

A systematic review of smart city development policies in Chinese cities



A Thesis Submitted in Partial Fulfillment of the Requirements  
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ปริทัศน์วรรณกรรมเชิงระบบของนโยบายการพัฒนาเมืองอัจฉริยะของเมืองในประเทศจีน



วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต  
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ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

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By    Mr. Mingqing Yin  
Field of Study                                      Urban Strategies  
Thesis Advisor                                      Assistant Professor Sutee Anantsuksomsri, Ph.D.

---

Accepted by the FACULTY OF ARCHITECTURE, Chulalongkorn University in  
Partial Fulfillment of the Requirement for the Master of Science

..... Dean of the FACULTY OF  
ARCHITECTURE  
(Associate Professor PINRAJ KHANJANUSTHITI, Ph.D.)

THEESIS COMMITTEE

..... Chairman  
(Associate Professor APIWAT RATANAWARAHA, Ph.D.)

..... Thesis Advisor  
(Assistant Professor Sutee Anantsuksomsri, Ph.D.)

..... External Examiner  
(Assistant Professor Suwadee Thongsukplang  
Hansasooksin, Ph.D.)



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การพัฒนาเมืองมีบทบาทสำคัญอย่างยิ่งในการเพิ่มผลผลิตภาพความสามารถในการแข่งขัน และการเติบโตทางเศรษฐกิจของประเทศ ในปัจจุบัน ประชากรจำนวนกว่าครึ่งหนึ่งของประชากรโลกอาศัยอยู่ในพื้นที่เมือง และในปี ค.ศ. 2050 คาดการณ์ว่าประชากรประมาณร้อยละ 70 ของประชากรโลกจะอาศัยอยู่ในพื้นที่เมือง ประเทศจีนเป็นหนึ่งในประเทศที่มีอัตราการกลายเป็นเมืองสูงที่สุดในโลก โดยเมืองในระดับที่หนึ่ง ซึ่งประกอบด้วยกรุงปักกิ่ง เซี่ยงไฮ้ กวางโจว และเซินเจิ้น เป็นเมืองที่มีการพัฒนามากที่สุดในด้านการพัฒนาโครงสร้างพื้นฐานและเศรษฐกิจ เมืองเหล่านี้เป็นศูนย์กลางสำคัญด้านเศรษฐกิจ การเมือง และวัฒนธรรมของประเทศ รวมถึงเป็นต้นแบบของการพัฒนาเมืองให้กับเมืองอื่น ๆ ในประเทศจีน เมืองเหล่านี้ยังเป็นเมืองแรก ๆ ในประเทศจีนที่นำแนวคิดเมืองอัจฉริยะมาใช้ในการพัฒนาเมือง งานวิจัยนี้มุ่งศึกษาการพัฒนาเมืองและนโยบายในระดับเมืองที่เกี่ยวข้องกับเมืองอัจฉริยะของเมืองระดับที่หนึ่งของประเทศจีนเป็นหลัก ในขณะที่งานวิจัยหลายฉบับได้ศึกษาเกี่ยวกับนโยบายระดับประเทศของประเทศจีนที่เกี่ยวข้องกับเมืองอัจฉริยะ งานวิจัยนี้เป็นงานวิจัยชิ้นแรก ๆ ที่ศึกษานโยบายในระดับเมืองที่เกี่ยวข้องกับเมืองอัจฉริยะ โดยจุดประสงค์ของงานวิจัยนี้มุ่งที่จะศึกษาลักษณะเฉพาะและความท้าทายในการพัฒนาเมืองอัจฉริยะ และนโยบายการวางแผนและพัฒนาเมืองของเมืองระดับที่หนึ่งของประเทศจีน รวมถึงนำเสนอข้อต่อนแนะในการพัฒนาเมืองอัจฉริยะในภูมิภาคและเมืองอื่น ๆ ในประเทศจีน

งานศึกษาที่ใช้การปริทัศน์วรรณกรรมเชิงระบบและการวิเคราะห์เนื้อหาเป็นระเบียบวิธีวิจัย บทความวิจัยในฐานข้อมูล CNKI, Wanfang, Web of Science, และ Scopus ถูกคัดกรองในระบบดัชนี PRISMA โดยบทความจำนวน 84 บทความที่เกี่ยวข้องกับสถานะการพัฒนาเมืองอัจฉริยะถูกคัดเลือกจากการวิเคราะห์ในการศึกษา นอกจากนี้นโยบาย 54 นโยบายที่เกี่ยวข้องกับเมืองอัจฉริยะในเมืองในระดับที่หนึ่งของประเทศจีนจากฐานข้อมูลกฎหมายของมหาวิทยาลัยปักกิ่งถูกนำเข้าสู่โปรแกรม NVIVO เพื่อวิเคราะห์จุดแข็งและจุดอ่อนในสถานะของเครื่องมือทางนโยบาย ผลการศึกษาแสดงให้เห็นว่า การพัฒนาเมืองอัจฉริยะในเมืองในระดับที่หนึ่งสามารถแบ่งเป็นรูปแบบการพัฒนาได้เป็น 6 มิติ ได้แก่ (1) การขนส่งอัจฉริยะ (2) ความปลอดภัยอัจฉริยะ (3) ความเป็นอยู่อัจฉริยะ (4) การศึกษาอัจฉริยะ (5) เศรษฐกิจอัจฉริยะ และ (6) สิ่งแวดล้อมอัจฉริยะ โดยเมืองแต่ละเมืองเน้นมิติในการพัฒนามิติของการพัฒนาเมืองอัจฉริยะที่แตกต่างกันตามบริบทและลักษณะของเมือง ในด้านนโยบายระดับเมืองที่เกี่ยวข้องกับการพัฒนาเมืองอัจฉริยะสามารถแบ่งได้เป็น 3 ด้าน ได้แก่ พื้นฐานด้านอุปสงค์ อุปทาน และ สิ่งแวดล้อม ผลการศึกษาของการวิเคราะห์นโยบายแสดงให้เห็นถึงความไม่สมดุลเชิงโครงสร้างของนโยบาย เช่น การใช้เครื่องมือเชิงนโยบายที่เป็นพื้นฐานด้านอุปทานมีมาก เครื่องมือเชิงนโยบายที่เป็นพื้นฐานด้านสิ่งแวดล้อมมีไม่เพียงพอ และการขาดแคลนเครื่องมือเชิงนโยบายที่เป็นพื้นฐานด้านอุปสงค์สามารถพบได้ในนโยบายในระดับเมือง

สาขาวิชา ยุทธศาสตร์เมือง  
ปีการศึกษา 2564

ลายมือชื่อนิสิต .....  
ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

# # 6378010825 : MAJOR URBAN STRATEGIES

KEYWORD: First-tier cities, Smart city, Smart city policy, Policy tool, Systematic review, Content analysis

Mingqing Yin : A systematic review of smart city development policies in Chinese cities. Advisor: Asst. Prof. Sutee Anantsuksomsri, Ph.D.

Urban development plays a vital role in enhancing the productivity, competitiveness, and economic growth of a country. Nowadays, more than half of the world's population lives in cities. By 2050, it is estimated that around 70 percent of the population will live in cities. China is one of the countries with the most rapid urbanization in the world. The first-tier cities comprising Beijing, Shanghai, Guangzhou, and Shenzhen are the most developed cities in China in terms of infrastructure development and economy. These cities are the major economic, political, and cultural engine of the country as well as role models of urban development for other cities. They are also the first cities in China to apply the smart city concept in urban development. This research focuses primarily on smart city development and policies of the first-tier cities in China. While many research studies on Chinese national-level policies in smart city development, this study is one of the first to explore the policies at the city level. The objectives of the study are to investigate the characteristics and challenges of smart city developments and urban development policies and planning in Chinese first-tier cities, as well as to provide policy recommendations for developing smart cities in other regions and cities in China.

The study employs the methodologies of a systematic review and content analysis. The research articles in CNKI, Wanfang, Web of Science, and Scopus databases, are screened by the PRISMA index. Eighty-four pieces of literature related to the development status of smart cities are included in the study. In addition, 54 smart city policies from China's first-tier cities are taken from the Peking University Law database and coded with the NVIVO software to learn about their strengths and weaknesses from the point of view of policy tools. The result shows that the smart city developments in the first-tier cities cover six smart city dimensions: (1) smart transportation, (2) smart security, (3) smart livelihood, (4) smart education, (5) smart economy, and (6) smart environment. Each city emphasizes the six dimensions differently based on its contexts and characteristics. The city-level policies on smart city development include three policy tools: demand-, supply-, and environmental-based. The result of policy analysis shows that structural imbalance of the policies, such as excess supply-based policy tools, insufficient environmental-oriented policy tools, and a lack of demand-oriented policy tools, can be found in the city-level policies

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Field of Study: Urban Strategies  
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Student's Signature .....  
Advisor's Signature .....

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Mingqing Yin

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## CHAPTER 1: INTRODUCTION

### 1.1 Background of smart cities

Cities play a pivotal role in human development and social progress, and urban development plays a vital role in improving comprehensive national strength. Smart cities are the primary choice for realizing new urbanization and solving urban development problems. Urbanization is a double-edged sword, with 80% of global GDP coming from total urban economic production and only 20% from rural areas (Samita, 2019; Shanghai Municipal Commission of Economy and Information, 2020). Urbanization has entered a transitional phase. Global urbanization will reach 68.4 percent by 2050 (World Bank, 2020), while more than half of the world's population lives in urban areas, according to a United Nations study. According to the United Nations, urban areas will account for 66% of the global population by 2050. (United Nations, 2014). China has made remarkable progress in urban construction since the reform and opening. In China, the urban structure has significantly developed from 1978 to the present. However, along with the increasing number of cities and population, the rapid expansion of cities has also brought about urban problems such as resource shortages, traffic congestion, environmental pollution, and various social conflicts and risks arising from them.

### 1.1.1 Global background

The increasing level of global urbanization has brought many challenges to the sustainable development of cities. According to a report by the World Bank, the global urbanization rate will reach 68.4% in 2050, and close to 70% of the world population will live in cities (World Bank, 2020). The improvement of urbanization has brought severe challenges to urban economic development, resource utilization, the ecological environment, and quality of life. (Ina et al., 2019) More city managers are choosing refined management efficiency as their first choice in order to meet a number of challenges in urban development, achieve long-term sustainable development, build a smart city development system, and improve scientific decision-making.

### 1.1.2 Chinese background

China has experienced a series of problems due to the development of urbanization. According to official statistics, the urbanization rate of Asian countries is higher than that of European countries. China has entered a transitional period of urbanization and construction. With the rapid growth of first-tier cities, urban clusters have emerged. This affects the increase in population density. Thus, the uneven distribution of urban resources and the urban development of the surrounding areas. In particular, the urbanization rate of China's resident population will increase to 72% in 2030 (Samita, 2019). Although remarkable achievements have been made in urban

construction, due to the rapid expansion of the urban population and the rapid expansion of urban scale, problems such as traffic congestion, lack of resources, and environmental pollution have become increasingly prominent, and social risks caused by governance problems have also increased.

### 1.1.3 Urbanization issue

As is shown in Figure 1, the global urbanization rate has reached 55.7%, with higher urbanization rates in developed cities, thus creating a number of pressures on urban population density and resource allocation. With the rapid development and popularization of information technology, the mobility of production factors such as capital and labor is increasing, and the large-scale urbanization movement is in full swing around the world. Although urbanization has achieved remarkable results, population expansion, environmental pollution, and traffic congestion are the main factors. The various social contradictions and risks brought about by this pose a severe test for the social governance capacity of Chinese urban governments. as a technology-based solution for urban governance. The construction of a smart city is a complex and systematic project. On the one hand, its complexity lies in all aspects of urban governance, such as transportation, medical care, education, public safety, and emergency management. On the other hand, the construction of a smart city needs to respond to the government, enterprises, media, different interests of the public and



other diverse subjects. So, for smart cities to be built, the government needs to take an active role in guiding policy and integrating and allocating resources like money, technologies, and skills by putting in place a set of public policies that bring together many different players.

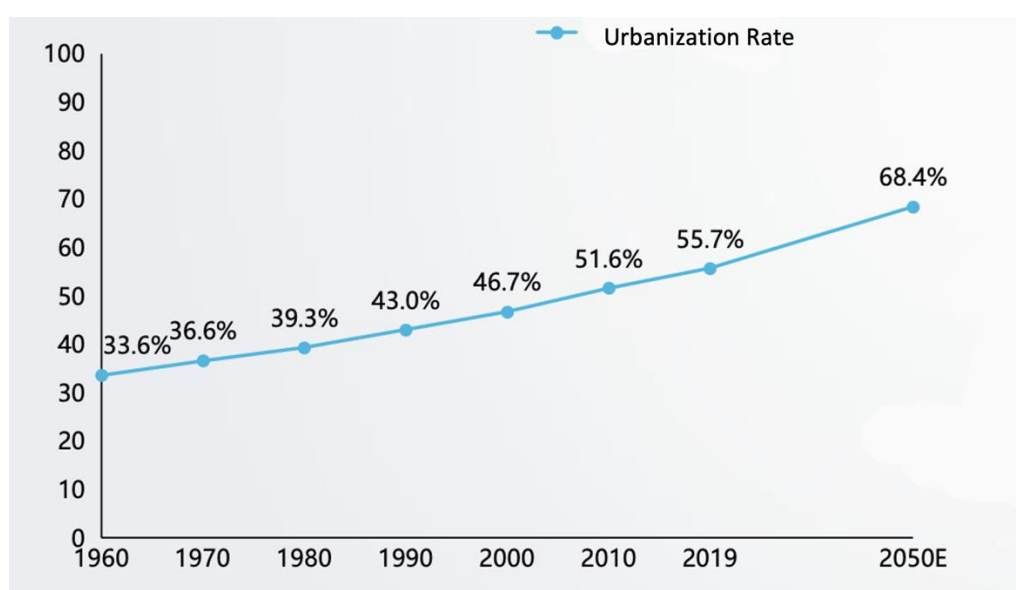


Figure 1, Global urbanization level and development forecast 1960-2050

Source: UN World Urbanization Trends, 2018, World Bank

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## 1.2 Smart city concept

Regarding the research on the concept of smart cities, the concept of SMCITY first appeared in the United States at the end of the twentieth century, and then Singapore, Japan, and South Korea took the lead in exploring the construction of smart cities. IMB Smart Planet put forward the innovative concept of a smart city in 2008, which proposed that government and business leaders could improve urban conditions and improve the quality of life of citizens through mobile technology.

### 1.2.1 Global smart city concept

According to the concept of a smart city, smart cities rely on a new generation of information technology to achieve the purposes of resource integration, service optimization, and efficient governance in the urban construction and operation system and ultimately use technology to meet the public's desire for a better life and the potential of smart cities (Caragliu et al., 2011). The definition of a "smart city" is still vague internationally, and it is accompanied by urban development planning and policy. In recent years, however, the concept of "smart cities" has come to represent more broadly the impact of advanced technologies on city management, governance, economies, and everyday life (Sagi, 2016).

The construction and development of cities play a key role in enhancing the comprehensive strength and competitiveness of countries and are a key link in human development and social progress. Since 1978, China's reform and opening have accelerated the process of urbanization. It is about to reach 75% in 2050, exceeding the world average of about 68%. China's urbanization has made remarkable achievements, which have also brought increasing governance pressure and social risks. Urbanization construction urgently needs to be transformed and upgraded (EO Intelligence, 2020).

Although remarkable achievements have been made in urban construction, due to the rapid expansion of the urban population and the rapid expansion of urban scale, problems such as traffic congestion, lack of resources, and environmental pollution have become increasingly prominent, and social risks caused by governance problems have also increased (Xu, 2021).



### 1.2.2 Chinese smart city concept

China ranks first in the world in the number of smart cities under construction. According to statistics, China has launched more than 500 smart cities and other related pilot projects. The Super Smart City Report found that the number of smart cities in China is much higher than that of the second European country. The world has become a smart city cluster in the Yangtze River Delta and the Pearl River Delta.

