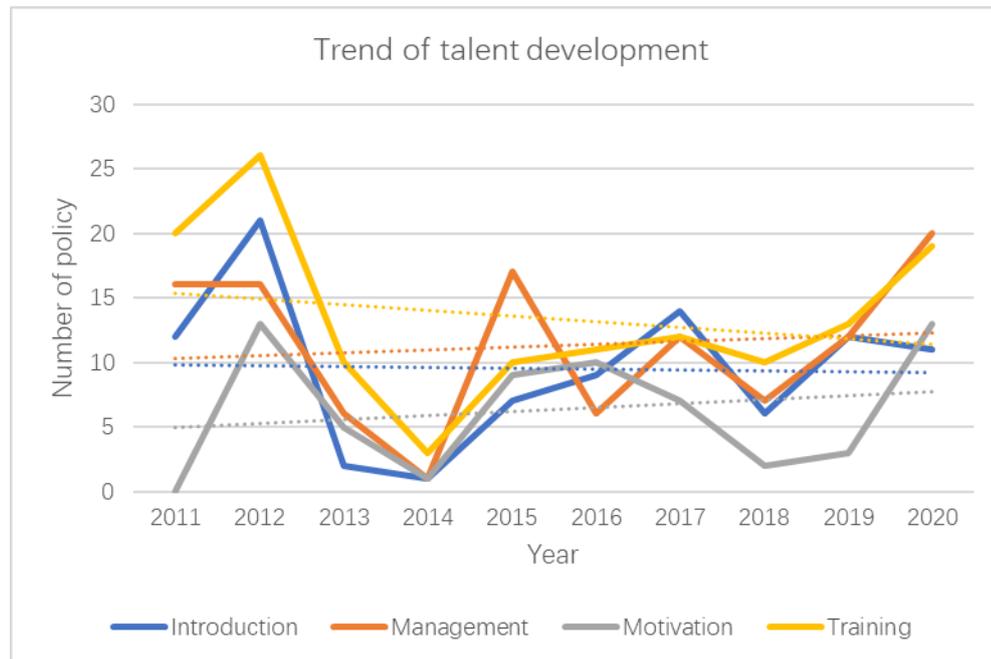
Figure 24*: Trend of talent development stage in China's first-tier cities*

From the analysis of time changes, the figure24 shows that the number of references in China's first-tier cities in the talent training stage has dropped, while the number of references in the management and motivation stage has an upward trend. This shows that in the past seven years, city governments have paid more and more attention to the management and motivating of scientific and technological talents; there is a downward trend in the focus on talent training and introduction. Although there are many policies for talent training, it will pay more attention to talent management in the future.

From the perspective of current talent management, fair and transparent talent recruitment and management system for universities and R&D institutions have been constructed:

The open recruitment of scientific and technological talents has established a

strict employment system, removed nationality, gender, and age restrictions, and implemented unified management of the scientific and technological talent team to achieve complete fairness, justice and openness in the process and results, and ensure the consistency and standardization of the management system. According to a series of standards such as output results, objective and professional evaluations of scientific and technological talents are carried out regularly.
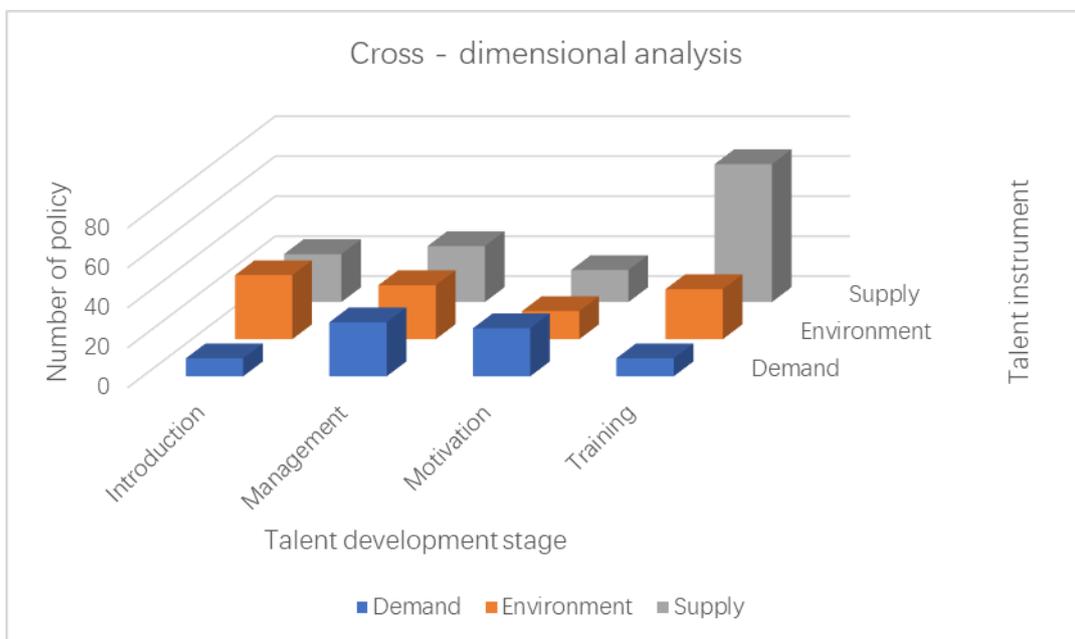
Figure 25*: Cross-analysis of the talent development stage and policy instruments*

From the perspective of the cross-analysis of the talent development stage and policy instruments, in the stage of talent introduction, the government adopts more supply and environmental policies, and the policy instruments used in the talent management stage are more balanced. In the talent motivation stage, more demand and supply policy instruments are used, while in the talent training stage, supply instruments are mainly used.
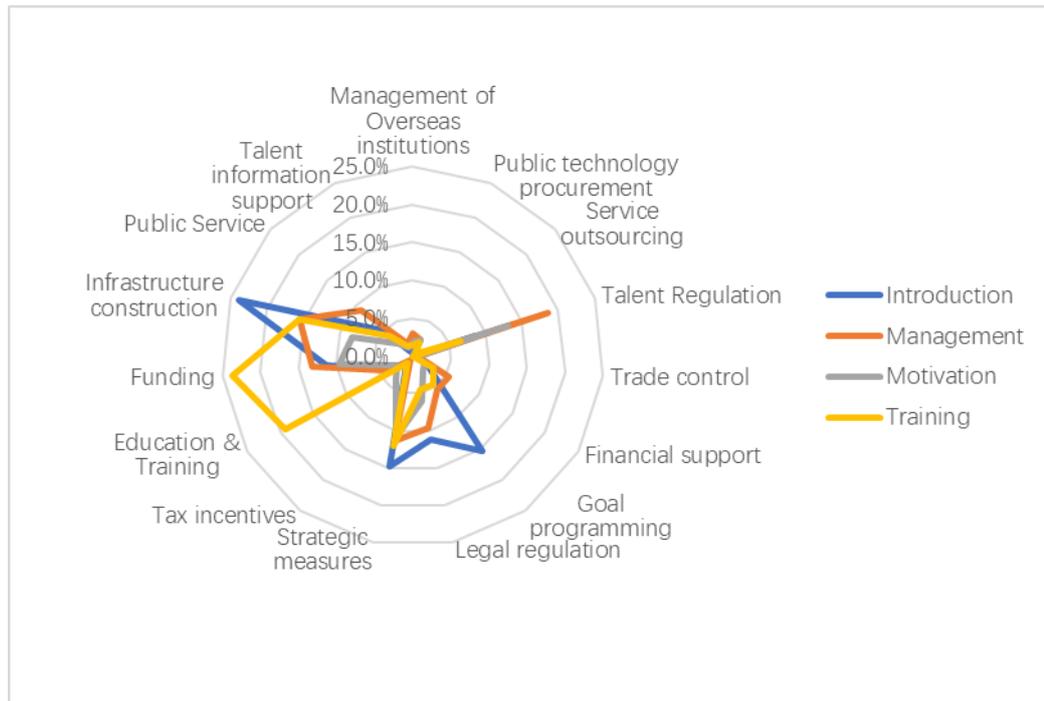
Figure 26: The use of policy instruments in talent development

From the statistical data of secondary indicators, infrastructure construction, financial support, strategic measures, and talent standards are used the most. It mainly uses infrastructure construction and financial support to attract and train talents, and manage talents through talent standards. Strategic measures are used in a balanced manner at each stage of talent.

More notably, the current first-tier cities in the talent training stage still mainly adopt supply-based measures. Through job title promotion, settlement subsidies, construction of scientific research bases, etc., starting from the needs of talents, open up future development channels, solve the difficulties in life and housing and the needs of ability improvement, and effectively let talents feel at ease in innovation and entrepreneurship.

4.2.5 Similarities and Differences

From the perspective of talent introduction, the four cities have their pertinence, focusing on key areas, and generally open the door to "high-quality, cutting-edge" talents, which is also related to their respective urban development.

Beijing is the nation's political, cultural, international exchange, and technological innovation center. Such a city's positioning determines that Beijing will build a "high-precision" industrial structure, so this type of talent is more favored;

Shanghai aims to build the "five centers" of the international economy, finance, trade, shipping, and technological innovation. Therefore, it also focuses on talents in key fields and introduces "key few" talents from scientific research institutes.

As a young immigrant city, Shenzhen has more relaxed conditions for the introduction of professional and younger high-skilled talents than Beijing, Shanghai, and Guangzhou.

Compared with the other three first-tier cities, Guangzhou's attractiveness to high-end talents, especially financial talents, is inadequate, so the scope of talents is wider than that of Beijing and Shanghai.

According to the previous two sections, it can be found that Beijing and Shanghai have begun to strictly control the population size, while Guangzhou's population control appears to be relatively loose, and it is proposed to scientifically control the population size.

In addition, Shenzhen, which is also a first-tier city, is the most friendly. For the

top domestic metropolises, Beijing and Shanghai, both are positioned more at a global level to consider the supply of talents. Strict population control and talent absorption are equally important. They clearly know what types of talents they need, so while bringing about population transfer through deconstruction, they also vigorously introduce the talents they need and constantly increase their investment in human capital to adjust the population structure and improve the overall population quality.

Guangzhou and Shenzhen have relatively loose population control. This is because they still have a relatively high tolerance for the population, but their attractiveness is less than that of the north. On the other hand, it is also because their industrial development requires more talent inflows.

In general, the talent policies of first-tier cities are generally closely related to their development and characteristics, and the introduction of talents is more targeted. While controlling the population, they still regard high-end talents as the target of introduction and are more focused and high-end.

The talent control policy is exemplified by Beijing and Shanghai, and the control is relatively strong, but the door is still open to "high-precision and short-cut" talents, focusing on the adjustment of the population quality structure.

While Guangzhou has moderate control over talents and strong recruitment of talents; Shenzhen has relatively loose policies for talent settlement and subsidies.

Based on the previous dimensional analysis, similarities and differences in first-tier cities have been sorted out, as shown in the table 9.