So, China's smart city research (Deloitte, 2020) has enough case data and reference value to work with.

Smart cities provide systematic and intelligent solutions to urban development problems and governance pressures. The Guiding Opinions on Promoting the Healthy Development of Smart Cities propose that by 2020, China will build a group of smart cities with distinctive features to greatly enhance the role of aggregation and radiation and significantly improve comprehensive competitive advantages. Remarkable progress has been made in terms of social management innovation and network security. In 2015, China's smart cities made great progress under the strong promotion of national policies covering Made in China 2025, smart medical care, smart transportation, the Internet, big data, cloud computing, etc.

In terms of smart city theory in China, the smart in the concept of a smart city should focus on intelligence, while smart focuses on spirituality and human culture. Since the concept of smart city was introduced in China in 2009, the concept of smart city is still in the discussion stage. Due to the different knowledge backgrounds and perspectives of each concept proposer, different definitions of the concept of a smart city have been formed. But they have their commonalities and intersections. That is, these concepts all hold the idea of using a new generation of information technology to achieve sustainable urban development and improve the quality of life of residents (Deng, 2016; Yang, 2014; Zhao, 2013).

### 1.2.3 Chinese smart city operational

Smart cities can be developed in two ways: top-down and bottom-up. The difference between Chinese and foreign smart cities is that foreign smart cities are driven by technology to achieve sustainable urban development. The connotation of smart cities in China believes that information technology is only a means of urban development, and the research on smart cities should pay more attention to the overall development and operation of cities and the humanistic perspective of people-oriented. The definition of the scope of smart city policy should be integrated into the policy of smart city construction (Long et al., 2020).

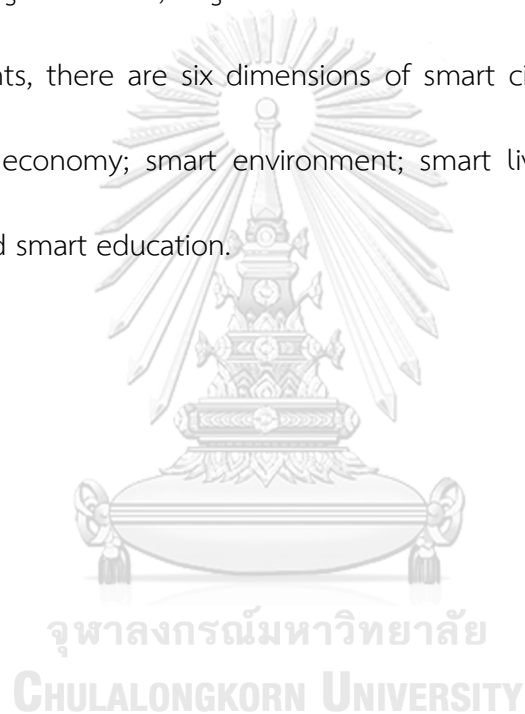
The growing demand for smart city construction has become China's response to the economy. Downward pressure and the highlight of promoting the Internet + strategy in December 2015, the Central City Work Conference made specific arrangements for doing a good job in urban work, pointing out that it is necessary to grasp the locomotive of the city, promote a new type of urbanization with people as the core, and strive to build a smart city, cultivate and develop in the central and western regions (EO Intelligence, 2020). The coordinated development of urban agglomerations, regional centers, and port cities will be approved. The building of smart cities in China is at its peak right now. Building smart cities has become an unavoidable part of urban development in China and a strategic commanding height for promoting new urbanization.

Big data is the key to smart city construction and the center of smart city construction. China's first-tier cities are national big data demonstration bases, and the big data industry has become the core strategy for economic and social development. The scope of this research is limited to China's first-tier city clusters for the following reasons: China's smart city projects are number one in the world, with more than 500 smart city projects (Deloitte, 2020).

#### 1.2.4 The difference of smart city between China and International

The purpose of China's smart cities is not only to rely on a new generation of information technology to achieve the purposes of resource integration, service optimization, and efficient governance, but also to combine urban humanities so that smart cities can develop in a long-term and healthy manner. China's large land area means that the central government sets the policy direction for urban planning and development, and the local government adjusts and promotes the setting of local policies by interpreting them in a way that is relevant to the area. Therefore, China's smart city development takes the form of a combination of top-down and bottom-up. Beijing, Shanghai, and Shenzhen adopt a top-down government-led development model; Hangzhou and Shenzhen adopt a bottom-up development model. It can be seen here that Shenzhen has adopted a more open and inclusive development model due to the special economic zone. It combines top-down and bottom-up diversified development models (Atha et al., 2020; Long et al., 2020).

Internationally, smart cities have different definitions and dimensions, so there are 11 dimensions that contribute to the development of smart cities: smart economy; smart governance; smart people; smart environment; smart infrastructure; smart technology; smart living; smart mobility; smart water and waste; smart security; and smart agriculture (Wahab et al., 2020). But combined with the background of China's smart cities, smart government, or government affairs as the first six basic indicators of smart city elements, there are six dimensions of smart city development in China, which are: smart economy; smart environment; smart living; smart transportation; smart security; and smart education.



### 1.3 Research questions

- What is the development of smart cities in Chinese first-tier cities?
- What are the characteristics and challenges of smart city development policies and plans in first-tier cities in China?

### 1.4 Research purposes

- To understand the development of smart cities in Chinese first-tier cities.
- To investigate the characteristics and challenges of smart city development policies and plans in first-tier cities in China.
- To provide policy suggestions for smart city development in other cities and regions.

### 1.5 Contributions



This research is one of the first studies related to smart city policies in first-tier Chinese cities. At the same time, it gives insight and vision to the development of smart city projects in China at the city level.



### Theoretical meaning

Based on drawing on relevant research at home and abroad, this study uses text analysis methods to conduct in-depth research on smart city policy and analyzes it from multiple dimensions based on the perspective of policy tools. By comprehensively and systematically sorting out all the policy documents related to smart cities in China's first-tier cities, we will conduct typed analysis and text content analysis of the policy texts, so as to explore the profound ideas and possible deep problems behind the policies. It adds to the perspectives and methods of smart city policy research, adds relevant information to previous research, and gives new real-world examples for theoretical research on tools for public policy, which has some theoretical value.

### Realistic meaning

The smart city concept provides new ideas for the refinement, intelligence, and sustainability of future urban development. While actively promoting the practice of smart cities, there are also a series of problems, such as unclear understanding and single subject. Therefore, for such a huge and complex system project, the government's policy planning and guidance play an important role. Therefore, an in-depth analysis of the policy system can not only find out the problems in the current formulation process in time, check and fill in the gaps, and ensure the effective

implementation of policy goals, but also help to improve and optimize the construction of smart city policy systems in first-tier cities and promote the development of guidance and practiced guidance, which play an important role. So, a thorough analysis of the policy system can not only find the problems in the current policy-making process in time, check and fill in the gaps, and make sure policy goals are met, but it can also help improve and optimize the building of smart city policy systems in first-tier cities and promote the development of guidance and practice, which has some practical value.

This study provides a systematic review of smart city policies and the status quo of smart city development. At present, papers with the same research methods in China and other countries mainly focus on a certain smart city field or a specific city. At present, there are still systematic review studies on smart cities in China. Blank. This paper takes China's first-tier city circle as the research scope. The organic combination of policy and development status in this paper is the innovation of the research.

## CHAPTER 2: LITERATURE REVIEW

At present, academic research on smart city construction mainly focuses on three aspects, namely, the application of new technologies in smart city construction, the specific fields of smart city construction, and the model architecture of smart city construction.

### 2.1 Research on smart city

The global smart city market is vast, and public safety needs, smart government affairs and transportation will be the main drivers of market growth. The global smart city market size was valued at USD 308.0 billion in 2018, and this figure is expected to grow to USD 717.2 billion by 2023, representing a CAGR of 18.4% (EO Intelligence, 2020).



#### 2.1.1 Smart city in China

China launched a pilot smart city program in 2012, and the first batch of 90 pilot cities passed in January 2013. In the process of the continuous development of smart cities, China's urbanization rate has continued to increase, from 49.68% in 2010 to 54.70% in 2014. Internet use has steadily grown, reaching 47.9% in 2014. Between 2012 and 2013, the average Internet speed went up a lot.

The sudden outbreak of the global epidemic has highlighted the shortcomings of traditional urban development, and the sudden epidemic has put a major test on the construction of smart cities. Some cities with better implementation of smart city construction have used the Internet, big data, artificial intelligence, and other information technology to improve the level of refinement and intelligence in urban governance and have successfully provided effective assistance for epidemic control (EO Intelligence, 2020).

In-depth understanding of the connotation of smart cities in China Table 1 presents the summary concept of smart cities in China. There is still no unified and clear definition of the concept of smart city at home and abroad. Table 1 shows that the concept of smart city in China can be understood from three different dimensions: the technical level, the urban development level and the social level.

Table 1, Smart city dimension in China

Dimensions	Technology	Urban Development	Society
Content	A smart city is a new concept and new mode of using new-generation information technology such as the Internet of Things, cloud computing, big data and geospatial information to promote the smart of urban planning, construction, management and services.	Smart City is a comprehensive urban development strategy that integrates urban operation and management, industrial development, public services, and	A smart city is a new urban ecosystem supported by new technologies covering and sand government and is digital networked management of complex systems such as urban geography, resources, ecology, environment, population and economy, with an information system for service and decision-making functions.

Source: Smart city report of China

### First-tier cities in China

Most countries in the world are actively involved in the construction and development of smart cities. According to Deloitte's statistics on the number of smart cities under construction around the world, China is the hottest country in the world for smart city construction, accounting for 48% of the total (Rao et al., 2020). At the same time, since the end of 2012, China has successively issued relevant policies to encourage the construction of smart cities, technology, the economy, information, comprehensive and other fields.

Figure 2 shows that Beijing, Shanghai, Guangzhou, and Shenzhen, as the first-tier cities in China, have a high degree of openness and are the windows for the world to understand China. They have formed their own unique urban personality and an increasingly clear urban positioning in the long-term open development process: Beijing is the political center; Shanghai is the fashion city; Guangzhou is the center of trade; and Shenzhen is the center of entrepreneurship.

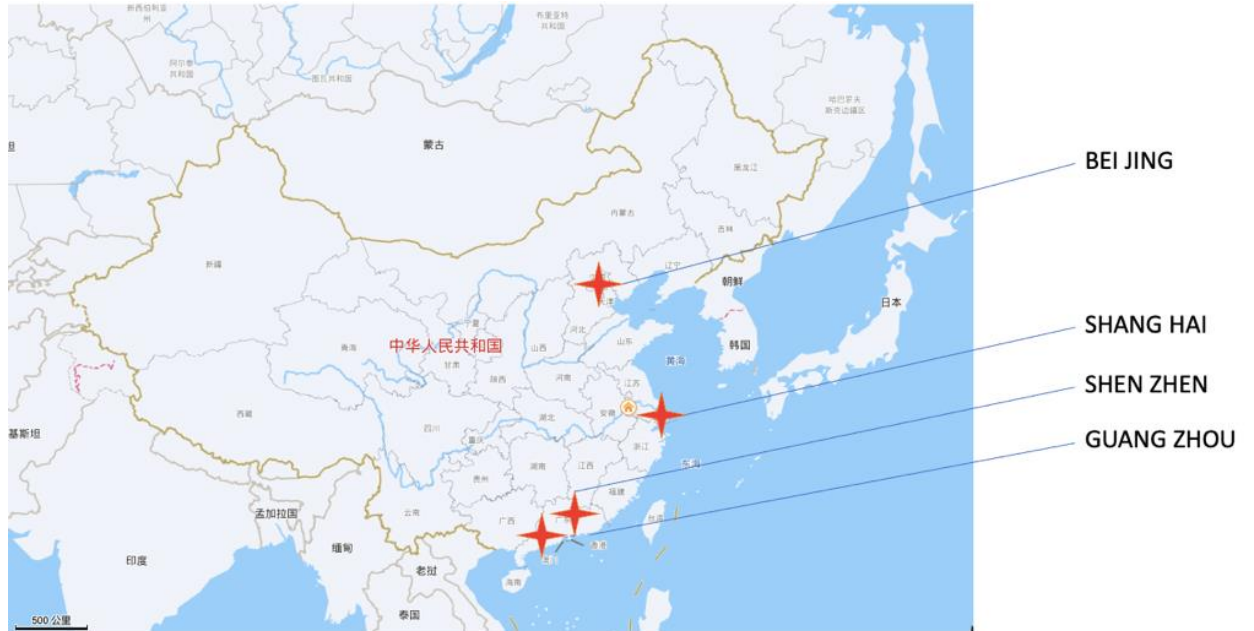


Figure 2, First-tire cities in China

Source: Baidu map



## Beijing

The figure below shows that Beijing is the capital of the People's Republic of China; the political and cultural center of the Chinese state; a world-famous ancient capital; and a modern international city. A total of 402.7 billion yuan of gross regional product was achieved in 2021, and the city's per capita gross regional product was 129,000 yuan based on the resident population.

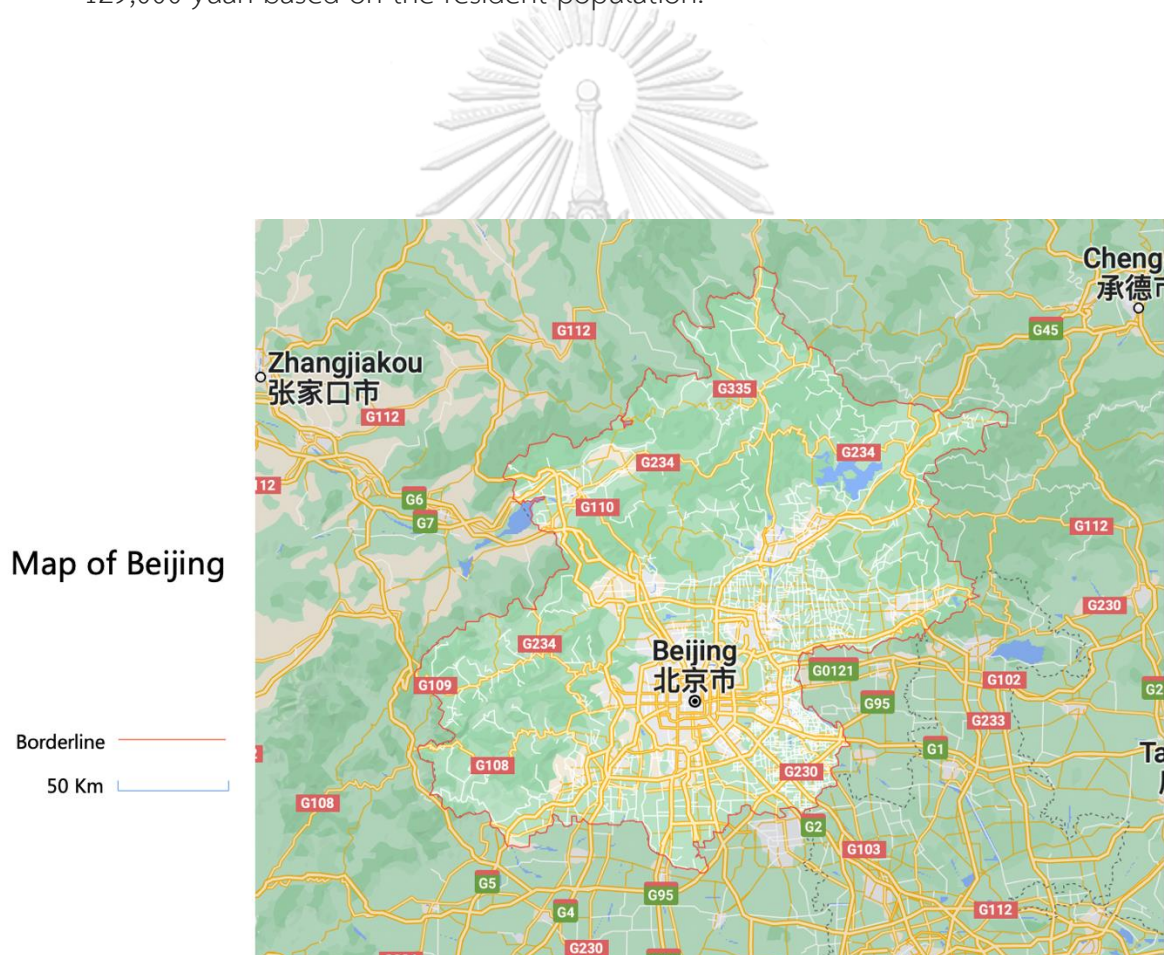


Figure 3, Beijing map

Source: Google map



Beijing's annual expenditure on research and experimental development was 159.53 billion yuan, and high-tech enterprises achieved a total revenue of 51.2 billion yuan, of which 832.77 billion yuan was achieved in technology revenue. The city's resident population was 21.707 million, and the resident foreign population was 7.943 million, accounting for 36.6% of the resident population. The number of people living in cities is 18.766 million, which is 86.5% of the total number of people living in China (Chinese government website, 2017).

## Shanghai

Located in the middle of China, Shanghai is a good river and seaport with convenient transportation and a wide hinterland. The land area of Shanghai city is 6340.5 square kilometers, accounting for 0.06% of the total area of the country. The cities of Chongming, Changxing, and Hengsha are in charge of three islands. Chongming Island is the third largest island in China.

By the end of 2017, the total resident population of the city was 24.1million. Among them, the household resident population was 14.4 million, and the foreign resident population was 9,726,800. According to the sample survey, the per capita disposable income of the city's residents was RMB 58,988, and the per capita disposable income of urban residents was 62,596 yuan.



Figure 4, Shanghai map

Source: Google map

The annual gross domestic product (GDP) of Shanghai in 2017 was 301,386 billion yuan, and the per capita GDP of Shanghai according to the resident population was 124,600 yuan. The total import and export of goods at Shanghai ports for the year was 7,921.140 billion yuan, and the total export was 3,223.782 billion yuan. Shanghai actively promotes the pilot construction of a new urban IOT network until the end of the year to achieve citywide coverage of the Internet of Things. The total coverage of the city's gigabit fiber to the home reached 4.05 million households. Shanghai's technology incubation enterprises totaled 1,798, and 274 were technologically

advanced service enterprises. During the year, 3,247 high-tech businesses were found, and the amount spent on research and experimental development (R&D) was equal to about 3.78 percent of Shanghai's gross domestic product (Chinese government, 2017).

## Guangzhou

Guangzhou is one of the first national historical and cultural cities and is the capital of Guangdong Province. Figure 5 shows the map of Guangzhou, and Guangzhou has 11 districts, with a total area of 7434.40 square kilometers. In 2021, Guangzhou City will achieve a regional GDP of 2823.2 billion yuan.

The number of residents in Guangzhou reached 18.68 million in 2020, and the urbanization rate was 86.46%. It accounts for 14.82% of the province's population, which is the highest in the province. Guangzhou is ranked as the world's top tier city and ranks third in the list of China's top 100 cities (Guangzhou Bureau of Statistics, 2020).

### Map of Guangzhou

Borderline ————  
50 Km [—————]

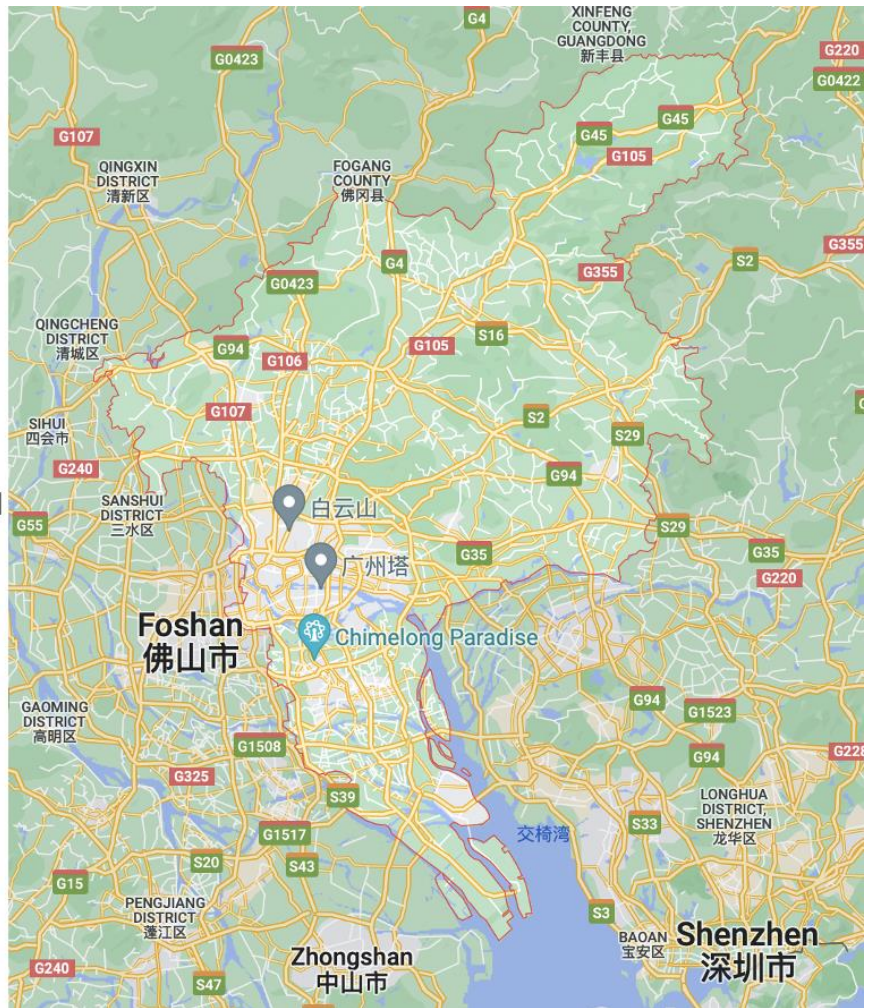
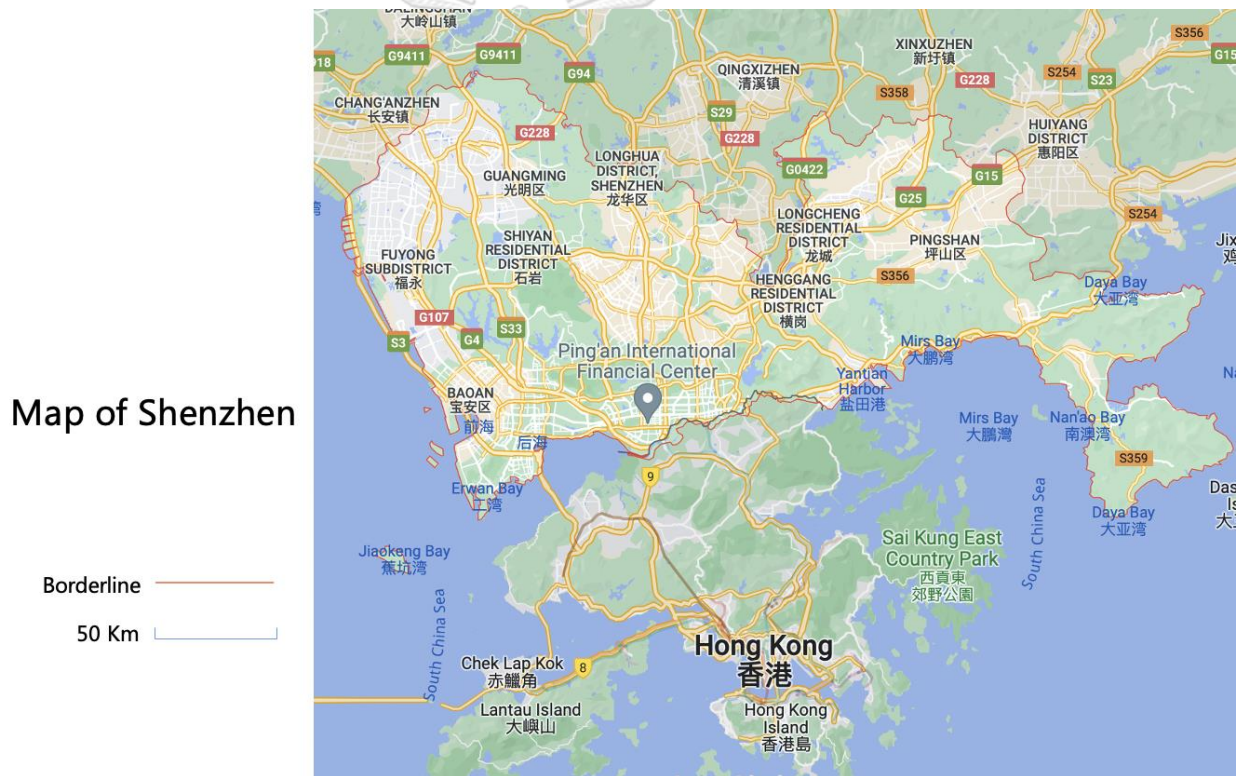


Figure 5, Guangzhou map  
Source: Google map

## Shenzhen

Shenzhen is a special economic zone, a national economic center, and an international city in China. The city has nine administrative districts and one new district, with a total area of 1997.47 square kilometers and a built-up area of 927.96 square kilometers.

Figure 6, Shenzhen map



Source: Google map

According to the data of the seventh census, as of November 1, 2020, Shenzhen's resident population was 17.67 million. Shenzhen is one of the central cities of China's economy, with a total economic output that has long been ranked fourth among mainland Chinese cities and now ranks behind Shanghai and Beijing. In 2021, the city's gross regional product was 3,066.5 billion yuan (Guangzhou Bureau of Statistics, 2020).

### Smart City Ecosystem

The government, enterprises, universities and research institutes, and citizens have played a key role in the development of smart cities in China. The government is the smart city's manager and guide, representing society's public interests and is primarily responsible for determining the urban development orientation, improving top-level design, and conducting comprehensive control. China's three levels of government, from the dimensions of the country, city, and district, from the macro and micro levels, all have the government's participation in the process of intelligence.

Enterprises are the main providers of smart city platforms, technologies, and services. They are driven by projects and focus on information and communication infrastructure construction, data collection, platform construction, cloud computing, intelligent transformation, and scenario applications. The corporate players in China's

smart cities are mainly intelligent integrators, telecom operators, large Internet companies (such as Baidu, Alibaba, and Tencent), and real estate developers.

Universities and research institutes are the participants and promoters of smart city innovation and are mainly responsible for standard formulation and innovation research. Overall, the government decides the priority and speed of smart city development, while businesses decide the size, quality, and type of field for smart cities, and universities and research institutes decide how smart city development can be made more innovative.

Ultimately, citizens determine the stability, sustainability, and comprehensiveness of smart city development. In European and American countries, universities, research institutes, and enterprises are more motivated to participate and cooperate more. In China, the dominant role of the government is relatively strong, and there are few cases of enterprises promoting policy formulation. So, this is also one of the reasons why China's current policy making, and development problems aren't taking the public's point of view into account.

### 2.1.2 Smart city policy in Global

As a special text, the different forms of this text and the corresponding words are the embodiment of power, and the content is also richer (Ball, 2000). At the same time, power and control have also begun to lean more towards the textual approach, with discourse contained in the text and expressed in the form of policy texts (Fairclough, 2003). A research method that applies text analysis to the field of official policy is policy text analysis. Because policy is also a policy tool, using policy tools is an essential part of the policy-making process (William, 2002), so research on policy tools is also a kind of deepening of the content of policy texts.

Smart city policies play an important role in smart city construction, but the policy system needs to be improved. Smart city construction is a huge and highly complex systematic project, which requires the government to play a leading role in policies, clarify the construction goals at each stage through the formulation of a series of public policies, coordinate the participation of multiple subjects, and rationally organize and allocate funds, technical and human resources (Sun et al., 2016; Xu, 2021). So, smart city development policy has a direct effect on smart city construction and is one of the most important parts of how well smart city construction works.

Regarding smart city policy on a global scale, Scholars have different elaborations on the research on policy tools. Woodside (1986) believes that policies are of great significance in realizing the national will, and the specific implementation of different policies after they are formulated needs further consideration, so the use



of policy tools should be concentrated. To help the government achieve its intended policy purpose and make corresponding adjustments according to the policy's importance or select tools to reflect the importance of the policy.

With the advancement of the world's smart city construction process in recent years, smart city policy, as an important field of smart city research, has become the focus of academic attention. Foreign scholars' research on smart city policy mainly focuses on the perspectives of policy function, policy development, and policy evaluation. Smart city policy innovation is an important factor affecting the development of smart cities, and it is a balance between demand-driven Different types of cities should make policy choices based on their conditions and development needs. Compared with foreign research on smart city policy, domestic scholars pay more attention to smart city policy (Caragliu et al., 2011).

In terms of smart cities at a global level, The United States, Australia, the European Union, and other countries, regions, and international organizations have carried out much exploration into building smart cities and issued a series of relevant policies with distinctive features to encourage the construction of local smart cities. Following the pace of smart city development in these countries and regions, China has also set off a wave of smart cities and smart projects. However, many problems have arisen during the implementation of smart city policies. This includes management issues, investment and construction issues, and operational issues.

Indeed, smart cities are the first choice for solving urban development problems (Tian, 2018).

In the smart city policy concept, they should adhere to the concept of sustainable development and should build multiple goals (Xu, 2021). Citizens can see a picture of how you want to see the city grow in the future. It's important to make sure that information technology and industrial development, government governance, and urban development all have the perspective of social subjects. This way, citizens can avoid the problem of separating policy design from real needs to a certain extent (Chen, 2017; Guo, 2016).

### 2.1.3 Smart city policy in China

In China, many scholars have tracked the intensity of policy concepts and compared the structural differences of smart city policies in different regions, different periods, different administrative levels, and different policy types. They believe that China's smart cities are reflected in the strength of policy concepts and the structure of policy concepts. high consistency and similarity (S. Tang et al., 2020; Xu, 2021). Huang (2014, 23p–33p) proposes that smart city policy presents two policy concept orientations of technology and humanities and has formed two basic cognitions of the city as "city-centered" and "people-centered" in policy discourse. The top-level design

of the city should include infrastructure, management services, smart industry, and a supportive environment.

The construction capacity, development level, and development potential of smart cities are evaluated by the policy. To promote the construction of smart cities, we must correctly handle the relationship between the "invisible hand" of the market and the "visible hand" of the government; drive technological innovation and financial innovation; ensure information integration, sharing, and interconnection in infrastructure construction; and pay attention to technical specifications and legal norms; and comprehensively promote it based on accumulated experience in typical demonstrations, to create a good policy environment for the construction of smart cities (Huang & Yuan, 2014).

However, the formulation of urban development policies lacks consideration of the actual situation, and there is no effective information sharing and cooperation mechanism between neighboring cities. Even though the smart city policy system has begun to take shape, local governments lack targeted and directional policies based on local characteristics and actual development when formulating policies, and the problems of blind construction and lag in institutional mechanisms still exist. There are also a lot of challenges in the smart city operation model. The operation of the public-private partnership (PPP) mechanism lacks the guidance of laws and regulations, and the government lacks effective supervision of private enterprises, resulting in the abuse and waste of R&D costs. Smart city policies play an important role in smart city

construction, but the policy system needs to be improved (X. Zhang, 2020). So, it's important to give different and perfect ideas for smart city policies in different parts of the world.

As Chinese scholars propose, many issues have emerged throughout smart city implementation, including management, investment, and construction during the operation of smart city projects. This research explores and studies the current status of smart city development and local policy formulation issues, including smart city case studies and policy analysis, to understand the challenges and difficulties of smart city development and to advise on policy formulation. The results of this research can be given to local cities in China as a reference for policy formulation, as well as other smart city projects in Asia and the world.