Table 9: *Similarities and differences in first-tier cities*

Type	Similarity	Difference
Economy	● GDP continues to rise, economic transformation, continuous development of the tertiary industry	● The economy of Guangzhou and Shenzhen is significantly lower than that of Beijing and Shanghai. ● Shenzhen has more industries, but the development of the tertiary industry is relatively weak
Science and technology	● The education expenditure in the city's fiscal expenditure has increased rapidly	● Due to the gathering of scientific research institutions and universities, Beijing's R&D investment is significantly higher than in other cities. ● More financial institutions in Shanghai, but the level of scientific research is weaker. ● Shenzhen relies on large enterprises.

		• The city background of Guangzhou is commerce, with a strong service industry and a weak manufacturing industry.
Policy instrument	• Most supply-oriented policies: funding • The demand-oriented policy is the least, mainly adopts talent regulation, rarely market pull • Insufficient environmental policies, need to strengthen tax incentives	• Beijing mainly provides education and infrastructure, is included in the incubation platform, and has more industry-university-research cooperation. • Shanghai mainly provides fund support • Guangzhou pays more attention to talent service and legal control • Shenzhen builds infrastructure, provides scientific research carriers, involves more overseas organization management, and has more

		tax policies
Talent development stage	● Introduction: Most use Infrastructure construction and funding ● Training: Strategic measures ● Motivation: Strategic measures ● Management: Legal & regelation	● Beijing mentions motivation more, Guangzhou ● Shanghai pay more attention to training: with funding, and is weaker in management ● Shenzhen stress more on talent introduction ● Guangzhou is weaker, in all aspect, need to be improved

4.3 Strengths of China's science and technology talent policy

4.3.1 Diversified policy instruments

China's urban science and technology talent policy instruments are often issued in the form of municipal action plans, involving scientific research funding, scientific research facility construction, science, and technology talent's living security, talent settlement, scientific research system reform, and science and technology talent training. At the same time as the introduction of talent policies, through the regulation of housing prices and other means to ensure the settlement of talents.

The main body of policy instruments also covers science and technology talents, employers, universities and scientific research institutions, government service agencies, etc., involving all stages of talent development. It is conducive to the

coordination of various policy instruments to provide support for science and technology talents from all aspects. It not only attracts talents by providing scientific research employment opportunities and optimizing the working environment but also relieves talents from worries about life and household registration.

These talent policies are issued by the municipal party committee or the municipal government in a unified manner, which can avoid multiple political outreaches and enable various policies to be connected.

4.3.2 Improved talent management

Many policies allow in-service science and technology talents in universities and scientific research institutions to bring scientific research projects and results to work in enterprises under the premise of retaining the establishment, and they can also start their businesses.

During the period, the salary and promotion of science and technology talents in the original unit will not be affected, and science and technology talents in scientific research institutes of universities and colleges are allowed to work part-time in the enterprise and receive remuneration.

The introduction of special talents by scientific research institutions may not be restricted by the establishment of positions, and the performance rewards issued to science and technology talents may not be included in the total salary.

This can not only enhance the enthusiasm of science and technology talents to engage in scientific research and innovation, solve the problem of scientific research

talents' treatment, but also relieve employers' worries and make them dare to introduce talents boldly.

At the same time, the use of scientific research achievement bonus awards, equity incentives, honorary title awards, and other methods to encourage science and technology talents to obtain scientific research results, and increase the proportion of science and technology talents' income in scientific research and innovation activities, in addition to stimulating science and technology talents to generate innovation motivation. In addition, it also helps to reduce the contradiction between the enterprise and the talents and create a better working environment.

4.3.3 Economic and Sci-tech support

The economic strength of the first-tier cities is very strong, and they are all on an upward trend. New strategic enterprises and the technology industry are developing very rapidly. Industrial development needs scientific and technological talents. And first-tier cities attach importance to financial expenditures on education and scientific research.

From the perspective of supply instrument policy, the government mainly provides financial support and public services to meet the daily needs of talents. Thoughtful policy design was carried out in response to the actual needs of science and technology talents, such as providing convenient conditions for family members to settle down and live for overseas talents, providing talent apartments for job-seeking college students, and providing convenient services for talents through

service organizations such as "Talent Homes".

4.4 Weaknesses of China's science and technology talent policy

4.4.1 Unbalanced use of instruments

Analysis shows that Beijing, Shanghai, Guangzhou, and Shenzhen have different reliance on policy instruments in talent work. The three types of policy instruments have the problem of unbalanced supply, namely, oversupply of supply-based policy instruments, and insufficient use of environmental and demand-based policy instruments.

The lack of demand-based policies shows that the government lacks top-level design, feedback mechanisms, and systematic inquiry in the process of designing and issuing policies related to science and technology talents. Therefore, improving the system and comprehensiveness of policy formulation for science and technology talents is the key driving force for doing a good job of science and technology talents. In the talent training stage, excessive use of supply-based policies, and doing so for a long time, may weaken the initiative of science and technology talents.

4.4.2 Incomplete talent information construction

In the previous part of this study, it is shown that the talent policy lacks the support of talent informatization. Talent informatization support is an important part of solving information asymmetry and doing a good job in cultivating and introducing talents.

Informatization support is the most important way for science and technology

talents to obtain information, and it is also the most important reference for science and technology talents when facing their development direction.

Therefore, to promote the rapid development of talent introduction, it is necessary to ensure the information support of science and technology talents.

At present, the science and technology talent policies formulated by China's first-tier cities involve less content about talent informatization, which will cause obstacles to communication with science and technology talents and problems caused by many information asymmetries, and there is a lack of a long-term mechanism for establishing real-time interaction with high-tech talents.

4.4.3 Strong government leadership

Among the policy instruments, there are too many government-led categories, and the introduction of markets and social forces is insufficient.

The financial support and incentive instruments in the policy are relatively strong, which puts a lot of pressure on fiscal expenditures.

Incentives for introduced talents, grants of talent settlement subsidies, scientific research support for talents, and construction of scientific research infrastructure are mostly borne by government finances.

The government encourages companies to provide vocational training for employees, but the government still provides subsidies and rewards to companies that provide employee training.

With the increase in the introduction of talents and the increase in scientific

research activities, the pressure on government fiscal expenditures will continue to increase.

With the continuous development of the high-tech industry, enterprises will gather a large number of science and technology talents, especially skilled talents will be mainly concentrated in enterprises. Their employment and remuneration will mostly be market-oriented, and personnel training and title promotion will also rely on enterprises. Need to introduce more market and social forces.

4.4.4 Lack of continuity in talent development

In terms of talent development, the focus is on talent training, and the support content is mainly funded.

There is still a shortage of talent incentive policies, the flexibility of using various policy instruments is not enough, and the indirect incentive effect of the institutional environment and the market is not paid attention to.

The high threshold of talent introduction adapts to the high-level strategic positioning, and the introduction target is greatly influenced by political factors.

Except for talent training, the policies in other links are evenly distributed, but the number is small or the gap is large, and the continuity of human resource process management is insufficient.

CHAPTER 5: CONCLUSION AND SUGGESTION

5.1 Overall findings

5.1.1 Comprehensive talent competition factors

The competition for talents is jointly promoted by a variety of factors such as national policy orientation, high-quality development needs, population aging trends, and urban labor shortages.

The current talent competition presents characteristics such as the increase in cities, the expansion of the scope of talents, the continuous improvement of policy preferences, and the gradual improvement of the talent system. However, there are still many problems such as the blind introduction of talents, lack of talent exchange mechanisms, and excessive government leadership.

At the same time, the talent introduction policies frequently introduced in first-tier cities in recent years have further controlled the quantity and quality of talent introduction and directly promoted the improvement of the level of urban talent resources.

5.1.2 Supportive policy environment

The situation of urban economic development is an important factor in attracting talents, and first-tier cities are the four most economically powerful cities in China.

Although money is not necessarily the most important thing for high-level talents, it can guarantee the basic needs of high-level talents, that is, the protection of food, clothing, shelter, property, and work. Cities with more educational resources will have better training resources and scientific research platforms to provide scientific and technological talents with a basis for scientific research and innovation. A better resource platform is the guarantee for scientific and technological talents to achieve higher levels of demand, but first-tier cities meet this demand.

5.1.3 Urban difference and policy convergence

From the perspective of population control, population restrictions are typical of Beijing and Shanghai. Beijing and Guangzhou have the most serious population size and population aging, Guangzhou is in the stage of "scientific regulation", and Shenzhen has the least force of population control. The talent policy of each city is generally closely related to its development and characteristics.

The attraction of talents is more targeted, usually combining the introduction of talents with population control, and focusing on the adjustment of population quality structure.

What's more, from the perspective of policy instruments, the excessive use of supply-oriented policies and the serious shortage of demand-oriented policies are reflected in the lack of communication of talent information needs, the similarity between the contents of talent policies, the lack of follow-up training of talents, and the lack of market participation and stimulation.

5.2 Science and technology talent policy improvement path

5.2.1 Optimize the use of supply-oriented policies

5.2.1.1 Improve policies on personnel training

Due to the rapid development of the social economy, if scientific and technological talents need to have strong competitiveness and skills superior to others, they must always maintain a learning and enterprising mentality, constantly learn new technologies and absorb new knowledge to promote their continuous growth, so they have a strong demand for self-growth.

Such as mechanism, the government needs to establish an effective training system of talent education training before must first understand the characteristics of the target population, combining the talent characteristics and job requirements, suitable for talent development, meets the needs of talent cultivation system, and talent cultivation of policy measures to specific, clear, In this way, the personnel training work has direction and pertinence, which is conducive to the development of personnel training work.

Academic exchange activities in different forms and contents can be held according to the work characteristics of different scientific and technological talents, to encourage scientific and technological talents to conduct more academic exchanges, which plays an important role in enhancing the ability of talents.

5.2.1.2 Efficient talent information support

On the one hand, sharing high-quality human resources can solve the urgent need

and shortage of scarce talents and reduce the corresponding labor costs; on the one hand, the sharing of talents is conducive to the complementary advantages, exchanges, and cooperation between cities.

Therefore, it is necessary to establish a talent sharing mechanism, develop a common mechanism for talent resource sharing and information exchange, and realize the real-time sharing of talent information, so that the needs of talents in various regions can be responded to in multiple places, and it is also convenient for the targeted circulation of talent resources; The role of urban agglomerations is to actively explore talent cooperation resources, build a diversified talent system, and build cooperation and win-win inter-city talent development model.

Including an open and integrated information release platform for attracting talents in a timely and comprehensive manner; a proactive talent docking platform to effectively attract science and technology talents to the talent team for urban development; A regular and orderly exchange platform creates opportunities for the display and sharing of the achievements of Tianjin's science and technology talents.

5.2.2 Promote the use of environment-oriented policies

In the market economy system, tax incentives and financial support can help science and technology talents to reduce the pressure of capital in scientific and technological innovation activities, reduce the resistance to innovation and entrepreneurship, and thus improve the enthusiasm and motivation of scientific and technological talents.

The talent policies of China's first-tier cities make low use of tax incentives and financial support and have few ways to subsidize talents, which cannot meet the diverse needs of talents. Moreover, most of the relevant measures formulated are abstract and without clear provisions, which is not conducive to the concrete implementation of policies.

Therefore, the government should strengthen policies in tax incentives, financial support, and other aspects to promote scientific and technological talents' research projects and achievements transformation, promote the growth and development of talents and realize their value, and meet the needs of talents for personal growth and development.