Although the above studies cover important issues of smart city policy, there is still a lack of research on smart cities from the perspective of policy tools. Research on policy tools is very necessary. Which policy tool to choose and which standard to use to evaluate the effect of the policy tool has a decisive impact on whether the government can achieve the established policy goals. From the perspective of policy tools, this paper takes the policy of smart cities in China's first-tier cities as the research object, explores the rationality of the use of policy tools in smart city policy plans, analyzes the existing problems, and puts forward suggestions for improvement.

Figure 7 illustrates the development plan of smart city policies in China. In 2012, China for the first time promulgated the core policy at the national level for

smart cities, "Developing National Smart City Pilot Work". The policy pointed out that "in order to explore the scientific methods of smart city construction, operation, management, service, and development," the state decided to carry out smart city pilot work. The national level was only deployed in November 2012. Subsequently, more than 300 cities, such as Beijing, Shanghai, and Nanjing, have proposed to build smart cities, and more than 100 cities have started smart city construction.

In August 2014, the Guiding Opinions on Promoting the Healthy Development of Smart Cities issued by the eight ministries and commissions of the State Council made overall arrangements for the construction of smart cities in China. problems such as unclear thinking and blind construction. It's clear that the choice of policy design and policy tools is a big part of why smart cities aren't making as much progress as they could be right now.

To promote the construction of smart cities, the central and local governments have issued some policies, initially forming a policy system with local characteristics. Since 2012, the central government has successively issued policy documents such as the Interim Administrative Measures for National Smart City Pilots and the National New Urbanization Plan (2014–2020). Planning guidance in many aspects. Although the smart city policy system has just begun to form, local governments lack targeted and directional policies based on local characteristics and development conditions when formulating policies. The problems of blind construction and lag in institutional mechanisms still exist. Therefore, it is necessary to provide smart city policies for

different regions. Differentiated Perfect Suggestions (Housing and Urban-Rural Development, 2012).

In the following three years, the core policies and supporting policies for smart cities have been continuously introduced. Among other policies based on urbanization, construction, information technology development, Internet +, and industrial innovation, the number of times smart cities have been mentioned has gradually increased. It can be seen that all walks of life have participated in the construction of smart cities.

In August 2014, the Guiding Opinions on Promoting the Healthy Development of Smart Cities issued by the eight ministries and commissions of the State Council made overall arrangements for the construction of smart cities in China, especially pointing out that the current construction of smart cities exposes the lack of top-level design and overall planning and the lag in institutional innovation. Afterward, unclear thinking, blind construction, and other problems followed. It's clear that the smart city's development is being slowed down in part because policy design and policy tools have been chosen in a way that is unreasonable and wrong.

In 2016, thanks to the proposal of the "13th Five-Year Plan," "focusing on intelligent infrastructure, facilitation of public services, and refinement of social governance, we should make full use of modern information technology and big data to build several new demonstration smart cities." The number of various policies issued for smart cities at the national level has reached a historical peak. The 13th Five-Year

Plan states: "By 2020, the construction of new smart cities will achieve remarkable results, forming ubiquitous services that benefit the people, a transparent and efficient online government, an integrated and innovative information economy, precise and refined urban governance, and safe and reliable operation."

In 2018, the State Administration for Market Regulation and the National Standardization Administration released 23 national standards, including the "Smart City Information Technology Operation Guide" on October 10. It includes national standards in a wide range of areas, including smart cities, information security, and the circular economy. The implementation of this new national standard will provide a theoretical basis and technical support for the construction of smart city information systems, help to standardize data resources, and help sort out the key functional elements of the construction of the Internet of Things system in a smart city. Guidance to improve the level and quality of smart city information technology construction.

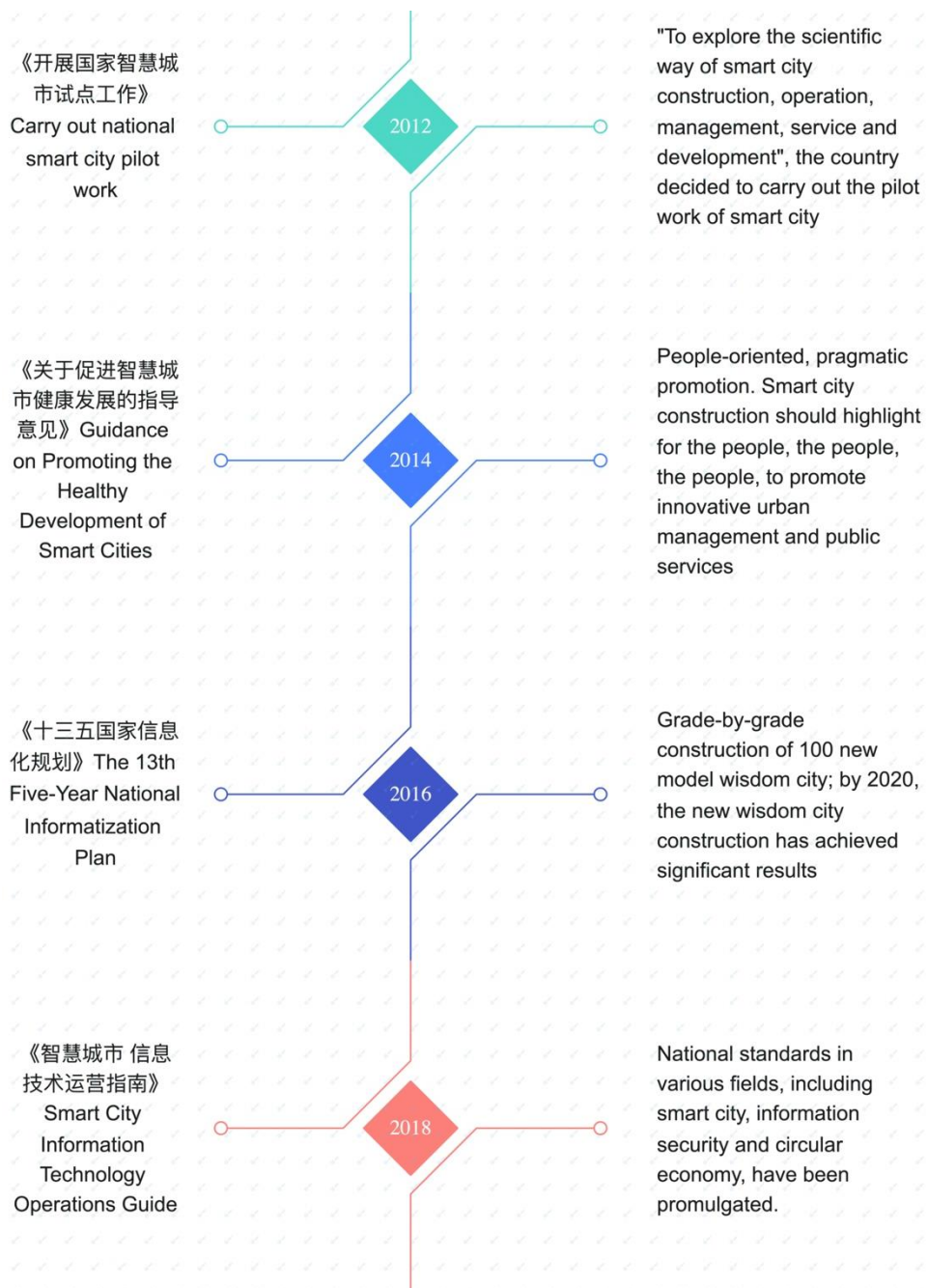


Figure 7, Timeline of the development

Source: Wang & Qian, 2017



At present, the development of smart cities in China still has the following problems: 1. The development orientation of smart cities in various cities is not clear, and the template construction of thousands of cities is on one hand. 2. The degree of cross-regional information infrastructure connectivity is insufficient, and the construction of a sharing platform covering all aspects of public information within the region is insufficient. To this end, it is necessary to conduct a comprehensive analysis of the existing policies of smart cities, to study the possible deficiencies and problems in policy formulation of cities with different basic levels, and to put forward directional and differentiated policy optimization suggestions for different types of cities.

From a theoretical point of view, based on the existing research, this paper conducts in-depth research on smart city policies through the policy analysis framework and text analysis methods, understands the characteristics of smart city policies in cities at different levels of development, and discovers different types of smart city policies. The problems are reflected in the city's policies.

On the one hand, most scholars have limitations in research objects, mainly focusing on discussing the characteristics and deficiencies of smart city policies at the national level and the overall level, and a lack of discussion on targeted policies for various cities at all levels; on the other hand, some scholars mainly focus on research. The goal is to look at the smart city policy of a single sample city, and there isn't a lot of support for the suggestion to improve the policy.

On the other hand, most scholars choose to analyze the framework application of smart city policies from the perspective of policy tools, mainly focusing on the choice of implementation means and methods after the formulation of policy goals and paying little attention to the composition and policy goals of smart city policies.

As a result, unlike previous studies, this paper begins with two aspects: systematic review method and text content analysis, in order to construct a framework system for smart city policy analysis and to innovate smart city policy research methods and perspectives.

From a practical point of view, in the process of promoting smart city practices across China, there have been problems such as blind construction and unclear understanding. Therefore, optimizing policy planning can provide better guidance for smart city practice. We provide directional guidance for different types of cities in the construction of smart cities through grading, classification, and coordinated development.

## 2.2 Policy on smart city

When the government formulates policies, the selection of policy tools needs to be comprehensively considered in combination with various factors such as goals, fields, and objects. The effective selection and use of types can not only promote the implementation of policies but also better mobilize the participation of relevant subjects. enthusiasm, so as to give full play to its guiding role. Therefore, the academic community has also conducted corresponding research on the types and application areas of policy tools. Rothwell and Zegveld (1985) divided policy tools from the perspective of different influences on technological innovation and summarized them into three types of policy tools: demand-type, supply-type, and environmental-type. Cohen and Amorós (2014) use past research to divide policies that encourage innovation into two groups: "policies based on supply" and "policies based on demand."

In terms of content analysis of smart city policies, Pei Lei and other scholars selected a total of 131 provincial, municipal, and county-level policies for text analysis, and found that China's smart city applications are mainly concentrated in smart applications and services, information infrastructure and key technologies, smart industry development, information This paper suggests that when choosing smart applications, the local government should strike a balance between consistency and homogeneity, diversity and individuality, coverage and key field construction.

Sun (2020) analyzed the content of policy tools in smart city policy texts and found that current local policies emphasize the use of supply-type and environmental-type policy tools while taking into account the use of regulatory policies and incentive-incentive policies. Smart city policies have problems like using too many tools that have to be used, not legalizing enough, not having enough market mechanisms, and not involving enough social forces.

This study believes that although the above studies have fully discussed smart city policies, there are still some shortcomings. On the one hand, the analysis of smart city policies at the national level in China is relatively lacking. Although there are many smart city strategies that are deployed by the State Council and its various ministries and commissions, and although local governments actively carry out advanced practices, they generally lack local characteristics and local characteristics. Of course, the study of local policies is also representative.

On the other hand, the lack of analytical methods for policy tools The choice and matching of policy tools determine the way and means the government will use to achieve the established policy goals, which plays a significant role in promoting the successful construction of smart cities. A comprehensive review of national policies

Howlett and Ramesh (2002) divide policy instruments into three categories: voluntary instruments, hybrid instruments, and mandatory instruments with a higher level of government intervention. According to different practical goals and personal research preferences, scholars from different academic backgrounds and fields in China

have different classifications of policy tools. Chen (2003) divided the policy tools of government management into three categories: market-oriented mechanisms, business management, and social tools.

This paper conducts a comprehensive analysis of the relevant policies of smart cities at the local level, grasps the development context and characteristics of smart city policies in China as a whole, and then uses policy tools and methods to conduct a statistical analysis on the text content of core policies and supporting policies, in order to examine policy tools. The rationality of the application is examined and, based on this, a comprehensive problem diagnosis and policy optimization suggestions are put forward.

Through the research described in this paper, it is expected to have a holistic understanding of the development context of smart cities in China's first-tier cities, to discover the inappropriate problems in the use of existing smart city policy tools, and to provide smart city policies for other cities in China and other countries and regions. The development provides reference.

Wahab et al. (2020) reviewed articles on the rationale for smart cities from two databases, Scopus and Science Direct, from 2010–2019. By looking at the literature, Wahab et al. (2020) came to the conclusion that a "smart city" is a city that uses information and communication technologies to manage human and social capital and make sure that resources are used in the best way possible.

In a systematic review of smart cities in developing countries, Tan & Taeihagh (2020) limited the scope of research to developing countries by restricting the search to developing countries and low- and middle-income countries as search terms and query terms. They examine the state of smart city development in developing countries, including the concepts, motivations, and unique drivers behind smart city development. Through a systematic literature review, 56 studies were initially identified from 3928 pieces of social science literature in two academic databases, Scopus and Web of Sciences. Tan and Taeihagh (2020) found that developing smart city projects in developing countries requires simultaneous socioeconomic, human, legal, and regulatory reforms to create technology-driven smart cities in developing countries.

American scholar Ruhlandt (2018) studied smart city governance, the logical classification of related literature, and the dimensions of collection, analysis, and generalization. This paper systematically reviews the literature on smart government from 2003 to 2017, and sequentially understands smart city governance from the perspectives of components, measurement methods, contextual factors, and envisaged outcomes (Ruhlandt, 2018). Huang-Lachmann (2019) looked at how smart city policies and smart cities work together to change the weather, and he found that smart cities can help reduce the risks caused by weather changes (Huang-Lachmann, 2019).

Rocha (2021) studied a systematic review of information technology for people with disabilities to understand the impact of current smart city infrastructure on the mobility of people with disabilities. (Rocha et al., 2021) The services that are already in place, like smart barrier-free navigation apps, parking, and smart semaphore, will stay the same.

To be more specific, Rocha (2021) research uses systematic review as the methodology because systematic reviews can clearly summarize the existing evidence and identify gaps in research in the field. Systematic reviews can use the PRISMA exclusion criteria to make sure that relevant literature is left out. This can make the results much less biased.

This paper takes policy tools as the research perspective and takes China's first-tier cities and smart city policies as the research object. Firstly, an analysis framework is constructed based on the theory of policy tools, and then the smart city policy texts are collected. Based on text coding, the content analysis method is used for statistical analysis; the weight and rationality of policy tools are analyzed; the existing problems are analyzed; and suggestions for improvement are put forward.

Figure 8 illustrates that the research directions of international and Chinese scholars are divided into two categories. The first is research on the development status of a specific city, using the method of case analysis. On the other hand, some scholars have paid attention to the research of a certain smart city dimension, which adopts the research method of systematic review.

Some Chinese scholars' research on smart city policy is mainly based on policy tools and content analysis research methods. So, it's clear that the research gap is that there isn't any research that looks at all aspects of smart cities and that there isn't any research done on clusters of first-tier cities.

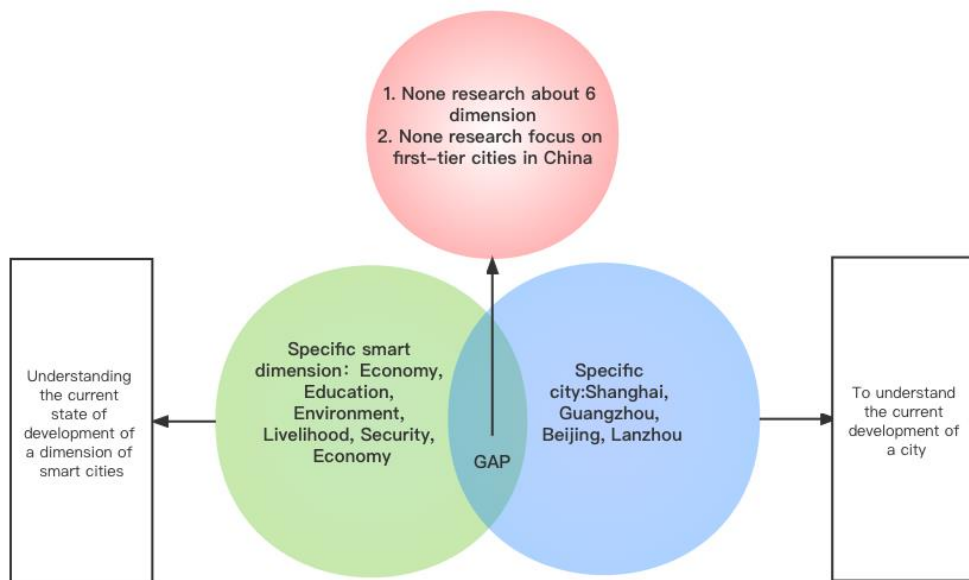


Figure 8, Research gaps



Therefore, based on the above analysis, this paper takes the policy of smart cities in China's first-tier urban circles as the research object, applies text analysis methods to smart city policies, collects policy samples comprehensively and systematically, and makes the data analysis results have statistical significance. Conduct in-depth research on the type attributes and content clauses of policy documents from multiple perspectives, discover deficiencies in the current smart city policy system, and put forward suggestions for improvement, making the research results valuable for promotion.

### 2.3 Conclusion of literature review

According to the review of the literature, the research of Chinese scholars mainly focuses on the dimension of textual analysis of smart city policy and mainly adopts the textual analysis method, ignoring the policy tools as an analytical perspective. At the same time, because scholars mainly study the policy itself, it lacks the test of the effect of policy implementation and attention to the effect of policy application.

However, this study adopts the research method of systematic review to study the development status of smart cities. At the same time, combined with text analysis methods, the text content is encoded by NVIVO software to understand the characteristics and challenges of policies from the perspective of policy tools.

So, the new thing about this paper is that it combines a systematic review with a text analysis to look at smart city policies. This is done so that we can find out what smart city policies are like in China's first-tier city circles and if they can solve all the problems that come up with the development of smart cities.



## CHAPTER 3: RESEARCH METHODS

The Cochrane Collaboration defines a systematic review as a scientific process in which all empirical evidence that meets pre-specified eligibility criteria is collated to answer a specific research question. It involves the systematic identification, selection, synthesis, and evaluation of primary research to provide a high-quality overview of a topic while answering predetermined research questions.

### 3.1 A systematic review

Systematic reviews differ from traditional narrative reviews in several ways. Narrative reviews tend to be primarily descriptive and do not involve a systematic search of the literature; therefore, they tend to focus on a subset of studies in a particular field that have been selected based on availability or author selection. Thus, narrative reviews, although informative, often include elements of selection bias. They can also be confusing at times, especially when similar studies have different results and conclusions. Systematic reviews, as the name implies, usually involve a detailed and comprehensive plan and a pre-established search strategy aimed at reducing bias by identifying, evaluating, and synthesizing all relevant studies on a given topic. Most systematic reviews have a meta-analytic part, in which statistical methods are used to

combine data from several studies into a single quantitative estimate or summary effect size (Petricrew & Roberts, 2006).

The strength of a systematic review is that it can help highlight areas of insufficient evidence in a field and areas where further research should focus. It can put together the results of different studies to show new findings that may have big effects on policy or practice.

According to Figure 9, systematic review is the regular integration of information, which is based on the premise of useful and sufficient background information and expert opinions, and the selection of evidence or statements with a high quality of relevance. This results in a systematic overview of the current state of the research topic. In this paper, a systematic review is used to look at the current situation and characteristics of smart city development in China's first-tier urban areas. A systematic review is a research method that gives an abstract overview of the status quo.

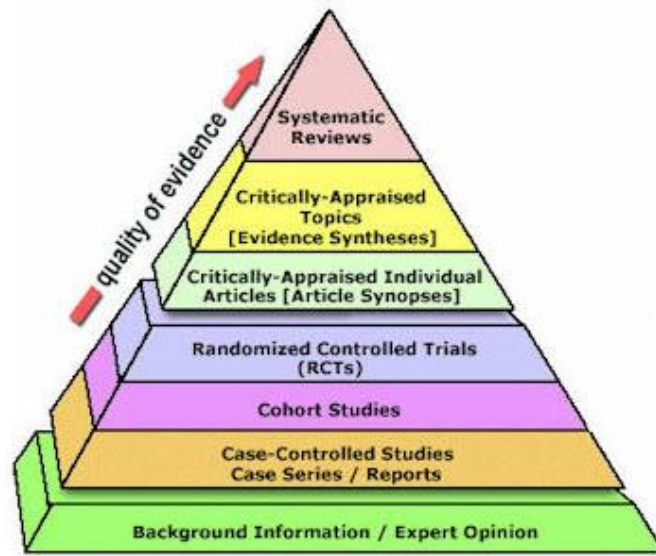


Figure 9, Case study pyramid  
Source: Roth, 2021

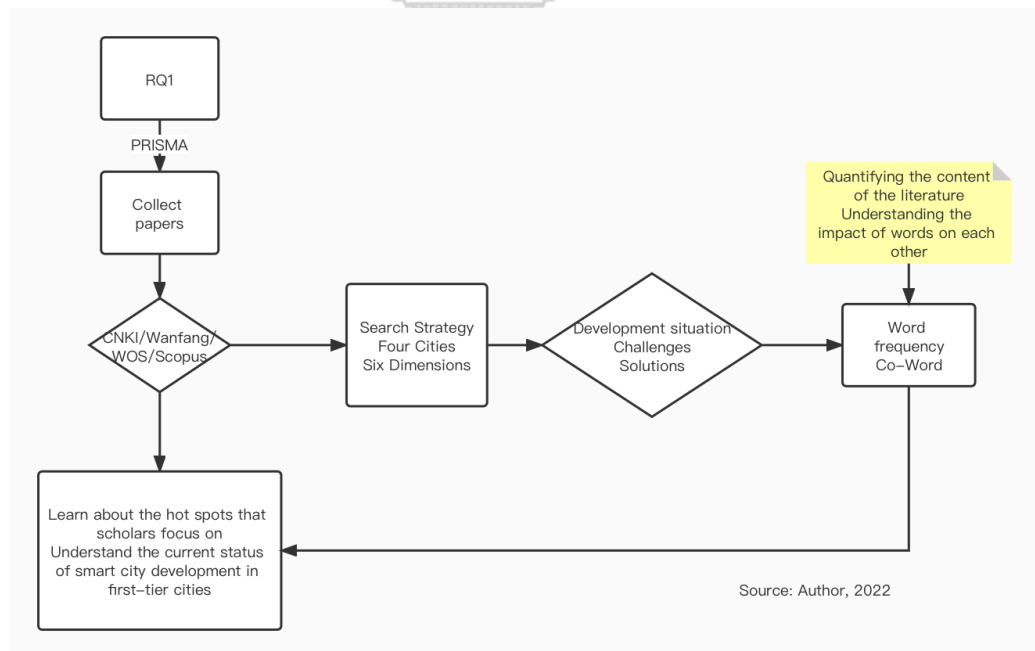


Figure 10, The flow of the systematic review

Source: Adopted from Xu, 2021

## Systematic review literature collection

Figure 10 summarizes the overall flow of the systematic review process in this paper and how to go through the systematic review to get the answers of this study.

Four stages:

- 1) Query to include all articles published before December 31, 2021, that have at least one of the following expressions in their titles, abstracts or keywords: Smart City, Digital City, Smart City.
- 2) Then carry out a secondary search in the search results, these articles have at least one of the following expressions in their titles, abstracts or keywords: Policy, notice, statement, laws and regulations.
- 3) Immediately after the third round of search results, these articles have at least one of the following expressions in their titles, abstracts, or keywords: Economy, Environment, Safety, Travel, Life, Education, Government.
- 4) Finally, in the fourth round of retrieval, these articles have at least one of the following expressions in their titles, abstracts or keywords: Beijing, Shanghai, Guangzhou, and Shenzhen.

Considering that the resources to be searched are 4 general databases, namely CNKI, Wanfang, Web of Science, and Scopus, A literature search was conducted in April 2022. As inclusion criteria, the authors aim to include all articles that report a clear

study of the current state of smart city development in the context of smart cities. Using the criteria for what to leave out, the authors tried to leave out any articles that weren't written in Chinese, weren't in English, didn't have abstracts, or didn't have the full text.

In addition, the authors aim to exclude all articles that report overviews and reviews that do not explicitly address the current state of smart city development or are not relevant to the specific goals of this study. After eliminating duplicate articles and articles without abstracts, the selection of the remaining articles is carried out in the following steps: (1) The authors assessed all abstracts for relevance, and those articles that were clearly outside the scope of this systematic review were removed. (2) The abstracts of the retrieved articles were then evaluated to verify whether they were relevant to smart city development, and articles of irrelevant research were excluded. (3) The abstracts of the remaining articles were evaluated according to the outlined inclusion and exclusion criteria, and the full text of the retrieved articles was evaluated and analyzed by the authors. Exclude non-core journals.

The systematic review method uses the PRISMA process to select articles. After the definition of research subject terms, articles were searched in multiple databases, and irrelevant and low-relevant articles were excluded after screening. In the systematic review, the total number of articles was part of the scope of articles.

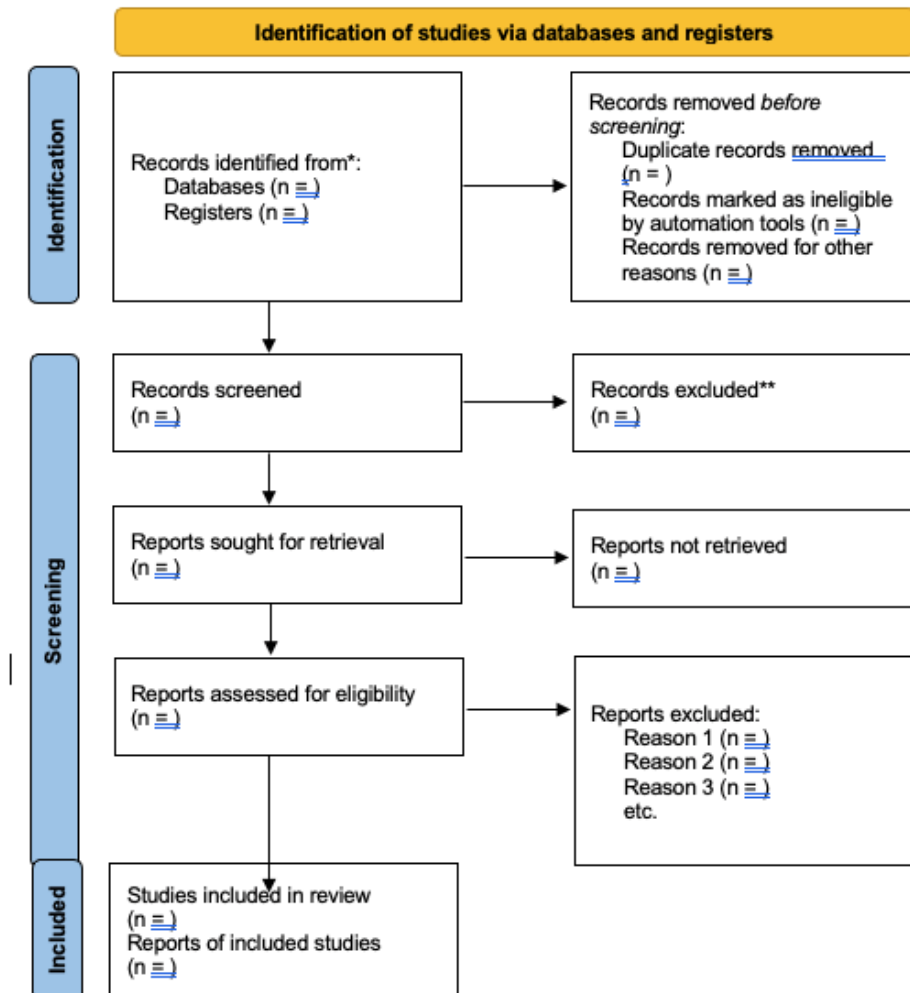


Figure 11, PRISMA flow

Source: PRISMA 2020

This systematic review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and Figure 11 presents the respective flowchart. A total of 1803 articles were retrieved through preliminary searches in the Web of Science, Scopus, CNIK and Wanfang databases. Figure 12 shows

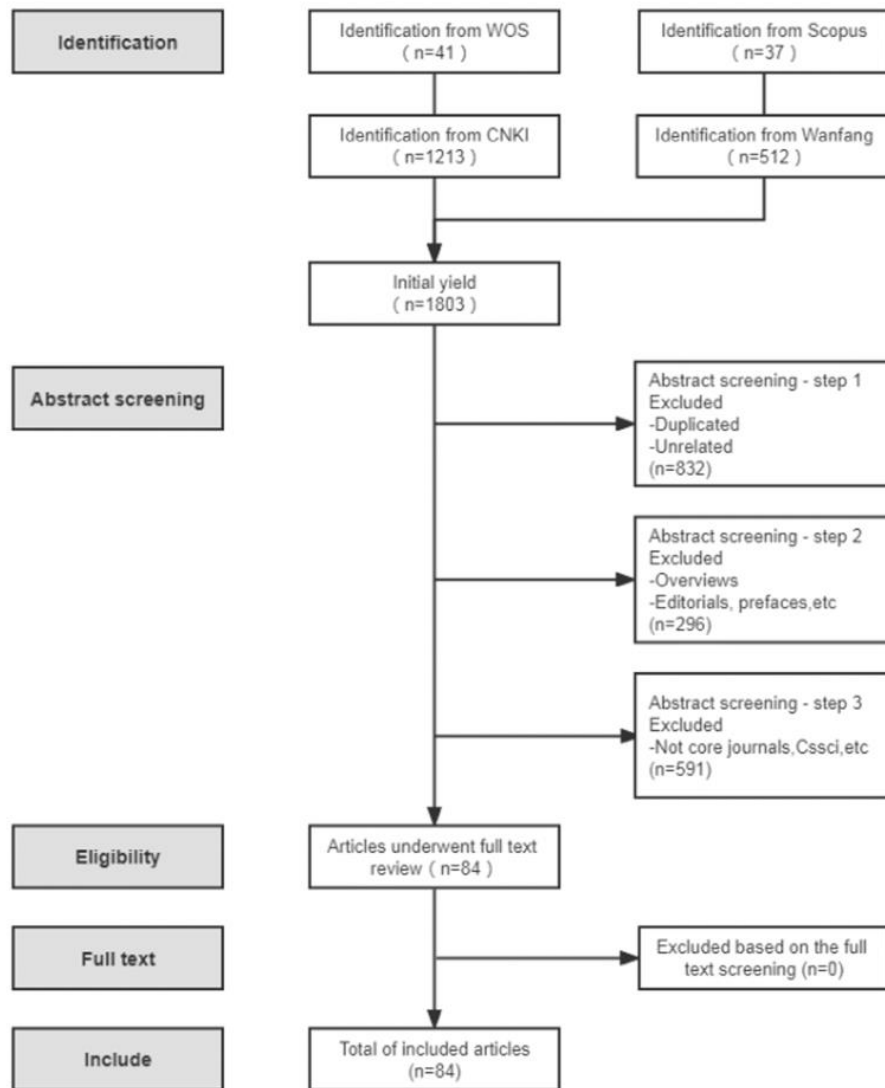


the whole process of how the standard PRISMA process is used to collect and exclude literature in a planned way.

The initial step of the screening phase (i.e., step 1 of abstract screening) resulted in 832 articles by removing duplicate articles or articles without abstracts. Based on abstracts (i.e., the second step of abstract screening), 296 articles were removed for the following reasons: not published in Chinese or English; editorials, prefaces, and announcements of special issues, seminars, or books; not related to smart city applications.