5.2.2.1 Build a systematic financial service mechanism

The first is to build a systematic financial service mechanism. Should make full use of government funds in the market leverage to adjust action, can be allied with qualified VC institutions, exploring the way more financial support, including, for example, "equity", "loan", "venture capital insurance", "credit guarantee", "project subsidy", to provide the relevant supporting services at the same time, explore the more financing channels for its to optimize the scientific and technological talents innovation and entrepreneurship, achievement transformation to provide financial services.

5.2.2.2 Explore more ways of funding talents

The second is to explore more ways of funding talents, better meet the needs of

talents for funds in the process of scientific and technological innovation research tax loan system.

For example, the "innovation voucher system" and "tax loan for scientific research", which are widely used in many developed countries, can be adopted.

"Innovation voucher system" is a kind of "innovation currency" to solve the problem of funding shortage in scientific research activities. The government issues "innovation vouchers" to enterprises to delay them from buying products and services related to science and technology talents through "innovation vouchers", which can be exchanged directly by the government finance department. At present, this method has been adopted by many countries, and Jiangsu Province of China has also implemented this method to increase the financial support for talents. "Tax loan for scientific research" means that the government returns the corresponding scientific research funds already spent by scientific researchers in the form of a tax refund.

5.2.2.3 Ensure the implementation of policies

The third is to formulate practical and concrete policies and measures on taxation and financial services to ensure their implementation. For example, for the additional deduction policy of scientific research tax mentioned in Shanghai policy, more specific implementation rules are needed, that is, to specify the intellectual property fees of scientific research activities and allow them to be included in the cost before tax so that the work of tax preference can be better carried out, rather than simply stating that additional deduction can be made directly.

5.2.3 Strengthen the use of demand-oriented policies

5.2.3.1 Increase government purchase

In future policy planning, first-tier cities should increase the use of demand-based policy tools and strengthen the government's purchasing power. For example, the government is exploring the establishment of corresponding platforms and systems to facilitate the direct purchase of scientific research personnel's labor services, including consulting services, labor services, etc., to implement a variety of incentives for scientific and technological personnel, promote the realization of scientific and technological personnel's value, meet their needs for self-achievement, and stimulate their enthusiasm.

In addition, other ways of purchase can be implemented, such as supporting talents to join the construction of overseas institutions and overseas talent training bases, to help them set up their private foreign institutions. In this way, the government can break the previous restriction of a one-time purchase of scientific and technological personnel services, and then realize multiple purchases.

At the same time, it can also change the way that the government can only purchase scientific and technological personnel services through employers. This is conducive to providing more opportunities for talents to participate in international exchanges and learn international technology, to update their knowledge reserve and improve their ability, and to meet their personal growth and development needs.

5.2.3.2 Develop overseas organization

Based on the international city positioning of first-tier cities, actively exploring overseas institutions plays a key role in promoting the efficient development of talent team construction. Strengthening efforts to encourage universities, science and technology enterprises, and scientific research institutes to set up overseas institutions, research and development bases, and establish talent training bases with international cooperation will play an important role in driving talents to exchange and cooperate, broaden their horizons, and improve their knowledge and professional literacy. This provides a favorable opportunity to promote the growth of talents themselves.

In first-tier cities policy for overseas institutions in the management of qualified personnel in science and technology policy in the way of supply, and rarely related to the use of specific regulations, rules, and regulations to regulate the establishment of overseas institutions, therefore, the government should increase the supply of the measures, by implementing some policy measures to encourage scientific and technological personnel to the outside world and the related institutions, into the international organization.

5.3 Suggestions for urban strategies in China

5.3.1 Put industrial transformation in the first place

In high-tech industries, first-tier cities have absolute advantages and can attract more talents. For many other non-first-tier cities, it is necessary to think about how to build a city into an industrial innovation center and strengthen the agglomeration effect, instead of just attracting talents but ruining industries and wasting social

resources. The fundamental purpose of introducing talents is to open up and develop emerging industries and at the same time give play to the role of industries in attracting talents.

It is necessary to vigorously develop strategic emerging industries, match industrial planning with talent introduction planning, and calculate the labor demand structure to make it consistent with the adjustment of the industrial structure.

The key factor to truly retain people lies in the upgrading and transformation of the industrial structure, especially the emerging competitive industries. The overall economic strength and industrial structure determine a city's economic level, industrial advantages, and employment prospects. To a large extent, it also determines whether the city can attract and retain talent.

5.3.2 Break the limits of single city development

Currently, cities are independently developing their characteristics, and there is little cooperation between cities. At present, there are few talent information exchanges between cities and no perfect human resource sharing platform. Only human resource organizations, such as talent introduction agencies, cannot share human resources and may further intensify the competitive relationship between cities

On the one hand, sharing high-quality human resources can solve the urgent need for scarce talents and reduce the related labor costs. On the other hand, it is conducive to complementary advantages, exchanges, and cooperation between cities.

Establishing a talent sharing mechanism to realize the real-time sharing of talent

information can understand the talent needs of each city, and at the same time, facilitate the targeted circulation of talent resources and build win-win cooperation and talent development model between cities.

5.3.3 Adhere to sustainable urban development

From the perspective of some infrastructure in first-tier cities, there has been an ecological trend of further integration between cities and industries. This is also the trend of urban development, accelerating the industrial upgrading of cities, but in this process, we should also pay attention to the sustainable development of cities.

Therefore, it is necessary to plan long-term goals, reduce construction costs and improve benefits. Unity of economic benefits, social benefits, and ecological benefits, deal with the harmonious relationship between man and nature and constantly pay attention to the construction of urban ecology.

Institutional support for sustainable innovation will be provided by designing supporting policies for talent, housing, and land use. It includes but is not limited to supporting the life of creative talents, accommodating the life of the disadvantaged and necessary policy housing supply, encouraging the exploration of land mix and compatibility, etc.

These can improve the inclusiveness and openness of the city, to encourage the cultural concept of the trial and error, is to build urban overall innovation atmosphere, the formation of the cohesion of urban residents, improve the key factors of the creative class attraction of the city and is also an important guarantee for the

sustainable development of city innovation.

5.4 Recommendation for future research

First, in terms of case selection, since the case of this study is a first-tier city in China, the recommendations made are based on the premise of better urban development and do not involve other second-and third-tier cities. Therefore, there are limitations in the scope of research and strategic recommendations. In the future, we can study the comparative study of different levels of cities, or conduct urban talent attraction policy research for a certain second-tier city.

Second, it is necessary to further enrich the research materials to make policy recommendations more concrete and effective. In terms of research methods, this study only uses text analysis and literature research methods, which are relatively subjective, and does not comprehensively use interview methods and other research methods. Therefore, in the follow-up research, on the one hand, it is possible to conduct in-depth and semi-structured interviews with relevant people involved in the process of formulating science and technology talent policies to understand the specific details of the formulation and implementation of innovation policies.

In this way, we can more accurately grasp the policy attitudes of policymakers and understand the direct goals and deeper goals of the scientific and technological innovation policy.

On the other hand, it is possible to conduct surveys on technology-based enterprises and innovative and entrepreneurial talents in the case cities through

questionnaires, interviews, etc., to understand the actual needs of these innovative entities, and to provide references for the optimization and improvement of science and technology talent policy instruments from a market perspective. To provide more comprehensive and rich policy suggestions for the layout of the urban science and technology talent policy system.

APPENDICES

Appendix 1: Collected talent policies of first-tier cities in China

No.	City	Policy name [Chinese]	Policy name [English]	Issuing department [Chinese]	Issuing department [English]
1	Beijing	《北京技术创新行动计划（2014－2017 年)》	Beijing Technology Innovation Action Plan (2014-2017)	北京市人民政府	Beijing Municipal People's Government
2	Beijing	《北京市促进金融科技发展规划(2018 年－2022 年)》	Plan for Promoting fintech Development in Beijing (2018-2022)	北京中关村科技园区管理委员会、北京市金融工作局、北京市科学技术委员会	Beijing Zhongguancun Science and Technology Park Management Committee, Beijing Municipal Financial Work Bureau, Beijing Municipal Science and Technology Commission
3	Beijing	关于开展北京市安全生产领域学科带头人评定工作的通知	Notice on the assessment of academic leaders in the field of Work safety in Beijing	北京市安全生产监督管理局、北京市人力资源和社会保障局、北京市教育委员会	Beijing Municipal Work Safety Administration, Beijing Municipal Human Resources and Social Security Bureau, Beijing Municipal Education Commission
4	Beijing	关于开展安全生产领域北京优秀青年工程师评选表彰工作的通知	Notice on the selection and commendation of Beijing Outstanding Young Engineers in the field of work safety	北京市安全生产监督管理局	Beijing Work Safety Administration
5	Beijing	关于印发《北京市环境保护局"十三五"时期科技管理工作方案》的通知	Scientific and technological Management plan of Beijing Environmental Protection Bureau during the 13th Five-Year Plan	北京市环境保护局	Beijing Municipal Environmental Protection Bureau

			period		
6	Beijing	关于遴选推荐新工科研究与实践项目的通知	Notice on the selection and recommendation of new engineering research and practice projects	北京市教育委员会	Beijing Municipal Education Commission
7	Beijing	《北京促进人工智能与教育融合发展行动计划》	Beijing Action Plan to Promote the Integrated Development of ARTIFICIAL Intelligence and Education	北京市教育委员会	Beijing Municipal Education Commission
8	Beijing	《北京市小型微型企业创业创新示范基地管理办法》	Management Measures for Entrepreneurship and Innovation Demonstration Base of Small and Micro Enterprises in Beijing	北京市经济和信息化委员会	Beijing Municipal Economic and Information Commission
9	Beijing	《北京市农业科技园区发展规划(2019－2025 年)》和《北京市农业科技园区管理办法(试行)》	Beijing Agricultural Science and Technology Park Development Plan (2019-2025) and Beijing Agricultural Science and Technology Park Management Measures (Trial)	北京市科学技术委员会、北京市农业农村局、北京市水务局	Beijing Municipal Commission of Science and Technology, Beijing Municipal Bureau of Agriculture and Rural Areas, Beijing Municipal Water Bureau
10	Beijing	于开展 2020 年北京市高级研修班选题申报工作的通知	Notice on the application of topic selection for 2020 Beijing Senior Seminar	北京市人力资源和社会保障局	Beijing Human Resources and Social Security Bureau
11	Beijing	《北京市全民科学素质行动计划纲要实施方案(2016-2020 年)》	Implementation Plan of Beijing National Scientific Literacy Action Plan (2016-2020)	北京市人民政府	People's Government of Beijing Municipality
12	Beijing	《北京市"十三五"时期城乡一体化发展规划》	Urban and Rural Integration Development Plan of Beijing during the 13th Five-Year Plan Period	北京市人民政府	People's Government of Beijing Municipality
13	Beijing	《北京市"十三五"时期现代产业发展和重点功能区建设规划》	Planning for The Development of Modern Industry and Construction of Key Functional Areas in the 13th Five-Year Plan Period of Beijing	北京市人民政府	People's Government of Beijing Municipality
14	Beijing	《北京市关于加强医疗卫生机构研究创新功能的实施方案(2020—2022 年)》	Implementation Plan of Beijing On Strengthening the Research and Innovation Function of Medical and	北京市卫生健康委员会等	Beijing Municipal Health Commission, etc