After that, through the analysis of the title, abstract, and full text (i.e., the third step of abstract screening), it was concluded that 591 articles were excluded through the evaluation of the full text and the evaluation of the published journals to exclude low-quality articles. quality articles.

Finally, the full texts of the remaining 849 articles were assessed as meeting the requirements of a systematic review (i.e., full-text screening). Among these 84 articles, after their respective analysis, these articles belong to smart city development research articles, and the scope is concentrated in China and China's first-tier cities: Beijing, Shanghai, Guangzhou, and Shenzhen.



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Figure 12, PRISMA process

Source: Adopted from PRISMA, 2020

### 3.2 Content analysis

Text analysis is a research and analysis method that combines qualitative and quantitative analysis. By analyzing the basic form of text and its content words, it can explore deep-level connotations through text performance. Shapiro and Markoff (1997) believe that text analysis is a measure of any method applied to text for social science research purposes. Titscher (2000) describes a variety of methods for text analysis.

Texts are divided into two categories: one is qualitative analysis, that is, to clarify and explain the changes in the text or the relationship between words in the text. It belongs to the category of pure discourse analysis, and the complexity of language also makes it subjective. The second is quantitative analysis, which focuses on finding keywords in policy texts to figure out what the policymakers are trying to do.

Text analysis methods are based on qualitative analysis and gradually apply quantitative analysis. This statistical method provides an objective and valid text analysis for research. It is used in a lot of different fields and disciplines, but its research value is most obvious in the social sciences, especially when it comes to public policies (Tu, 2009).

Through a systematic search on the magic weapon website of Peking University, a total of 51 related policies have been retrieved as of April 30, 2022. This paper must classify and code each smart city policy document for the sake of future analysis.

During the specific coding process, policy tools are used as the standard to break up the smart city policy texts into separate units of policy text content.

### 3.2.1 Co-word analysis

Co-word analysis is a method for investigating the field's hotspots, structure, and subject development by using the co-occurrence of words to reflect the degree of correlation between keywords. The use of co-word analysis can be divided into the following steps: determining the problem of analysis; determining the analysis unit; selection of high-frequency words; frequency of occurrence of co-words; statistics in co-word analysis; and analysis of co-word results. The main methods used in this research are co-word association analysis and co-word frequency analysis.

In the co-word association analysis method, association rules are knowledge patterns that describe the laws of co-occurrence between items in a thing. More specifically, it is to use quantitative data to describe how the appearance of item A affects the appearance of item B.

The word frequency analysis method uses the frequency of the key subject words to reveal or express the core content of the literature in a certain thing and shows the development trend of things by counting the frequency ranking of the subject words.

The literature screened by PRISMA is used as the analysis object, and the research question is: what is the development status of smart cities in China's first-tier cities? The literature keywords and subject words are the analysis units, and the selection of word frequency and word frequency ranking is carried out. According to the word segmentation of the literature, and then according to the co-occurrence between words and words as a basis, the correlation between words is judged, and Gephi is used to draw a co-word network diagram. From this, we obtained the subject headings, the word frequency and ranking of keywords in the literature about the development status of China's first-tier cities, and the co-word network between the words in the literature descriptions about the status quo. The research scope of this study is the first-tier cities in China. including Beijing, Shanghai, Guangzhou, and Shenzhen, four cities within the scope of the study.

The flow of Figure 13 shows the analytical process of the systematic review study methodology. The research method makes it possible to answer research questions 1 and 2 and use NVIVO software for coding to find out how development is going in China's first-tier cities right now.

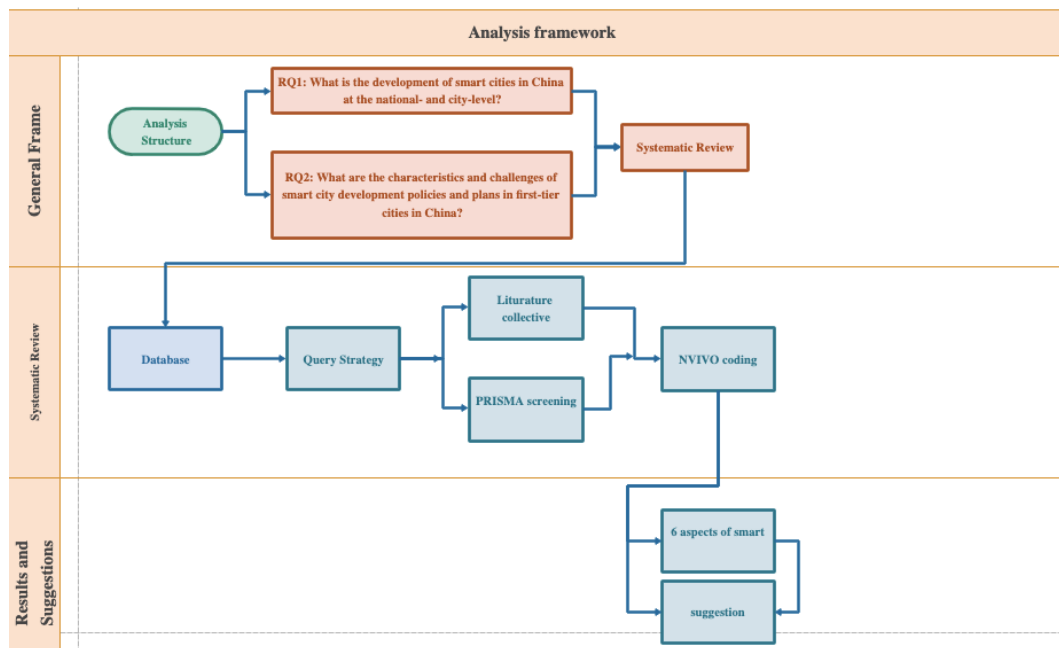


Figure 13, Analysis framework

Source: Adopted from Rocha et al., 2019


### 3.2.2 Coding smart city policies

The supply-oriented policy tool is the government's investment in talents, technology, capital, information, and other aspects to ensure the supply of basic elements required by the government to promote the construction of smart cities. Supply-oriented policy tools can be subdivided into talent input, information support, and infrastructure construction.

Environmental policy tools are used by the government to indirectly affect the construction of smart cities using regulations, finance, taxation, and other measures, and provide a favorable development environment for them. Environmental policy tools can be further subdivided into target planning, tax incentives, regulations, etc.

Demand-based policy tools are more manifest as the driving force of policies for the construction of smart cities, which means that the government reduces market uncertainty by purchasing services and contracting abroad to ensure a relatively stable environment for the development of smart cities. Demand-based policy tools can be further divided into government procurement, service outsourcing, and other aspects.

Table 2, Classification of policy tool



Supply-based Policy Tools	Environmental- based Policy Tools	Demand-based policy Tools
Talent	Target Planning	Government
Information	Financial Support	Service Outsourcing
Infrastructure	Tax incentives	Demonstration
Technical Support	Regulatory Control	Smart Application
Others	Others	Others

Source: Lin et al., 2017

Table 2 is the main policy tool for smart city policy in China, by identifying the specific terms of the policy text, defining the policy tool category to which it belongs, and using Nvivo software to build nodes and code the policy text. First, import all 54 smart city-related policy texts into Nvivo software and establish three tree nodes of supply-based tools, environmental-based tools, and demand-based tools; secondly, under the tree node, according to the above policy tools Sub-nodes are established in turn by the specific classification of the policy text; finally, the content analysis method is used to encode the specific clauses of the policy text line by line, and the words or sentences appearing in the text are classified under the corresponding nodes. The coding method is a policy number-specific clause. When all the texts are encoded, the Nvivo software uses the statistical function of the reference points to create a final set of 267 codes.

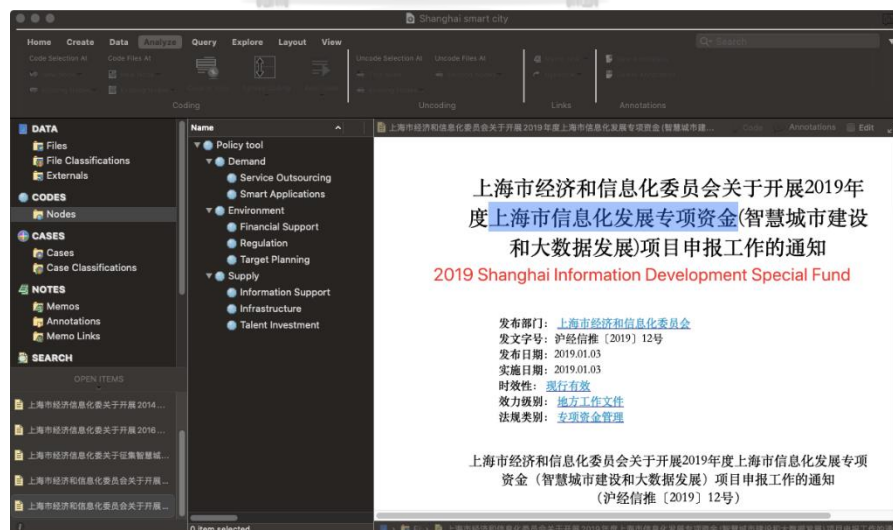


Figure 14, An example of NVIVO coding policy

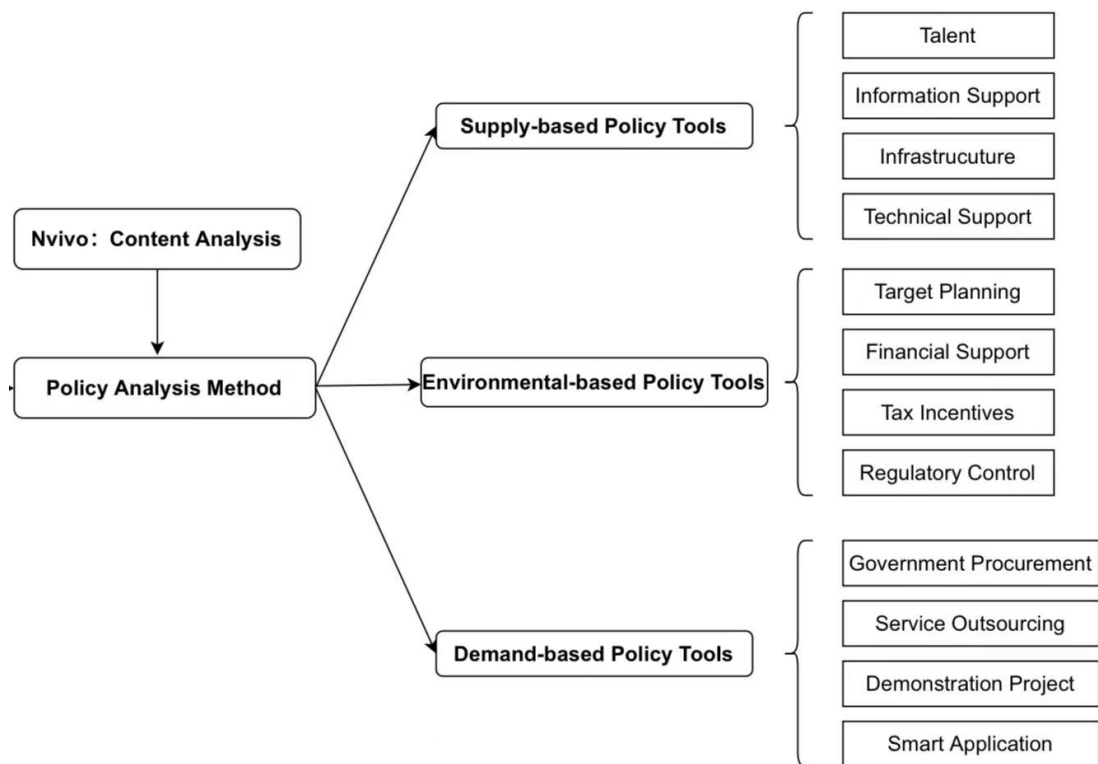


In the research of policy analysis tools, most of them focus on the evaluation of smart city policy effects and the coding statistics of policy tools, and the theory of policy tools has been widely used. Most scholars use the content analysis method to document statistical analysis of smart city policy texts. At the national policy level, scholars have found that China's smart city policy highlights the main role of the government through the coding and statistics of policy texts and policies while considering the use of regulatory policies and incentive policies (Huang & Yuan, 2014). The five dimensions of policy analysis are policy quantity, text form, policy issuing department, policy theme, and policy tool. Smart city policy has problems such as excessive use of mandatory policy tools, low legalization, insufficient market mechanisms, and insufficient participation of social forces, and puts forward suggestions for improvement in response to the above problems.

Lin et al. (2017) divide policy tools into three types: supply-based policy tools play a driving role in the construction of smart cities; demand-based policy tools play a pulling role; and environmental-based policy tools play an indirect role (Lin et al. 2017).

The analysis process in this research used quantitative analysis of textual content as the main research method and was coded by Nvivo software. The specific coding dimensions were adopted as the research dimensions of policy instruments, which were supply-based, environmental-based, and demand-based (Huang & Yuan, 2014; Sun et al., 2016). Further, the different policy tool dimensions were refined and

categorized through the coding process, which can be referred to as the classification method in Table 2. Thus, the 51 policy texts were coded in full text to understand the main contents of the first-tier city smart city policies.



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Figure 15, Policy analysis method

Source: Adopted from Xu, 2021

In terms of Figure 15, this research uses the content analysis method to encode the policy text. First, the Nvivo software is used to screen the core word frequency of the policy text, and the words and associated words with a word frequency of less than 5% are directly eliminated, and then the core words of the text are determined. Afterward, the text is defined, and the tools are divided according to the taxonomy of policy tools. Then, use the Nvivo software to code the policy tool type and specific tool based on the tree node and sub-nodes of the policy text.

In order to fully reflect the development process and status quo of smart city policies in first-tier cities, the policy texts selected for the case are mainly collected from the websites of relevant ministries and commissions of Beijing, Shanghai, Guangzhou, and Shenzhen, including various opinions, notices, suggestions, approvals, plans, and other documents in different periods. After sorting and screening, 51 valid texts were finally selected (Peking University, n.d.). Compare the status quo of smart cities in China's first-tier cities and the characteristics of policy formulation to understand the differences and contradictions between policy makers and smart city implementers.

## CHAPTER 4: DATA

### 4.1 Scope of the Study

China's first-tier cities have concentrated talents and developed technologies. Talent and technology are the main forces for the diffusion of urban innovation. To stand out in the battle for talent, all provinces and cities in China have successively introduced attractive talent policies, trying to gather talents through favorable treatment and conditions (Shan, 2021). According to data from the Centaline Real Estate Research Center (2020), more than 150 towns throughout the country have published talent plans since 2019, an increase of more than 40% over the same period in 2018. The talent battle is attracting a growing number of cities. Refer to Figure 16. Therefore, the selection of Beijing, Shanghai, Guangzhou, and Shenzhen as the research objects is also representative.

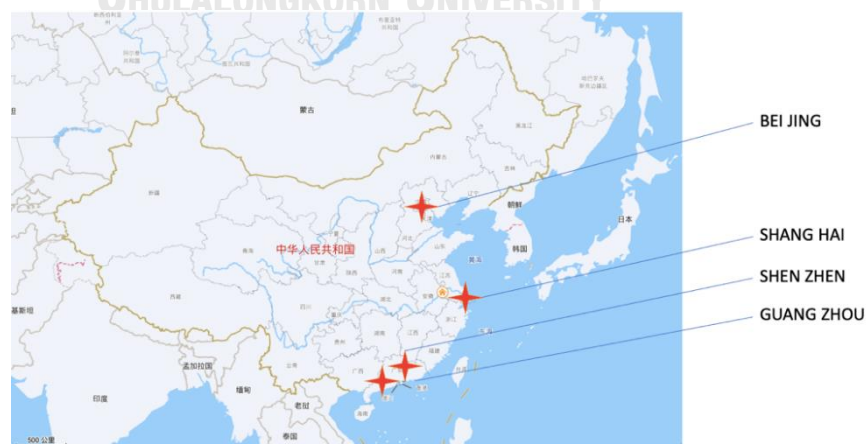


Figure 16, First-tire cities in China

Source: Baidu Map

From the perspective of city selection, this research takes the smart city policies of China's first-tier cities: Beijing, Shanghai, Guangzhou, and Shenzhen as the research objects. Because the development results of smart city projects in first-tier cities are successful, the development models are rich, and they have great reference value.

#### 4.2 Data collection

Databases are used more and more widely because they can provide people with the information they need quickly, accurately, and everywhere. The domestic databases that are widely used in China include Wanfang Data Resource System, CNKI Database. Among them, Wanfang Data Resource System (hereinafter referred to as Wanfang Data) and CNKI have more abundant information resources. Based on their massive data resources, these two databases have become the best among many databases because they provide users with value-added information services such as information analysis and academic misconduct detection while providing traditional information services (Kong, 2010).

#### 4.2.1 Web of Science & Scopus database

The Web of Science is the world's largest and most complete source of academic information. It includes the most important core academic journals in research fields like natural sciences, engineering technology, and biomedicine.

SCOPUS is not a journal or a journal. Like SCI, it is a search tool. It contains abstracts, references, and indexes of the world's most extensive scientific and medical literature. The main fields included are: medicine; agricultural and biological sciences; physics; engineering; sociology; economics; business and management; and other disciplines. It is the largest abstract and citation database in the world. Both Web of Science and Scopus are platforms that have become well-known and important ways to find documents around the world.

Kong (2010) found that these two databases have their own strengths in the process of proposing them. Wanfang Data's collection of dissertations, conference papers, scientific and technological achievements, and patent documents is better than CNKI. The collection of academic journals and Chinese and foreign standards in CNKI is better than that of Wanfang Data; books, reference books, yearbooks, and newspapers are its unique literary resources.

#### 4.2.2 CNKI & Wanfang database

China National Knowledge Infrastructure (CNKI, China National Knowledge Infrastructure) project CNKI is a national informatization key project to realize the dissemination, share and value-added utilization of knowledge and information resources in the whole society. Thus, regarding table 3, China CNKI (www.cnki.net) is a digital publishing full scope platform and knowledge service platform for CNKI's various knowledge information content.

Table 3, CNKI database scope

Database	Scope	Web Link
<ul style="list-style-type: none"> <li>● CNKI, ChinaNational Knowledge Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>● Full Database</li> </ul>	<a href="https://www.cnki.net/">https://www.cnki.net/</a>
<ul style="list-style-type: none"> <li>● China Academic Journals Online Publishing Database</li> </ul>	<ul style="list-style-type: none"> <li>● Full Database</li> </ul>	<a href="https://kns.cnki.net/kns/brief/result.aspx?dbprefix=CJFQ">https://kns.cnki.net/kns/brief/result.aspx?dbprefix=CJFQ</a>
<ul style="list-style-type: none"> <li>● China Ph.D. Thesis Full-Text Database</li> </ul>	<ul style="list-style-type: none"> <li>● Full Database</li> </ul>	<a href="https://kns.cnki.net/KNS/brief/result.aspx?dbprefix=CDFD">https://kns.cnki.net/KNS/brief/result.aspx?dbprefix=CDFD</a>

Baidu Academic is an academic resource search platform under Baidu that provides massive Chinese and English literature retrieval, covering various academic journals and conference papers, aiming to provide domestic and foreign scholars with the best scientific research experience. Baidu Scholar can retrieve paid and free academic papers and improve the accuracy of retrieval through time filtering, titles, keywords, abstracts, authors, publications, document types, citations and other refined indicators.

On the Baidu search page, appropriate results provided by Baidu Academic Search will be presented for the academic content searched by the user. Users can choose to view the detailed information of academic papers, or they can choose to jump to the Baidu academic search page to view more related papers, allowing users to choose freely. In Baidu Scholar, users can also choose to sort the search results according to the three dimensions of relevance, cited frequency, and published time to meet different needs.





The screenshot shows a Baidu Academic search result for the paper "中国智慧城市发展关键问题的实证研究". The page includes the title, author information (张楠, 陈雪燕, 宋刚), a detailed abstract, keywords (智慧城市, 信息技术, 关键问题, 验证性因子分析), DOI (10.3969/j.issn.1006-3862.2015.06.005), citation count (24), and year (2015). Below the text are buttons for收藏 (收藏), 引用 (引用), 批量引用 (批量引用), 报错 (报错), and 分享 (分享). At the bottom, there is a table with columns for 文库来源 (文库来源), 其他来源 (其他来源), 免费下载 (免费下载), and 求助全文 (求助全文). The table lists various sources like 知网, 万方, 钛学术, 维普网, 掌桥科研, and 查看更多.

Figure 17, Example of Baidu academic  
Source: Baidu academic, 2022

In terms of Figure 17, it shows the unified discovery of massive academic documents by integrating hundreds of millions of global high-quality resources. It integrates more than ten resource types such as journals, degrees, conferences, scientific reports, patents, videos, etc., covering multilingual documents, and is committed to helping users accurately discover, acquire, and precipitate academic essence.

Wanfang is a new platform launched based on the Chinese Periodical Service Platform 7 and the Chinese Science and Technology Periodical Database, which has completed the upgrade from Journal Literature Library to Journal Big Data.

Table 4, Research database in China

Database	Scope	Web Link
<ul style="list-style-type: none"> <li>Baidu Academy</li> </ul>	<ul style="list-style-type: none"> <li>Full Database</li> </ul>	<a href="http://xueshu.baidu.com/">http://xueshu.baidu.com/</a>
<ul style="list-style-type: none"> <li>Wanfang Database</li> </ul>	<ul style="list-style-type: none"> <li>Full Database</li> </ul>	<a href="http://www.wanfangdata.com.cn/index.html">http://www.wanfangdata.com.cn/index.html</a>

#### 4.3 Policy scope

In total, the research selects policies from the central government and first-tier cities in China, including Beijing, Shanghai, Guangzhou, and Shenzhen, as the scope of this research. The total number of policies collected is 51. through the Peking University Law website (<https://www.pkulaw.com>). Searching for the notional-level and city-level laws and regulations on smart cities with the year filtered from 2010 to 2021. The website is a database of Chinese laws and regulations built by Peking University,

which is extremely rich in content and has been upgraded to a certain market share and is well received by domestic and foreign customers.

Figure 18 shows that the characteristics of China's first-tier cities have concentrated talents and developed technologies. Talent and technology are the main forces for the diffusion of urban innovation. To stand out in the battle for talent, all provinces and cities in China have successively introduced attractive talent policies, trying to gather talents through favorable treatment and conditions (Shan, 2021). According to data from the Centaline Real Estate Research Center (2020), more than 150 towns throughout the country have published talent plans since 2019, an increase of more than 40% over the same period in 2018. The talent competition is attracting a growing number of cities. So, to learn more about how smart cities are being built in China, four cities or areas with typical importance have been chosen as research cases. These are Shenzhen, Shanghai, Beijing, Guangzhou, and Shenzhen.

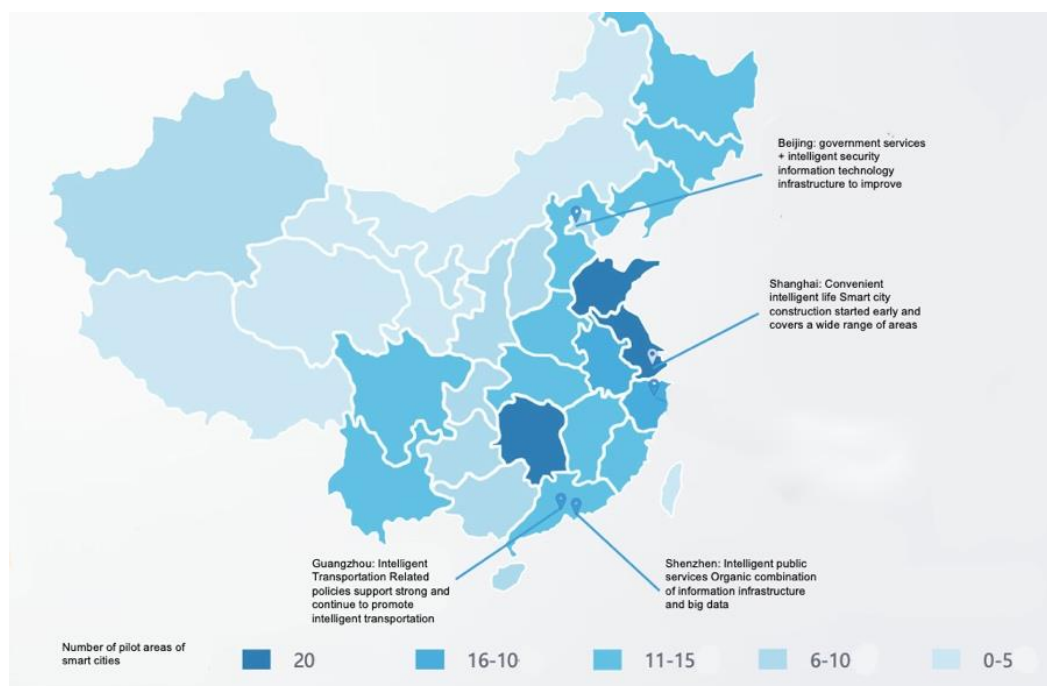


Figure 18, Distribution of smart city pilot areas in China

Source: China Smart City Development Research Report, 2021

Table 5, Literature query terms

Set	Chinese Query Terms	English Terms	Query
First Set	智慧城市	Smart Cities	
	数字城市	Digital City	
	智能城市	Smart City	
Second Set	政策	Policy	
	通知	Notification	

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	声明	Statement
	法律法规	Laws and Regulations
Third Set	经济	Economy
	环境	Environment
	安全	Security
	生活	Life
	教育	Education
	政务	Government
Fourth Set	北京	Beijing
	上海	Shanghai
	广州	Guangzhou
	深圳	Shenzhen

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The China National Knowledge Infrastructure (CNKI) database and Wanfang database were searched as the main Chinese databases. At the same time, this paper uses Web of Science and Scopus as the main global databases as important platforms for literature retrieval. The search period is limited to January 1, 2010, to December 31, 2022.

## Policy collection

To comprehensively and deeply understand the development context of my country's smart city policies, this research has carried out a maximum retrieval of smart city policies at the national level through a variety of policy retrieval methods: First, search for relevant policies on the portal websites of the State Council and its various departments. Second, use the Peking University Magic Weapon policy database to conduct a full-text search through the search terms "smart city," Beijing, Shanghai, Guangzhou, and Shenzhen; finally, review the policy by browsing relevant literature and news reports. In the end, on the magic weapon website of Peking University, search with each city as a keyword, download the full text, and a total of 51 articles.

## CHAPTER 5: RESULT

A total of 84 studies were included in this study after systematically reviewing the research method to search the literature and excluding the literature through PRISMA. Figure 19 illustrates the analysis process. First, the content of the literature is classified by NVIVO software. After classifying the six dimensions of the smart city as nodes, the content of the literature dimension is reclassified into: 1. The state of smart city development; 2. Using word frequency analysis to understand the state of smart city development that scholars are concerned about; and co-word analysis to understand the connections that exist in smart city development. Finally, by reading the full text, we understand the development of the six dimensions of smart cities in the first-tier city clusters. From the point of view of policy tools, policy analysis means using the NVIVO code to understand the features and problems of smart city policy tools.

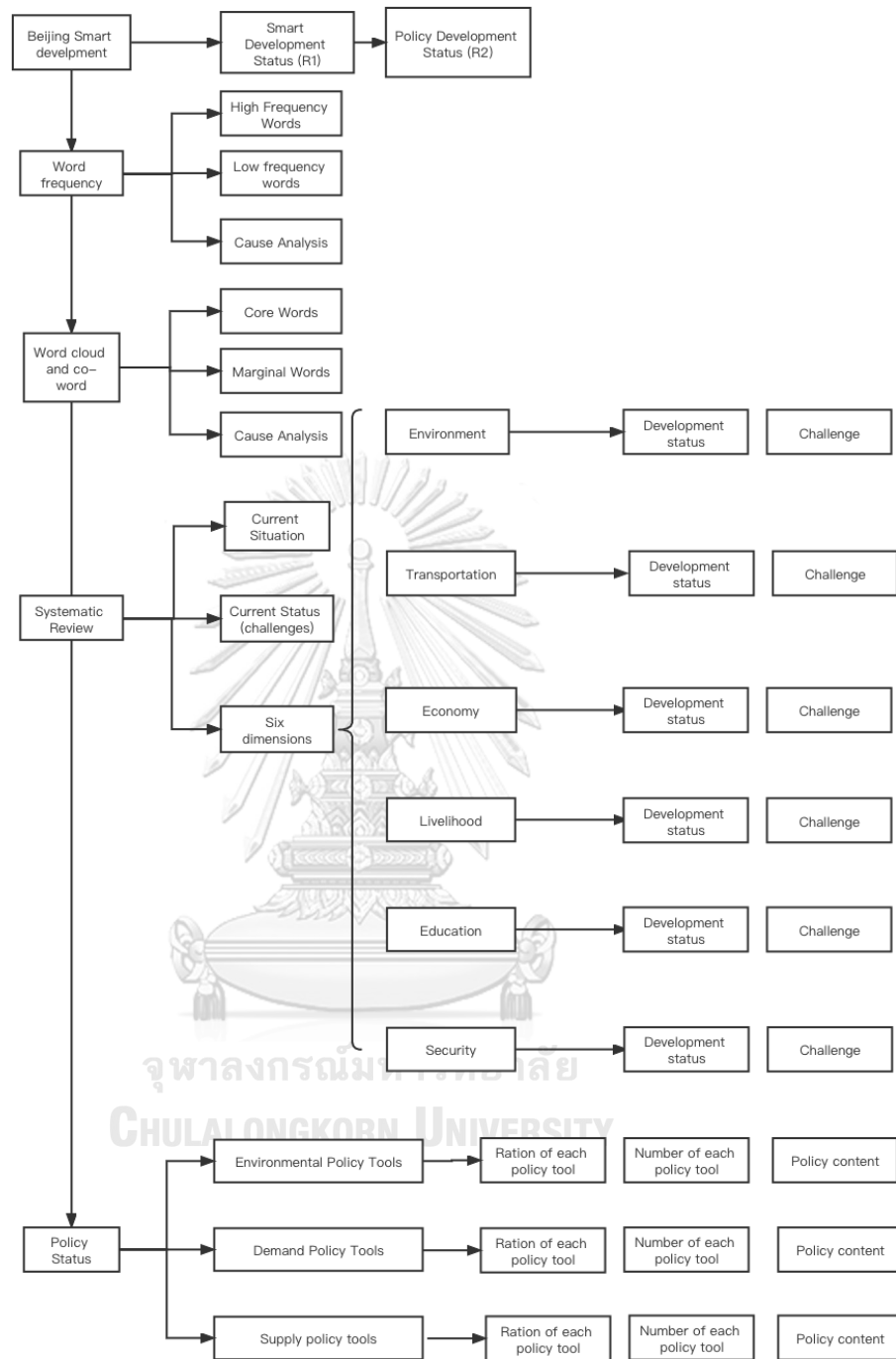


Figure 19, Result analysis process in Beijing



Chinese governments at all levels are also actively engaged in the practice of smart city construction and promote its implementation at the policy level. By the end of 2020, 100% of cities above the sub-provincial level, 95% of prefecture-level cities, and 20% of county-level cities will have launched the construction of smart cities (Shanghai Municipal Commission of Economy and Information, 2020).