			Health Institutions (2020-2022)		
15	Beijing	关于开展北京市应急管理领域学科带头人评定工作的通知	Notice on the assessment of academic leaders in the field of emergency management in Beijing	北京市应急管理局、北京市人力资源和社会保障局、北京市教育委员会	Beijing Municipal Emergency Management Bureau, Beijing Municipal Human Resources and Social Security Bureau, Beijing Municipal Education Commission
16	Beijing	关于开展 2019 年度应急管理领域北京市科技新星计划推荐工作的通知	Notice on the recommendation of Beijing Science and Technology New Star Program in the field of emergency Management in 2019	北京市应急管理局	Beijing Municipal Emergency Management Bureau
17	Beijing	关于开展 2020 年度应急管理领域北京市科技新星计划推荐工作的通知	Notice on the recommendation of Beijing Science and Technology New Star Program in the field of emergency Management in 2020	北京市应急管理局	Beijing Municipal Emergency Management Bureau
18	Beijing	关于开展应急管理领域北京优秀青年工程师评选表彰工作的通知	Notice on the selection and recognition of Beijing Outstanding Young Engineers in the field of emergency management	北京市应急管理局	Beijing Municipal Emergency Management Bureau
19	Beijing	《中关村丰台园轨道交通产业创新发展行动计划（2020－2022 年)》	Notice on printing and distributing the Action Plan for Innovation and Development of Zhongguancun Fengtai Yuan Rail Transit Industry (2020-2022)	北京市中关村科技园区管理委员会、北京市丰台区人民政府	Beijing Zhongguancun Science and Technology Park Management Committee, Beijing Fengtai District People's Government
20	Beijing	关于 2019 年度北京市自然科学基金项目申请的通知	Beijing Natural Science Foundation of 2019 Project Application Notice	北京市自然科学基金委员会	Beijing Natural Science Foundation Committee
21	Beijing	《关于建立以国家公园为主体的自然保护地体系的实施意见》	Opinions on the Implementation of establishing a System of Protected Natural Areas with National Parks as the Main Body	中共北京市委、北京市人民政府	Beijing Municipal Party Committee and Beijing Municipal People's

					Government
22	Beijing	贯彻《中共中央关于坚持和完善中国特色社会主义制度推进国家治理体系和治理能力现代化若干重大问题的决定》的实施意见	Implementing the "Decision of the Central Committee of the Communist Party of China on Several Major Issues Concerning Upholding and Improving the Socialist System with Chinese Characteristics and Promoting the Modernization of the National Governance System and Governance Ability"	中共北京市委	Beijing Municipal Committee of CPC
23	Beijing	关于认真学习贯彻党的十八届三中全会精神全面深化改革的决定（FBM-CLI-14-811046）	Decision on Conscientiously Studying and Implementing the Spirit of the Third Plenary Session of the 18th CPC Central Committee and Comprehensively Deepening Reform (FBM-CLI-14-811046)	中共北京市委	Beijing Municipal Committee of CPC
24	Beijing	北京市促进科技成果转化条例（FBM-CLI-10-1550644）	Regulations of Beijing Municipality on Promoting the Transformation of Scientific and Technological Achievements (FBM-CLI-10-1550644)	北京市人民代表大会常务委员会	Standing Committee of Beijing Municipal People's Congress
25	Beijing	关于进一步提高北京高等学校科技创新能力的意见	Suggestions on further improving the ability of scientific and technological innovation in Beijing colleges and universities	北京市教育委员会	Beijing Municipal Education Commission
26	Beijing	《北京市科学技术委员会关于建设京津冀协同创新共同体的工作方案（2015－2017 年)》	Work Plan of Beijing Municipal Commission of Science and Technology on the Construction of Beijing-Tianjin-Hebei Collaborative Innovation Community (2015-2017)	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
27	Beijing	关于进一步加强农业科技工作的意见	Opinions on further strengthening agricultural science and technology work	北京市人民政府	People's Government of Beijing Municipality
28	Beijing	2015 年市政府工作报告重点工作分工方案	2015 Municipal Government work report key work division plan	北京市人民政府	People's Government of Beijing Municipality
29	Beijing	北京市"十二五"时期科技北京发展建设规划	Beijing science and Technology Development and Construction Plan during the 12th Five-Year Plan period	北京市人民政府	People's Government of Beijing

					Municipality
30	Beijing	关于全面深化新时代教师队伍建设改革的实施意见	Opinions on comprehensively deepening the reform of teacher team construction in the new Era	中共北京市委、北京市人民政府	Beijing Municipal Party Committee and Beijing Municipal People's Government
31	Beijing	关于制定北京市国民经济和社会发展第十三个五年规划的建议	Suggestions on the formulation of the 13th Five-year Plan for Beijing's national economic and social development	中共北京市委	Beijing Municipal Committee of CPC
32	Beijing	《北京实验室建设发展规划(2017－2035)》(附 北京实验室建设与运行管理办法(试行))	Beijing Laboratory Construction and Development Plan (2017-2035) (With Beijing Laboratory Construction and Operation Management Measures (trial))	北京市教育委员会	Beijing Municipal Education Commission
33	Beijing	《北京市杰出青年科学基金项目管理办法(试行)》	Administrative Measures of Science Fund for Outstanding Youth of Beijing (Trial)	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
34	Beijing	《北京市"十三五"时期都市现代农业发展规划》	Urban Modern Agriculture Development Plan of Beijing during the 13th Five-Year Plan Period	北京市农村工作委员会、北京市发展和改革委员会、北京市农业局	Beijing Municipal Rural Affairs Commission, Beijing Municipal Development and Reform Commission, Beijing Municipal Agriculture Bureau
35	Beijing	《北京市深化自然科学研究人员职称制度改革实施办法》	Measures of Beijing for Deepening the Reform of the Professional Title System for Natural Science Researchers	北京市人力资源和社会保障局、北京市科学技术委员会关	Beijing Municipal Human Resources and Social Security Bureau, Beijing Municipal Science and Technology Commission guan
36	Beijing	《北京市深化市级财政科技计划(专项、基金等)管理改革实施方案》	Implementation Plan for Deepening The Management Reform of Municipal Financial Science and Technology Programs (Special Projects, Funds, etc.) in Beijing	北京市人民政府	People's Government of Beijing Municipality
37	Beijing	关于印发 2019 年市政府工作报告重点工作分工方案的通知	Notice on printing and distributing the plan of major Division of Work in 2019 Municipal Government Work Report	北京市人民政府	People's Government of Beijing

					Municipality
38	Beijing	建设中关村军民融合科技创新示范基地行动计划（2013—2015 年）	Action Plan for Building Zhongguancun Military-Civilian Integration Technological Innovation Demonstration Base (2013-2015)	北京市人民政府	People's Government of Beijing Municipality
39	Beijing	关于 2020 年度北京市自然科学基金杰出青年科学基金项目申报的通知	Notice on the application of the Outstanding Youth Science Fund project of Beijing Natural Science Foundation in 2020	北京市自然科学基金委员会	Beijing Natural Science Foundation Committee
40	Beijing	关于深化首都人才发展体制机制改革的实施意见	Opinions on deepening the reform of talent development system and mechanism in the Capital	中共北京市委	Beijing Municipal Committee of CPC
41	Beijing	关于开展 2018 年度安全生产领域北京市科技新星计划申报工作的通知	Notice on the application of Beijing Science and Technology Star Program in the field of Work Safety in 2018	北京市安全生产监督管理局	Beijing Work Safety Administration
42	Beijing	关于开展 2020 年度北京市科技新星计划推荐工作的通知	Notice on the recommendation of 2020 Beijing Science and Technology Star Program	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
43	Beijing	关于印发《北京市科技新星计划管理办法》的通知（2017 修订）	Notice on Printing and Distributing Administrative Measures of Beijing Science and Technology New Star Program (Revised in 2017)	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
44	Beijing	《怀柔科学城建设发展规划（2016－2020 年）》	Construction and Development Plan of Huairou Science City (2016-2020)	北京市人民政府	People's Government of Beijing Municipality
45	Beijing	《关于深化中关村人才管理改革的若干措施》	Several Measures on Deepening talent Management Reform in Zhongguancun	中共中央组织部、国家发展改革委、教育部	Organization Department of the CPC Central Committee, National Development and Reform Commission, Ministry of Education
46	Beijing	北京市国民经济和社会发展第十三个五年规划纲要	Outline of the 13th Five-year Plan for Beijing's National Economic and Social Development	北京市发展和改革委员会	Beijing Municipal Development and Reform

				Commission
47	Beijing	《北京市"十二五"时期交通发展建设规划》	Transportation Development and Construction Plan of Beijing during the 12th Five-Year Plan Period	北京市交通委员会、北京市发展和改革委员会	Beijing Municipal Commission of Transportation, Beijing Municipal Commission of Development and Reform
48	Beijing	北京城市总体规划(2016年—2035年)	Master Plan of Beijing (2016-2035)	中共北京市委、北京市人民政府	Beijing Municipal Party Committee and Beijing Municipal People's Government
49	Beijing	关于 2012 年度北京市自然科学基金项目申请的通知	Beijing Natural Science Foundation of 2012 Project Application Notice	北京市自然科学基金委员会	Beijing Natural Science Foundation Committee
50	Beijing	《北京市自然科学基金发展规划(2011—2020年)》	Development Plan of Beijing Natural Science Foundation (2011-2020)	北京市自然科学基金委员会	Beijing Natural Science Foundation Committee
51	Beijing	北京市"十二五"科学技术普及发展规划纲要	Outline of Beijing's 12th Five-Year Plan for the Popularization of science and technology	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
52	Beijing	对北京市 2014 年国民经济和社会发展计划上半年执行情况审议意见研究处理情况的报告	Report on the study and treatment of the opinions on the implementation of Beijing's 2014 National Economic and Social Development Plan in the first half of the year	北京市发展和改革委员会	Beijing Municipal Development and Reform Commission
53	Beijing	《北京市关于全面深化改革、扩大对外开放重要举措的行动计划》	Action Plan of Beijing on Important Measures to Comprehensively Deepen Reform and Expand Opening-up	中共北京市委、北京市人民政府	Beijing Municipal Party Committee and Beijing Municipal People's Government
54	Beijing	关于推进北京市种业人才发展和科研成果权益改革工作的若干意见	Some opinions on promoting the development of talents in seed industry and the reform of rights and interests of scientific research achievements in Beijing	北京市农村工作委员会、北京市教育委员会、北京市科学技术委员会	Beijing Municipal Rural Affairs Commission, Beijing Municipal Education Commission, Beijing Municipal Science and

					Technology Commission
55	Beijing	关于强化企业技术创新主体地位全面提升企业创新能力的意见	Opinions on strengthening the main position of enterprises in technological innovation and comprehensively improving the innovation ability of enterprises	北京市人民政府	People's Government of Beijing Municipality
56	Beijing	关于制定北京市国民经济和社会发展第十四个五年规划和二〇三五年远景目标的建议（	Suggestions on the formulation of the 14th Five-Year Plan for Beijing's National Economic and Social Development and the Long-term Goals for 2035 (	中共北京市委	Beijing Municipal Committee of CPC
57	Beijing	《北京市促进科技成果转移转化行动方案》	Action Plan of Beijing for Promoting transfer and Transformation of Scientific and Technological Achievements	北京市人民政府	People's Government of Beijing Municipality
58	Beijing	《关于新时代深化科技体制改革加快推进全国科技创新中心建设的若干政策措施》	Policies and Measures on Deepening reform of Science and Technology System and Accelerating Construction of National Science and Technology Innovation Center in the New Era	北京市人民政府	People's Government of Beijing Municipality
59	Beijing	《北京市"十三五"时期加强全国科技创新中心建设规划》	Beijing's Plan for Strengthening the Construction of National Science and Technology Innovation Center during the 13th Five-Year Plan Period	北京市人民政府	People's Government of Beijing Municipality
60	Beijing	《关于首都金融科技创新发展的指导意见》	Guidance on innovation and Development of Fintech in The Capital	北京市金融工作局、中关村科技园区管理委员会、西城区人民政府、海淀区人民政府	Beijing Municipal Bureau of Finance, Zhongguancun Science and Technology Park Management Committee, Xicheng District People's Government, Haidian District people's Government
61	Beijing	《北京市现代服务业科技发展专项工作意见》	Opinions on The Special Work of Science and Technology Development of Modern Service Industry in Beijing	北京市科学技术委员会	Beijing Municipal Commission of Science and

					Technology
62	Beijing	《首都科技领军人才培养工程实施管理办法》	Administrative Measures for the Implementation of Training Project for Capital Science and Technology Leaders	北京市科学技术委员会	Beijing Municipal Commission of Science and Technology
63	Beijing	《北京市园林绿化科技创新行动计划(2013—2020年)》	Beijing Landscape Science and Technology Innovation Action Plan (2013-2020)	北京市园林绿化局	Beijing Municipal Bureau of Landscaping
64	Beijing	贯彻落实市委、市政府关于深化科技体制改革加快首都创新体系建设意见任务分工	To implement the opinions of the Municipal Party Committee and the municipal government on deepening the reform of the science and technology system and speeding up the construction of the Innovation system in the Capital	北京市人民政府	People's Government of Beijing Municipality
65	Beijing	关于深化科技体制改革加快首都创新体系建设的意见	Opinions on Deepening the reform of science and technology system and speeding up the construction of innovation system in the Capital	中共北京市委、北京市人民政府	Beijing Municipal Party Committee and Beijing Municipal People's Government
66	Shanghai	关于促进上海国家级经济技术开发区转型升级创新发展的实施意见	Implementation Opinions on Promoting the Transformation, Upgrading, innovative development of Shanghai National Economic and Technological Development Zone	上海市人民政府	People's Government of Beijing Municipality
67	Shanghai	上海市 2017 年度"科技创新行动计划"科普项目指南	Shanghai Science and Technology Innovation Action Plan 2017	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
68	Shanghai	上海市 2017 年度"科技创新行动计划"软科学研究指南	Soft Science Research Guide of Shanghai Science and Technology Innovation Action Plan 2017	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
69	Shanghai	《上海市科研计划项目(课题)专项经费管理办法》	Measures of Shanghai Municipality on The Administration of Special Funds for Scientific Research Projects (Topics)	上海市财政局、上海市科学技术委员会	Shanghai Municipal Finance Bureau, Shanghai Municipal Science and Technology Commission
70	Shanghai	上海市城市总体规划（2017—2035 年）	Master Plan of Shanghai Municipality (2017-2035)	上海市委、上海市人民	Shanghai Municipal Party Committee

				政府	and Shanghai Municipal People's Government
71	Shanghai	上海市贯彻《长江三角洲区域一体化发展规划纲要》实施方案	Shanghai has implemented the implementation plan of the Outline of the Regional Integrated Development Plan for the Yangtze River Delta	中共上海市委、上海市人民政府	Shanghai Municipal Party Committee and Shanghai Municipal People's Government
72	Shanghai	关于开展上海市 2020 年度全国广播电视和网络视听行业领军人才工程、青年创新人才工程推荐选拔工作的通知	Notice on the recommendation and selection of Shanghai 2020 National Radio, TELEVISION and Internet Audiovisual Industry Leading Talents Project and Young Innovative Talents Project	上海市广播电视局	Shanghai Radio and Television Bureau
73	Shanghai	《上海创意与设计产业发展"十三五"规划》	The 13th Five-Year Plan for the Development of Shanghai's Creative and Design Industry	上海市经济和信息化委员会	Shanghai Municipal Economic and Information Commission
74	Shanghai	《上海市工业绿色发展"十三五"规划》	13th Five-Year Plan of Shanghai Industrial Green Development	上海市经济和信息化委员会	Shanghai Municipal Economic and Information Commission
75	Shanghai	关于开展上海市制造业创新中心建设申报工作的通知	Notice on applying for the construction of Shanghai Manufacturing Innovation Center	上海市经济信息化委	Shanghai Municipal Economic and Information Commission
76	Shanghai	关于组织申报 2016 年度上海市青年科技计划项目的通知	Notice on organizing the application of 2016 Shanghai Youth Science and Technology Program	上海市科委	Shanghai Science and Technology Commission
77	Shanghai	关于组织申报 2016 年度上海市青年科技英才扬帆计划项目的通知	Notice on organizing the application of 2016 Shanghai Youth Science and Technology Talents Sailing Project	上海市科委	Shanghai Science and Technology Commission
78	Shanghai	关于组织申报 2016 年度上海市优秀学术 技术带头人计划项目的通知	Notice on organizing the application of 2016 Shanghai Outstanding Academic and Technical Leader Program	上海市科委	Shanghai Science and Technology Commission
79	Shanghai	关于组织申报 2017 年度上海市青年科技启明星计划项目的通知	Notice on organizing the application of 2017 Shanghai Youth Science and Technology Bright Star Program	上海市科委	Shanghai Science and Technology Commission
80	Shanghai	关于组织申报 2017 年度上海市青年科技英才扬帆计划项目的通知	Notice on organizing the application of 2017 Shanghai Youth Science and Technology Talents Sailing Project	上海市科委	Shanghai Science and Technology Commission

81	Shanghai	关于组织申报 2017 年度上海市优秀学术 技术带头人计划项目的通知	Notice on organizing the application of 2017 Shanghai Outstanding Academic and Technical Leader Program	上海市科委	Shanghai Science and Technology Commission
82	Shanghai	上海市科学技术奖励管理办公室关于征集 2020 年度国家科学技术奖候选者的通知	Notice of Shanghai Municipal Science and Technology Award Administration Office on soliciting candidates for the 2020 State Science and Technology Award	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
83	Shanghai	上海市科学技术奖励管理办公室关于征集 2021 年度国家科学技术奖候选者的通知	Notice of Shanghai Municipal Science and Technology Awards Administration Office on soliciting candidates for 2021 State Science and Technology Awards	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
84	Shanghai	《市级财政科技投入基础前沿类专项联动管理实施细则》	Implementation Rules for Special Linkage Management of Basic Frontier Science and Technology Investment of Municipal Finance	上海市科学技术委员会、上海市发展和改革委员会、上海市财政局	Shanghai Municipal Science and Technology Commission, Shanghai Municipal Development and Reform Commission, Shanghai Municipal Finance Bureau
85	Shanghai	《市级财政科技投入科技创新支撑类专项联动管理实施细则》	Detailed Rules for the Implementation of Special Linkage Management of Scientific and Technological Innovation Support Of Municipal Financial Investment in Science and Technology	上海市科学技术委员会、上海市发展和改革委员会、上海市财政局	Shanghai Municipal Science and Technology Commission, Shanghai Municipal Development and Reform Commission, Shanghai Municipal Finance Bureau
86	Shanghai	《市级财政科技投入科技人才与环境类专项联动管理实施细则》	Implementation Rules for The Special Linkage Management of Scientific and Technological Talents and Environment in Municipal Financial Science and Technology Investment	上海市科学技术委员会、上海市发展和改革委员会、上海市财政局	Shanghai Municipal Science and Technology Commission, Shanghai Municipal Development and Reform Commission, Shanghai Municipal Finance Bureau

87	Shanghai	《上海市临床医学研究中心发展规划(2019－2023年)》	Development Plan of Shanghai Clinical Medical Research Center (2019-2023)	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
88	Shanghai	上海市 2018 年度"科技创新行动计划"青年科技启明星项目指南	Shanghai 2018 "Science and Technology Innovation Action Plan" Young Science and Technology Star Project guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
89	Shanghai	上海市 2018 年度"科技创新行动计划"青年科技英才扬帆计划项目指南	Shanghai 2018 "Science and Technology Innovation Action Plan" Young Science and Technology talents Sailing Project guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
90	Shanghai	上海市 2018 年度"科技创新行动计划"优秀学术 技术带头人项目指南	Shanghai 2018 "Science and Technology Innovation Action Plan" Outstanding Academic Technology leader Project guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
91	Shanghai	上海市 2019 年度"科技创新行动计划"青年科技启明星项目指南	Shanghai 2019 "Science and Technology Innovation Action Plan" Young Science and Technology Star Project guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
92	Shanghai	上海市 2019 年度"科技创新行动计划"软科学研究领域重点项目指南	Guide to key projects in soft science research field of 2019 "Science and Technology Innovation Action Plan" of Shanghai	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
93	Shanghai	上海市 2019 年度"科技创新行动计划"优秀学术 技术带头人项目指南	Shanghai 2019 "Science and Technology Innovation Action Plan" Outstanding Academic Technology leader Project Guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
94	Shanghai	上海市 2021 年度"科技创新行动计划"扬帆计划项目申报指南	Shanghai 2021 "Science and Technology Innovation Action Plan" sailing project application guide	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
95	Shanghai	关于开展 2019 年上海领军人才(科技人才)选拔工作的通知	Notice on the selection of Leading Talents (scientific and technological talents) in Shanghai in 2019	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
96	Shanghai	关于开展 2019 年上海市青年拔尖人才(科技人才)开发计划的通知	Notice on launching the 2019 Shanghai Youth Top-notch Talents (Scientific and technological Talents) Development Plan	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission

97	Shanghai	关于全力支持科技企业抗疫情稳发展的通知	Circular on fully supporting the stable development of science and technology enterprises in fighting the epidemic	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
98	Shanghai	《上海市科学技术奖励规定实施细则》(2013 修订)	Implementation Rules of Shanghai Municipal Regulations on Science and Technology Awards (revised in 2013)	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
99	Shanghai	《上海市科学技术奖励规定实施细则》(2020 修订)	Implementation Rules of Shanghai Municipal Regulations on Science and Technology Awards (Revised in 2020)	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
100	Shanghai	《上海市优秀科技创新人才培育计划管理办法》	Administrative Measures of Shanghai Excellent Scientific and Technological Innovation Talents Training Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
101	Shanghai	《上海市重点实验室建设与运行管理办法》(2015 修订)	Administrative Measures of Shanghai Municipal Key Laboratory on Construction and Operation (2015 Revision)	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
102	Shanghai	《上海市重点实验室建设与运行管理办法》(2019)（附 上海市重点实验室评估规则)	Measures of Shanghai Municipality on The Administration of Construction and Operation of Key Laboratories (2019)(With Evaluation Rules of Shanghai Municipal Key Laboratories)	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
103	Shanghai	关于组织申报 2012 年度上海市优秀学术带头人、优秀技术带头人计划项目的通知	Notice on organizing the application of 2012 Shanghai Outstanding Academic Leaders and Outstanding Technical Leaders Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
104	Shanghai	关于组织申报 2013 年青年科技启明星计划项目的通知	Notice on organizing the application of 2013 Youth Science and Technology Morning Star Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
105	Shanghai	关于组织申报 2014 年度上海市优秀学术 技术带头人计划项目的通知	Notice on organizing the application of 2014 Shanghai Outstanding Academic and Technical Leader Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
106	Shanghai	关于组织申报 2014 年青年科技启明星计划项目的通知	Notice on organizing the application of 2014 Youth Science and Technology Morning Star Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission

107	Shanghai	关于组织申报 2014 年青年科技英才扬帆计划项目的通知	Notice on organizing the application of 2014 Young Science and Technology Talents Sailing Project	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
108	Shanghai	关于组织申报 2015 年度上海市农业科技成果转化资金项目的通知	Notice on organizing the application of 2015 Shanghai Agricultural Scientific and Technological Achievements Transformation Fund Project	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
109	Shanghai	关于组织申报 2015 年度上海市优秀学术 技术带头人计划项目的通知	Notification on organizing the application of 2015 Shanghai Outstanding Academic and Technical Leader Program	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
110	Shanghai	关于印发上海市市级农口系统青年人才成长计划管理办法的通知	Notice on printing and distributing administrative Measures of Shanghai Municipal Agricultural System Youth Talent Development Plan	上海市农业委员会	Shanghai Municipal Agricultural Commission
111	Shanghai	《上海市人力资源和社会保障事业发展"十二五"规划》	The 12th Five-Year Plan for the Development of Human Resources and Social Security in Shanghai	上海市人力资源和社会保障局	Shanghai Human Resources and Social Security Bureau
112	Shanghai	《上海市国内合作交流"十三五"规划》	13th Five-Year Plan for Domestic Cooperation and Exchange of Shanghai	上海市人民政府	Shanghai Municipal People's Government
113	Shanghai	关于本市改革国有企业工资决定机制的实施意见	Opinions on the implementation of wage determination mechanism of state-owned enterprises reform in Shanghai	上海市人民政府	Shanghai Municipal People's Government
114	Shanghai	《本市加强财政科技投入联动与统筹管理实施方案》	Implementation Plan for Strengthening linkage and Overall Management of Financial Investment in Science and Technology in Shanghai	上海市人民政府	Shanghai Municipal People's Government
115	Shanghai	《上海市激发重点群体活力带动城乡居民增收实施方案》	Implementation Plan of Shanghai Municipality to Stimulate the Vitality of Key Groups and Increase the Income of Urban and Rural Residents	上海市人民政府	Shanghai Municipal People's Government
116	Shanghai	《上海市人口和计划生育事业"十二五"规划》	Shanghai Population and Family Planning Program during the 12th Five-Year Plan Period	上海市人民政府	Shanghai Municipal People's Government
117	Shanghai	上海市推进科技创新中心建设条例	Regulations of Shanghai Municipality on Promoting the Construction of Science and Technology Innovation Center	上海市人民代表大会	Shanghai Municipal People's Congress

118	Shanghai	关于上海银行业保险业进一步支持科创中心建设的指导意见	Guidance on further supporting the construction of science and Technology Innovation Center by Shanghai Banking and Insurance Industry	上海银保监局	Shanghai Banking and Insurance Regulatory Bureau
119	Shanghai	关于开展 2017 年上海领军人才选拔工作的通知	Notice on the selection of Leading Talents in Shanghai in 2017	中共上海市委组织部、上海市人力资源和社会保障局	Organization Department of CPC Shanghai Committee, Shanghai Human Resources and Social Security Bureau
120	Shanghai	关于印发《上海市人才发展"十二五"规划》的通知	Notice on printing and distributing the 12th Five-Year Plan of Shanghai Municipality on Talent Development	中共上海市委组织部、上海市人力资源和社会保障局	Organization Department of CPC Shanghai Committee, Shanghai Human Resources and Social Security Bureau
121	Shanghai	关于进一步加快推进上海国际金融中心建设和金融支持长三角一体化发展的意见	Opinions on further accelerating the construction of Shanghai International Financial Center and financial support for the integrated development of the Yangtze River Delta	中国人民银行、中国银行保险监督管理委员会、中国证券监督管理委员会	People's Bank of China, China Banking and Insurance Regulatory Commission, China Securities Regulatory Commission
122	Shanghai	《上海市鼓励跨国公司设立地区总部的规定》	Provisions of Shanghai Municipality on Encouraging Multinational Corporations to Set up Regional Headquarters	上海市人民政府	Shanghai Municipal People's Government
123	Shanghai	《上海市船舶与海洋工程装备产业"十二五"发展规划》	Shanghai Shipbuilding and Ocean Engineering Equipment Industry Development Plan during the 12th Five-Year Plan period	上海市经济信息化委	Shanghai Municipal Commission of Economy and Informatization
124	Shanghai	《上海妇女发展"十二五"规划》和《上海儿童发展"十二五"规划》	The 12th Five-Year Plan for Women's Development and the 12th Five-year Plan for Children's Development in Shanghai	上海市人民政府	Shanghai Municipal People's Government
125	Shanghai	《上海市科技创新"十三五"规划》	Shanghai 13th Five-Year Plan for Scientific and Technological Innovation	上海市人民政府	Shanghai Municipal People's Government

126	Shanghai	上海市促进科技成果转化条例（FBM-CLI-10-1271969）	Regulations of Shanghai Municipality on Promoting the Transformation of Scientific and Technological Achievements (FBM-CLI-10-1271969)	上海市人民代表大会常务委员会	Standing Committee of Shanghai Municipal People's Congress
127	Shanghai	关于完善本市科研人员双向流动的实施意见	Opinions on the implementation of improving the two-way flow of scientific research personnel in this city	上海市人力资源社会保障局	Shanghai Human Resources and Social Security Bureau
128	Shanghai	《关于促进上海医学科技创新发展的实施意见》	Implementation Opinions on Promoting the Innovative Development of Medical Science and Technology in Shanghai	上海市卫生和计划生育委员会	Shanghai Municipal Health and Family Planning Commission
129	Shanghai	关于加快建设具有全球影响力的科技创新中心的意见	Suggestions on accelerating the construction of a science and technology innovation center with global influence	中共上海市委、上海市人民政府	Shanghai Municipal Party Committee and Shanghai Municipal People's Government
130	Shanghai	《上海市财政局 2015 年财政监督工作要点》	Key Points of Financial Supervision work of Shanghai Finance Bureau in 2015	上海市财政局	Shanghai Finance Bureau
131	Shanghai	《上海市国资委 2012 年工作要点》	Key Points of work of Shanghai SasAC in 2012	上海市国有资产监督管理委员会	Shanghai Municipal State-owned Assets Supervision and Administration Commission
132	Shanghai	《技术创新引导专项联动管理实施细则》	Implementation Rules for Special Linkage Management guided by Technological Innovation	上海市经济和信息化委员会、上海市科学技术委员会、上海市发展和改革委员会	Shanghai Municipal Economic and Information Commission, Shanghai Municipal Science and Technology Commission, Shanghai Municipal Development and Reform Commission
133	Shanghai	《加快推进上海人工智能高质量发展的实施办法》	Implementation Measures for Accelerating the High-quality Development of Artificial Intelligence in Shanghai	上海市经济信息化委、市发展改革委、市科委、市人力资源社会保障局、市财	Shanghai Municipal Economic and Information Technology Commission, Shanghai Municipal

					政局	Development and Reform Commission, Shanghai Municipal Science and Technology Commission, Shanghai Municipal Human Resources and Social Security Bureau, Shanghai Municipal Finance Bureau
134	Shanghai	关于修订《上海市优秀科技创新人才培育计划管理办法》的通知	Notice on amending the Administrative Measures of Shanghai Municipality for Cultivating Outstanding Scientific and Technological Innovative Talents	上海市科委	Shanghai Science and Technology Commission
135	Shanghai	《关于加强公共卫生应急管理科技攻关体系与能力建设的实施意见》	Implementation Opinions on Strengthening the Scientific and Technological Tackling System and Capacity Building of Public Health Emergency Management	上海市科学技术委员会、上海市卫生健康委员会、上海市药品监督管理局	Shanghai Municipal Science and Technology Commission, Shanghai Municipal Health Commission, Shanghai Drug Administration
136	Shanghai	关于强化科技应急响应机制实现科技支撑疫情防控的通知	Notice on strengthening science and technology emergency response mechanism to support epidemic prevention and control	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
137	Shanghai	上海市人才发展"十三五"规划	Shanghai talent Development "13th Five-Year plan"	中共上海市委、上海市人民政府	Shanghai Municipal Party Committee and Shanghai Municipal People's Government
138	Shanghai	《上海市促进科技成果转移转化行动方案（2017－2020）》	Shanghai Municipal Action Plan for Promoting the Transfer and Transformation of Scientific and Technological Achievements (2017-2020)	上海市人民政府	Shanghai Municipal People's Government
139	Shanghai	关于贯彻国务院印发的《计量发展规划(2013－2020	Opinions on implementing the Metrology Development Plan (2013-2020) issued by	上海市人民政府	Shanghai Municipal People's

		年)》实施意见	The State Council		Government
140	Shanghai	《上海市关于开展种业人才发展和科研成果权益改革试点工作方案》	Work Plan of Shanghai Municipality on Pilot Reform of Human Resources Development and Rights and Interests of Scientific Research Achievements in Seed Industry	上海市农业委员会、上海市科学技术委员会、上海市财政局	Shanghai Municipal Agriculture Commission, Shanghai Municipal Science and Technology Commission, Shanghai Municipal Finance Bureau
141	Shanghai	《关于加强本市战略性新兴产业知识产权工作的实施意见》	Opinions on The Implementation of Strengthening the Intellectual Property Work of Strategic Emerging Industries in Shanghai	上海市知识产权局、上海市发展和改革委员会、上海市经济和信息化委员会	Shanghai Intellectual Property Office, Shanghai Municipal Development and Reform Commission, Shanghai Municipal Economic and Information Commission
142	Shanghai	《上海市科技创新计划专项资金管理办法》	Measures of Shanghai Municipality on The Administration of Special Funds for Science and Technology Innovation Plan	上海市科学技术委员会、上海市财政局	Shanghai Municipal Science and Technology Commission, Shanghai Municipal Finance Bureau
143	Shanghai	关于进一步深化人才发展体制机制改革加快推进具有全球影响力的科技创新中心建设的实施意见	Opinions on further deepening the reform of talent development system and mechanism and accelerating the construction of science and technology innovation center with global influence	中共上海市委、上海市政府	Shanghai Municipal Party Committee and Shanghai Municipal Government
144	Shanghai	《加快推进上海金融科技中心建设实施方案》	Implementation Plan for Accelerating the Construction of Shanghai Fintech Center	上海市人民政府	Shanghai Municipal People's Government
145	Shanghai	上海市科学和技术发展"十二五"规划	Shanghai 12th Five-Year Plan for Scientific and technological development	上海市人民政府	Shanghai Municipal People's Government

146	Shanghai	关于进一步深化科技体制机制改革增强科技创新中心策源能力的意见	Opinions on further deepening the reform of science and Technology systems and mechanisms to enhance the capacity of the Science and Technology Innovation Center to provide strategic resources	上海市科学技术委员会	Shanghai Municipal Science and Technology Commission
147	Guangzhou	关于举办"民营企业服务周"科技创新专项服务活动的通知	Notice on holding "Private Enterprise Service Week" special service activities of science and technology innovation	广州市科学技术局	Guangzhou Science and Technology Bureau
148	Guangzhou	关于制定广州市国民经济和社会发展第十四个五年规划和二〇三五年远景目标的建议	Suggestions on the formulation of the fourteenth five-year plan of Guangzhou's national economic and social development and the long-term goals of 2035	中共广州市委	Guangzhou Municipal Committee of the CPC
149	Guangzhou	关于组织申报 2018 年度广州市卫生计生科技一般引导项目和两新项目的通知	Notice on organizing the application of guangzhou Health and Family Planning Technology General Guidance Project and two new projects in 2018	广州市卫生和计划生育委员会	Guangzhou Municipal Health and Family Planning Commission
150	Guangzhou	关于印发广州开发区瞪羚企业认定扶持办法的通知	Notice on printing and distributing measures for identifying and supporting Gazelle Enterprises in Guangzhou Development Zone	广州开发区管委会	Management Committee of Guangzhou Development Zone
151	Guangzhou	广州市关于粤港澳大湾区个人所得税优惠政策财政补贴管理暂行办法的通知	Notice of Guangzhou Municipality on interim Measures for the Administration of Individual Income Tax Preferential Policies and Financial Subsidies in the Guangdong-Hong Kong-Macao Greater Bay Area	广州市财政局、广州市科学技术局、广州市人力资源和社会保障局、国家税务总局广州市税务局	Guangzhou Finance Bureau, Guangzhou Science and Technology Bureau, Guangzhou Human Resources and Social Security Bureau, State Administration of Taxation Guangzhou Taxation Bureau
152	Guangzhou	《广州市关于加快粉末冶金产业发展工作方案》	Working Plan of Guangzhou on Accelerating the Development of POWDER Metallurgy Industry	广州市工业和信息化局	Guangzhou Industry and Information Bureau
153	Guangzhou	《广州市关于促进金融科技创新发展的实施意见》	Implementation Opinions of Guangzhou Municipality on Promoting the Innovative Development of Fintech	广州市金融工作局	Guangzhou Financial Work Bureau
154	Guangzhou	《广州市珠江科技新星专项管理办法》	Guangzhou Pearl River Science and Technology New Star Special	广州市科技创新委员会	Science and Technology

			Management Measures		Innovation Commission of Guangzhou City
155	Guangzhou	关于发布 2013 年广州市第二批科技计划项目申报指南的通知	Notice on the issuance of 2013 Guangzhou second Batch of Science and Technology Project application Guidelines	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau
156	Guangzhou	关于开展科技人才公寓建设及管理有关情况调查的通知	Notice on investigation of construction and management of apartment for Scientific and technological Talents	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau
157	Guangzhou	《关于市区联动支持番禺节能科技园先行先试进一步加快发展的若干措施》	Some Measures on Supporting the Development of Panyu Energy-saving Science and Technology Park through Linkage between Urban areas	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau
158	Guangzhou	广州市珠江科技新星专项管理暂行办法	Interim Measures for the special Management of Guangzhou Pearl River Science and Technology Star	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau
159	Guangzhou	关于 2019 年广州市农村科技特派员立项的通知	Notice on project approval of Guangzhou Rural Science and Technology Commissioners in 2019	广州市科学技术局	Guangzhou Science and Technology Bureau
160	Guangzhou	关于 2020 年广州市农村科技特派员项目立项的通知	Notice on the project of Rural Science and Technology Commissioners in Guangzhou in 2020	广州市科学技术局	Guangzhou Science and Technology Bureau
161	Guangzhou	公开遴选全市科技人才调研服务单位	Public selection of municipal scientific and technological personnel research service units	广州市科学技术局	Guangzhou Science and Technology Bureau
162	Guangzhou	关于开展农村科技特派员征集备案工作的通知	Circular on The Collection and filing of Rural Science and Technology Commissioners	广州市科学技术局	Guangzhou Science and Technology Bureau
163	Guangzhou	关于做好广东省科技计划项目中后期管理工作有关事项的通知	Notice on matters related to the mid - and late-stage administration of Science and technology Planning projects in Guangdong Province	广州市科学技术局	Guangzhou Science and Technology Bureau
164	Guangzhou	关于加快生物医药产业发展的实施意见	Implementation opinions on accelerating the development of biomedical industry	广州市人民政府	People's Government of Guangzhou Municipality
165	Guangzhou	广州市安全生产第十三个五年规划(2016—2020 年)	The 13th Five-year Plan of Guangzhou Municipality on Work Safety (2016-2020)	广州市人民政府	People's Government of Guangzhou

				Municipality
166	Guangzhou	广州市汽车产业 2025 战略规划	Guangzhou Automobile industry 2025 strategic plan	广州市人民政府	People's Government of Guangzhou Municipality
167	Guangzhou	广州市全民科学素质行动计划纲要实施方案（2011－2015 年）	Implementation Plan of Guangzhou National Scientific Literacy Action Plan (2011-2015)	广州市人民政府	People's Government of Guangzhou Municipality
168	Guangzhou	关于进一步促进利用外资工作的实施意见	Opinions on further promoting the use of foreign capital	广州市人民政府	People's Government of Guangzhou Municipality
169	Guangzhou	关于进一步加强招商引资促进产业转型升级的指导意见	Guiding opinions on further strengthening investment attraction to Promote Industrial Transformation and Upgrading	广州市人民政府	People's Government of Guangzhou Municipality
170	Guangzhou	关于修订广州市建设"中国制造 2025"试点示范城市实施方案的通知（	Notice on Revising the Implementation Plan of Guangzhou for The Construction of "Made in China 2025" Pilot Demonstration City (	广州市人民政府	People's Government of Guangzhou Municipality
171	Guangzhou	广州国家自主创新示范区建设实施方案(2016—2020 年)	Construction and Implementation Plan of Guangzhou National Independent Innovation Demonstration Zone (2016-2020)	广州市人民政府	People's Government of Guangzhou Municipality
172	Guangzhou	广州市建设"中国制造 2025"试点示范城市实施方案	Implementation plan of Guangzhou to build "Made in China 2025" pilot demonstration city	广州市人民政府	People's Government of Guangzhou Municipality
173	Guangzhou	广州市国民经济和社会发展第十二个五年规划纲要	Outline of the twelfth five-year Plan of Guangzhou National Economic and social development	广州市人民政府	People's Government of Guangzhou Municipality
174	Guangzhou	关于组织申报 2012 年度广州市医药卫生科技项目的通知	Notice on organizing the application of guangzhou Medical and Health Science and Technology Project in 2012	广州市卫生局	Health Bureau of Guangzhou
175	Guangzhou	2013 年广州市第一批科技计划项目申报指南	Application Guide for the first batch of science and technology projects in Guangzhou in 2013	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau

176	Guangzhou	广州市科技创新委员会主要职责内设机构和人员编制规定	Guangzhou Science and Technology Innovation Commission main responsibilities of the internal structure and staffing provisions	广州市人民政府	People's Government of Guangzhou Municipality
177	Guangzhou	广州市全面推进基层政务公开标准化规范化工作实施方案	Guangzhou city comprehensively promotes the standardization and standardization of grass-roots government affairs	广州市人民政府	People's Government of Guangzhou Municipality
178	Guangzhou	广州市战略性新兴产业第十三个五年发展规划（2016—2020 年）	The 13th Five-year Development Plan of Guangzhou Strategic Emerging Industries (2016-2020)	广州市人民政府	People's Government of Guangzhou Municipality
179	Guangzhou	广州市系统推进全面创新改革试验三年行动计划（2016—2018 年）	Three-year Action Plan of Guangzhou Municipal System to Promote Comprehensive Innovation Reform Experiment (2016-2018)	广州市人民政府	People's Government of Guangzhou Municipality
180	Guangzhou	《广州市高层次卫生人才引进培养项目实施办法(试行)》	Implementation Measures of Guangzhou High-level Health Talents Introduction and Training Program (Trial)	广州市卫生和计划生育委员会	Guangzhou Municipal Health and Family Planning Commission
181	Guangzhou	《关于加快云计算产业的发展行动计划(2011—2015 年)》	Action Plan on Accelerating the Development of cloud Computing Industry (2011-2015)	广州市科技和信息化局	Guangzhou Science and Technology and Information Bureau
182	Guangzhou	2020 年法治政府建设年度报告	2020 Annual Report on Building a Law-based Government	广州市科学技术局	Guangzhou Science and Technology Bureau
183	Guangzhou	广州市国民经济和社会发展第十三个五年规划纲要（2016—2020 年）	Outline of the 13th Five-year Plan for National Economic and Social Development of Guangzhou Municipality (2016-2020)	广州市人民政府	People's Government of Guangzhou Municipality
184	Guangzhou	广州市人口发展和基本公共服务体系建设第十三个五年规划(2016—2020 年)	The 13th Five-year Plan of Guangzhou Population Development and Basic Public Service System Construction (2016-2020)	广州市人民政府	People's Government of Guangzhou Municipality
185	Guangzhou	发广州市建设国家创新型城市试点工作实施方案的通知	Notice on the implementation plan of the pilot work of building a national innovative city in Guangzhou	广州市发展和改革委员会、广州市科技和信息化局	Guangzhou Development and Reform Commission, Guangzhou Science and Technology

					and Information Bureau
186	Guangzhou	广佛肇经济圈发展规划（2010－2020 年）	Guangfo Zhao Economic Circle Development Plan (2010-2020)	广州市人民政府、佛山市人民政府、肇庆市人民政府	People's Government of Guangzhou city, Foshan City, Zhaoqing City
187	Guangzhou	关于推进人才集聚工程的实施意见	Opinions on the implementation of talents gathering Project	中共广州市委、广州市人民政府	Guangzhou Municipal Party Committee and Guangzhou Municipal People's Government
188	Guangzhou	广州市全面深化服务贸易创新发展试点实施方案	Implementation plan of the pilot program for comprehensively deepening innovative development of trade in services in Guangzhou	广州市人民政府	People's Government of Guangzhou Municipality
189	Guangzhou	关于实施鼓励海外人才来穗创业"红棉计划"的意见	Suggestions on implementing the "Khmer Rouge Program" to encourage overseas talents to start their own businesses in Guangzhou	广州市人民政府	People's Government of Guangzhou Municipality
190	Guangzhou	进一步加快促进科技创新政策措施的通知	Notice on Further accelerating policies and Measures for Promoting Scientific and technological Innovation	广州市人民政府	People's Government of Guangzhou Municipality
191	Guangzhou	关于加快科技创新的若干政策意见	Some policy opinions on accelerating scientific and technological innovation	广州市人民政府	People's Government of Guangzhou Municipality
192	Shenzhen	深圳经济特区技术转移条例(2019 修正)(FBM-CLI-10-1546193)	Regulations on Technology Transfer of Shenzhen Special Economic Zone (2019 Amendment)(FBM-CLI-10-1546193)	深圳市人民代表大会常务委员	Standing member of Shenzhen Municipal People's Congress
193	Shenzhen	关于征集海外人才科技交流合作需求的通知	Notice on the demand for overseas talents for scientific and technological exchange and cooperation	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
194	Shenzhen	深圳市诺贝尔奖科学家实验室组建管理办法(试行)	Measures for the Establishment and Administration of Shenzhen Nobel Prize Scientist Laboratory (Trial)	深圳市科技创新委员会、深圳市财政	Science and Technology Innovation

				委员会	Commission of Shenzhen Municipality, Finance Commission of Shenzhen Municipality
195	Shenzhen	深圳市新设基础研究机构建设管理办法(试行)	Measures of Shenzhen Municipality for the Administration of The Construction of Newly Established Basic Research Institutions (Trial)	深圳市科技创新委员会、深圳市财政委员会	Science and Technology Innovation Commission of Shenzhen Municipality, Finance Commission of Shenzhen Municipality
196	Shenzhen	《深圳市优秀科技创新人才培养项目管理办法》	Management Measures of Shenzhen Excellent Scientific and Technological Innovation Talents Training Program	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
197	Shenzhen	《深圳市重点企业研究院资助管理办法》	Funding Management Measures of Shenzhen Key Enterprise Research Institute	深圳市科技创新委员会	Science, Technology, and Innovation Commission of Shenzhen Municipality
198	Shenzhen	《深圳市重点实验室建设和运行管理办法》	Administrative Measures on The Construction and Operation of Shenzhen Key Laboratory	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
199	Shenzhen	《深圳市有关部门食品安全监管事权清单》	List of Food Safety Supervision Powers of Relevant Departments in Shenzhen	深圳市人民政府	Shenzhen Municipal People's Government
200	Shenzhen	深圳市促进生物医药产业集聚发展指导意见及相关配套文件	Guidelines and related supporting documents on Promoting the agglomeration development of Biomedical industry in Shenzhen	深圳市人民政府	Shenzhen Municipal People's Government

201	Shenzhen	深圳市全面深化气象管理体制改革实施细则	Shenzhen municipality comprehensively deepened the implementation rules of the meteorological management system reform	深圳市人民政府	Shenzhen Municipal People's Government
202	Shenzhen	深圳国家创新型城市总体规划实施方案(2011－2013年)	Implementation Plan of Shenzhen National Innovative City Master Plan (2011-2013)	深圳市人民政府	Shenzhen Municipal People's Government
203	Shenzhen	深圳市科学技术发展"十二五"规划	Shenzhen science and technology development "12th Five-Year plan"	深圳市人民政府	Shenzhen Municipal People's Government
204	Shenzhen	关于印发深圳市建筑节能与绿色建筑"十二五"规划的通知	Notice on the issuance of shenzhen Building Energy Conservation and Green Building "twelfth Five-Year" Plan	深圳市住房和建设局、深圳市发展和改革委员会	Housing and Construction Bureau of Shenzhen Municipality, Development and Reform Commission of Shenzhen Municipality
205	Shenzhen	关于制定深圳市国民经济和社会发展第十四个五年规划和二〇三五年远景目标的建议	Suggestions on the formulation of the fourteenth Five-Year Plan of Shenzhen's national economic and social development and the long-term goals of 2035	中共深圳市委	Shenzhen Municipal Committee of CPC
206	Shenzhen	深圳经济特区技术转移条例	Regulations on Technology Transfer of Shenzhen Special Economic Zone	深圳市人民代表大会常务委员	Standing member of shenzhen Municipal People's Congress
207	Shenzhen	《深圳国际生物谷总体发展规划(2013-2020 年)》	Overall Development Plan of Shenzhen International Biovalley (2013-2020)	深圳市发展和改革委员会	Development and Reform Commission of Shenzhen Municipality
208	Shenzhen	深圳市 2019 年软科学研究项目合同签订及拨款手续办理的通知(事前资助项目)	Shenzhen Soft Science Research Project Contract Signing and Funding Procedures (Pre-funded projects)	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
209	Shenzhen	2020 年深圳市软科学研究项目申请指南	Application Guide for Shenzhen Soft Science Research Project in 2020	深圳市科技创新委员会	Science, Technology and Innovation

					Commission of Shenzhen Municipality
210	Shenzhen	关于公布深圳市具备承接政府职能转移和购买服务资质的市级社会组织目录的通知	Notice on publishing the catalogue of municipal social organizations qualified to undertake the transfer of government functions and purchase services in Shenzhen	深圳市民政局	Shenzhen Municipal Civil Affairs Bureau
211	Shenzhen	《深圳市中长期人才发展规划纲要(2011－2020年)》	Outline of Shenzhen Medium and Long Term Talent Development Plan (2011-2020)	中共深圳市委、深圳市人民政府	Shenzhen Municipal Party Committee and Shenzhen Municipal People's Government
212	Shenzhen	关于召开《深圳市扶持金融科技发展若干措施(征求意见稿)》听证会的公告	Notice on holding a hearing on Several Measures to Support the Development of Fintech in Shenzhen (Draft for Comments)	深圳市地方金融监督管理局	Local Financial Supervision administration of Shenzhen Municipality
213	Shenzhen	关于深圳市国民经济和社会发展第十三个五年规划纲要的决议	Resolution on the 13th Five-Year Plan for shenzhen's National Economic and Social Development	深圳市人民代表大会常务委员	Standing member of Shenzhen Municipal People's Congress
214	Shenzhen	关于开展2013年度深圳市企业技术中心认定工作的通知	Notice on the accreditation of Shenzhen Enterprise Technology Center in 2013	深圳市经济贸易和信息化委员会	Economic, Trade and Information Commission of Shenzhen Municipality
215	Shenzhen	《深圳市促进科研机构发展行动计划(2013—2015年)》	Shenzhen Action Plan for Promoting the Development of Scientific Research Institutions (2013-2015)	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
216	Shenzhen	关于做好2015年广东省科技计划申报的通知	Notice on the application of science and Technology Plan of Guangdong Province in 2015	深圳市科技创新委员会	Science, Technology and Innovation Commission of Shenzhen Municipality
217	Shenzhen	关于加快生物医药产业高质量发展的决定	The decision on accelerating the high-quality development of the	深圳市人民代表大会常	Standing Committee of

			biomedical industry	务委员会	Shenzhen Municipal People's Congress
218	Shenzhen	深圳国家自主创新示范区建设实施方案	Implementation plan of Shenzhen National Independent Innovation Demonstration Zone construction	深圳市人民政府	Shenzhen Municipal People's Government
219	Shenzhen	深圳市院士(专家)工作站管理与资助办法(试行)	Measures for the Management and Funding of Shenzhen Academician (Expert) Workstation (Trial)	深圳市人民政府	Shenzhen Municipal People's Government
220	Shenzhen	关于加强基础科学研究实施办法的通知	Notice on strengthening measures for the Implementation of Basic Scientific Research	深圳市人民政府	Shenzhen Municipal People's Government
221	Shenzhen	《深圳市认定企业技术中心管理办法》	Measures of Shenzhen Municipality on the Administration of Enterprise Technology Center	深圳市经济贸易和信息化委员会、深圳市发展和改革委员会、深圳市财政委员会	Economic, Trade and Information Commission of Shenzhen Municipality, Development and Reform Commission of Shenzhen Municipality, Finance Commission of Shenzhen Municipality
222	Shenzhen	深圳市海洋经济发展"十二五"规划	Shenzhen's 12th Five-Year Plan for Marine economy development	深圳市经济贸易和信息化委员会、深圳市发展和改革委员会	Economic, Trade and Information Commission of Shenzhen Municipality, Development and Reform Commission of Shenzhen Municipality
223	Shenzhen	深圳市人口发展"十二五"规划	Shenzhen population development "12th Five-Year plan"	深圳市人民政府	Shenzhen Municipal People's Government
224	Shenzhen	深圳市建设科技"十二五"规划	Shenzhen construction science and technology "12th Five-Year" plan	深圳市住房和建设局、深圳市发展和	Housing and Construction Bureau of Shenzhen

				改革委员会	Municipality, Development and Reform Commission of Shenzhen Municipality
225	Shenzhen	《深圳市科技计划项目管理办法》	Measures for The Administration of Science and Technology Projects of Shenzhen Municipality	深圳市科技创新委员会、深圳市财政委员会	Science and Technology Innovation Commission of Shenzhen Municipality, Finance Commission of Shenzhen Municipality
226	Shenzhen	关于加快发展民生科技若干措施	Measures to accelerate the development of science and technology for people's livelihood	深圳市人民政府	Shenzhen Municipal People's Government
227	Shenzhen	深圳市海洋产业发展规划（2013-2020 年）	Shenzhen Marine Industry Development Plan (2013-2020)	深圳市人民政府	Shenzhen Municipal People's Government
228	Shenzhen	深圳高新区优化升级工作方案(2012—2015 年)	Work Plan for Optimization and Upgrading of Shenzhen High-tech Zone (2012-2015)	深圳市人民政府	Shenzhen Municipal People's Government
229	Shenzhen	深圳经济特区科技创新促进条例(2014 修正)	Regulations on Promotion of Science and Technology Innovation of Shenzhen Special Economic Zone (Revised in 2014)	深圳市人民代表大会常务委员	Standing member of shenzhen Municipal People's Congress
230	Shenzhen	关于促进文化与科技融合若干措施的通知	Circular on measures to promote the integration of culture and science and technology	深圳市人民政府	Shenzhen Municipal People's Government
231	Shenzhen	深圳经济特区科技创新促进条例(2019 修正)	Regulations on The Promotion of Science and Technology Innovation in Shenzhen Special Economic Zone (2019 Amendment)	深圳市人民代表大会常务委员	Standing member of shenzhen Municipal People's Congress
232	Shenzhen	关于努力建设国家自主创新示范区实现创新驱动发展的决定	The decision on striving to build national innovation demonstration zones to achieve innovation-driven development	中共深圳市委、深圳市人民政府	Shenzhen Municipal Party Committee and Shenzhen Municipal People's Government

233	Shenzhen	深圳市人才发展"十二五"规划	Shenzhen talent development "12th Five-Year plan"	深圳市人民政府	Shenzhen Municipal People's Government
234	Shenzhen	深圳经济特区科技创新条例	Regulations on Science and Technology Innovation of Shenzhen Special Economic Zone	深圳市人民代表大会常务委员	Standing committee of shenzhen Municipal People's Congress

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VITA

NAME	YUXUAN SHAN
DATE OF BIRTH	31 August 1996
PLACE OF BIRTH	China
INSTITUTIONS ATTENDED	Chulalongkorn University
HOME ADDRESS	Lumpini Suite Phetchaburi, 1515 Phetchaburi Rd, Makkasan, Ratchathewi, Bangkok 10400