### 5.1 Smart city development status

As of November 2018, 14,249 smart city projects have been awarded to smart cities across the country, while a total of 12,162 smart community projects have been awarded. This includes municipalities directly under the central government, sub-provincial cities, prefecture-level cities, county-level cities, etc. The development of smart cities in first-tier cities plays a leading role for cities in central and western China. More and more are joining the ranks of those building new smart cities (EO Intelligence, 2020).

### 5.1.1 Beijing

Table 6 compares the summary statistics for word frequency of selected papers of Beijing. A total of 27 papers were included in the Beijing smart city development literature search. Through the word frequency analysis of NVIVO, the words and word frequencies ranked 1-10 in the included literature were obtained. Table 6 shows that the high-frequency words are infrastructure, community, consumption norms, environmental governance and so on. From this, it can be concluded that the development of smart cities in Beijing around the 6 dimensions of smart cities, but Beijing pays more attention to digital and informatization.

*Table 6, Word frequency of selected journals in Beijing*

	Word	Frequency
1	Infrastructure	190
2	Community	177
3	Information Resources	152
4	Data	124
5	Technology	119
6	Environmental Monitoring	68
7	Policy	66
8	Consumption norms	65
9	Government	62
10	Environmental Governance	51

According to the co-words map of smart city development in Beijing, smart, data, information, and community are the main high-frequency words, and the derived words in this field include library, environment, medical care, enterprises, transportation, financing, and environment. Scholars have researched the six dimensions of smart cities in the 27 included literature.

However, through the figure 20 co-world map, we can see that there are many smart city fields in the edge vocabulary that appear frequently, such as: pollutants, soil, investment, consumers, sensors, and artificial intelligence. According to Norm, this category is a vocabulary that appears in the literature review of smart city development in Beijing but is less frequent. From this, it can be concluded that the development of a smart city in Beijing has revolved around the six dimensions outlined in the international definition of a smart city. Pollutant treatment and soil protection don't get enough attention in the environmental field, and scholars don't pay enough attention to how sensor equipment and artificial intelligence can be used to build smart cities in Beijing.

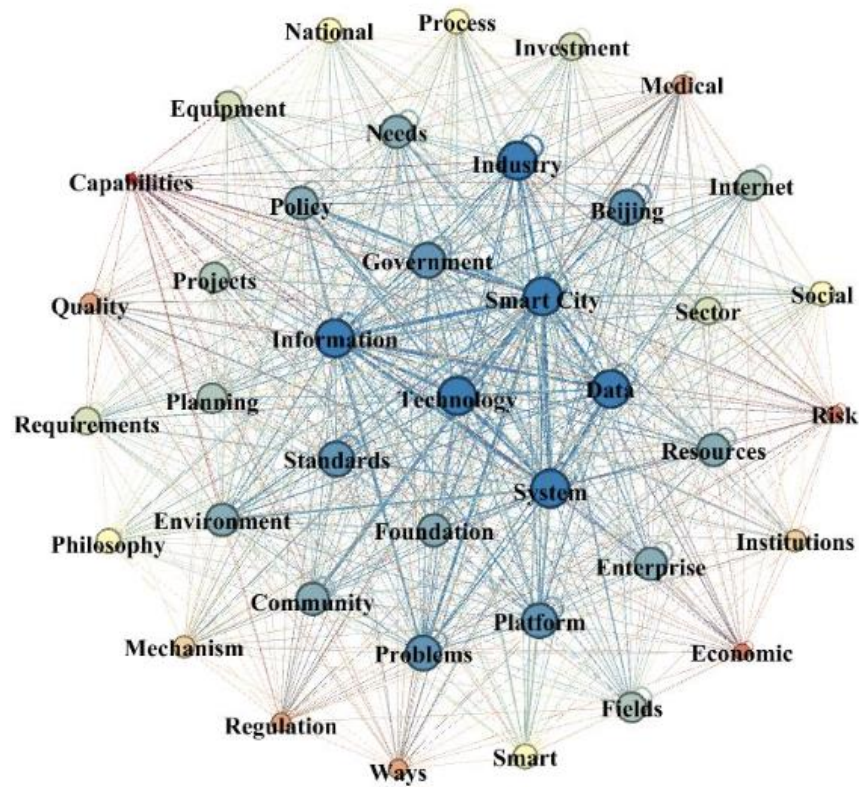


Figure 20, Beijing smart city literature common word network map

Figure 20 provides some of the main relationships between different themes.

After the co-word analysis of the total literature, the co-word pairs or noun phrases in the literature collection are used to count the frequency of the subject words of a group of kinds of literature appearing in the same literature to determine the discipline represented by the literature collection. relationship between the themes. A co-word network consisting of these word pair associations is formed. This study draws the following conclusions:

The most frequent words in the co-word network are in the blue part of the figure below, including technology, government affairs, smart city, system, information, data, and the technical dimension of smart city development. It is most closely related to the other dimensions. Conversely, words such as finance, investment, law, and society are marginal words with fewer co-words. Therefore, the integration of other fields into the financial and commercial fields is lacking to a certain extent. At the same time, laws and regulations are marginal words with a small number of co-words, which can reflect that there are few descriptions of laws and regulations in the literature, and scholars are to a certain degree. There is a lack of attention to the importance of laws and regulations in the development of smart cities. Policies and the development of technology affect the current state of each of the six specific aspects of smart cities in different ways, and they all have their own traits.

As the capital of China, Beijing has a developed economy and sufficient financial subsidies. The management policies for supporting smart transportation are relatively complete, including the management policies for connected vehicles, financial subsidy policies, and the establishment of data sharing platforms for various data departments. However, there are also the problems of duplication, disorder, and inefficiency in data construction. Second, there is a lack of clear deployment of macro policies related to smart city construction, and the construction plan is relatively vague. Third, most of the policies at the local level are meant to get the central policies across, and there aren't many policies that deal with the real problems of the area.

The status quo of smart finance development in Beijing and those with relatively complete policies already have clear action plans, laws and regulations. In the cooperation between the government and enterprises, some fintech laboratories have been established. State-owned banks and private technology companies carry out technology cooperation and development.

At present, the products existing in the smart financial industry have just started, and the related products, services, and applications are not mature enough, the degree of intelligence is limited, and the advantages of intelligent information technology have not yet fully manifested. Research on the development and application of cutting-edge technologies such as artificial intelligence, block chain, cloud computing, and big data in the P2P industry of smart products.

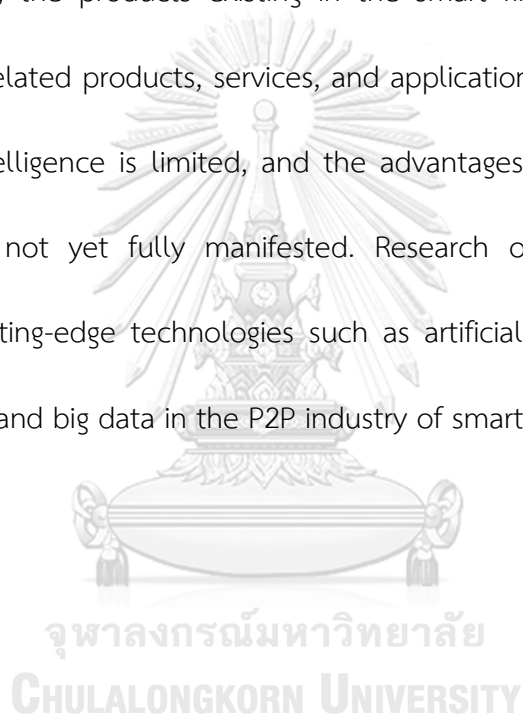


Table 7, The selected journal based on the smart city aspect in Beijing

No.	Author	Title	T	EC	S	ED	L	EN
1	Intelligent Buildings editor (2021)	AI Empowerment Makes Buildings More Vital--Interview with Cheng Xugen, Vice President of Smart City Business Group of KDDI and Executive President of Xunfei Zhiyuan	√*					√
2	Ma & Yi (2020)	Study on the construction of informationization of rail transit operation and management in smart cities	√*		√			
3	Ren (2021)	Intelligent Management of Automated Traffic Flow in Smart Cities Based on Big Data Analysis	√*				√	
4	Gao & Zhou (2020)	Digitization to create a high-level smart city		√*				√

5	Zhang (2021)	New smart city construction ushered in the wind	√*	√	
6	Gao & Zhou (2020)	Empirical Analysis of Smart City Development Level in Beijing-Tianjin-Hebei Integration	√*		√
7	China Construction Information Technology editor (2019)	New wave of smart cities	√*		
8	Tao (2018)	Forerunner of smart city construction	√*		
9	Peng (2020)	Urban integrated security service platform Security standards in the era of smart cities		√*	



		Smart Property Presses the Fast Forward Button - Summary of Exciting Views		
10	Chen (2021)	from the 2020 Finance- Technology Enabled Smart Property and Smart City Summit	√*	√
11	Lu (2019)	Experimenting with the identification of non- traditional security threats in smart city construction	√*	
12	Wang (2018)	Cooperation to build a new sample of smart city Study on the Quantification of	√*	
13	Zhu (2019)	Smart City Policies and Network Structure	√*	√
14	Yang (2018)	A comparative study on the construction path of mega smart cities in China	√*	√

15	J. Zhang et al. (2021)	Practical Exploration of the Implementation of "Three-Whole Education" in Engineering Faculties: The Case of Smart City College of Beijing Union University		√*	√
16	Shi (2018)	Top e-Government and Smart City Solution Providers 2018		√	√*
17	Du et al. (2020)	Evaluation of the Development Status of China's Smart Cities Based on Multi-source Data	√		√*
18	D. Lu (2019)	The Ninth Annual China Internet of Things Industry and Smart City Development Conference was held in Beijing		√	√*
19	Teng (2018)	Smart City Conference 2018 Smart City is the key to cure "urban disease"	√		√*

20	H. Wang (2019)	A Study of Smart City Policy Diffusion in China	√	√*
21	Zhai (2019)	Development and application of media mirroring tools for smart cities	√	√*
22	Li (2017)	Research on the innovation of urban management mode under the background of smart city construction	√	√*
23	Rong et al. (2021)	Research on the planning of smart city perception system based on geocoding - taking Beijing's smart city planning and construction as an example	√	√*
24	M. Li (2021)	Urban environmental brain helps build an ecological smart city	√	√*

		Exploring the Function and Participation Mechanism of University Resources in Smart City Construction--Based on Beijing International Green Smart City Construction		
25	Qiao & You (2020)		√	√*
26	Lin et al. (2019)	Smart city practice supported by IoT and visualization technology	√	√*
27	C. Zhang (2019)	Big Data Platform 2018 Smart City Solution	√	√*

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Note: T: Transoportation  
 EC: Economy  
 S: Security  
 ED: Educatiin  
 L: Livelihood  
 EN: Environment  
 √\*: Main filed  
 √: Sub filed

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Table 7 presents an overview of research papers of Smart city in Beijing. As shown in Table 7, a total of 27 literatures were included in this study. The table shows that most of the literature covers multiple research areas and covers six dimensions of smart city research.

### **Smart transportation**

Based on the current situation of smart transportation development in Beijing, a total of 8 papers were included in this study. It found that in recent years, smart transportation has made more progress in the areas of traffic flow control, transportation services, and intelligent management. Safety and efficiency have also gotten better (Ma & Yi, 2020).

Ren (2021) revealed that during the Eleventh Five-Year Plan, 1.08 million new motor vehicles were added to Beijing in five years, and the growth rate of motor vehicle ownership was about 11.4% per year. The investment in municipal transportation infrastructure accounted for 5.6% of the total GDP, or about 105.2 billion RMB. Beijing has initially built an intelligent traffic management system with two major systems and eight projects as its core, which has largely improved the traffic demand management capability. Beijing has added more than 2 million cars in the past five years. In the same time period, the city invested 4.0% of its GDP, or about 211.8 billion RMB, in its transportation infrastructure. This money was used to build a new transportation

system for Beijing that focuses on people, technology, and the environment (Ren, 2021).

The sudden increase in motor vehicles has increased the demand for traffic management policies. During this period, Beijing has achieved remarkable results in traffic information technology, with the successful establishment of intelligent traffic command and control systems in hardware systems and the development of more than 30 local traffic standards in policy systems. In particular, the traffic information standards in the municipal traffic card have been pushed hard.

The 1+1+N policy system for managing intelligent network-linked vehicles was adopted, and Beijing released the Overall Implementation Plan of Beijing Intelligent Network-Linked Vehicle Policy Early Zone and Management Measures for Intelligent Network-Linked Vehicles in the Beijing Intelligent Network-Linked Vehicle Policy Early Zone and the Beijing Intelligent Network-Linked Vehicle Policy Early Zone N basic support management policies, such as Implementation Rules.

Regarding the establishment of the traffic data platform, the Beijing Municipal Transportation Commission and the Traffic Management Bureau have each built their own cloud platforms, built their business application systems and data resource centers, and at the same time, shared data information with various state departments, and some public information services require traveler data. data platform construction mode. The overall structure construction mode adopts the mode of graded construction, hierarchical management, and data storage at different levels, as follows:

the traffic commission and the traffic management bureau are each constructed by their systems, and their respective units will send the result data to the above-mentioned relevant units. The following are the benefits of establishing an information platform in this manner: 1. The division of labor is relatively clear, that is, to ensure the investment in the original information system and at the same time to mobilize the enthusiasm of each business unit for construction; 2. But in the long run, such as Beijing, Xi'an, etc., after improving its own business, it is more practical to develop external services according to needs, and after exchanging data on demand, the operation effect is more reasonable than the investment; 3. In the follow-up maintenance, the maintenance work is independently responsible by each business unit, with less pressure, the quality is higher, and the response to data quality management and data upload requirements such as dynamic data (such as GPS) is more effective. But there are still a lot of problems and risks with the way data is set up (Ma and Yi, 2020).

In terms of the risks and limitations of smart transportation, Ren (2021) pointed out that Beijing's information construction is restricted by the sharing of information resources. Due to the lack of support from the spatial information resources system, the development of information technology construction in various departments in the city is unbalanced. Although the spatial information resources on the Internet are constantly increasing, for reasons of industry management and data security, these resources are independent, shielded from each other, segmented, and lack a basic

sharing mechanism, which means they cannot realize the sharing of information resources across fields, departments, and applications. It is impossible to integrate all of the city's resources. The high cost of building the city's basic geographic database leaves the city's spatial information resources seriously lacking. The degree of standardization of spatial information is low, and the heterogeneity and limitations of GIS products in service interfaces make it difficult to meet the needs of interoperability based on network spatial information. At the same time, there are problems with the way policies are made about technology and patents.

Since the construction of smart cities in my country is still in its infancy, there are still some problems in policy issuance, and relevant regulations and measures need to be further improved. First, China currently has a relatively small number of policies on smart city construction. At the end of 2012, the central level issued a strategic plan for smart cities, but the release of supporting policies at the local level is lagging. Second, there isn't a clear deployment of the overall construction target framework for smart cities in the macro policies for building them, and the planning for building them isn't very clear (Intelligent Buildings editor, 2021).

At the same time, most of the policies at the district level focus on conveying and forwarding central policies, which lack specific policies that address actual issues in the region. The content of the policies is relatively macro, and the content related to the actual operation of smart city construction is relatively small. Finally, the degree of mining and application of existing information technology or patents in the policy is



not high, the content of cooperation and communication with information enterprises and universities is low, and the training of innovative talent is weak. Technology and patent applications are hard to fill out, there are no green fast lanes, and patented technologies are not safe.

### **Smart economy**

A smart economy industry policy has been formulated. In 2017, China's State Council called for the development of "smart finance," which would require the creation of smart financial products and services and the creation of new ways to finance things.

Smart financial products are developing rapidly. Since 2016, major banks in Beijing have successively launched smart wealth management products. The Industrial and Commercial Bank of China, Agricultural Bank of China, China Construction Bank, and some joint-stock banks have also launched smart banks and smart outlets, and actively used technologies such as big data and artificial intelligence. Explore smart applications such as smart approval, smart customer service, and smart risk control. China Ping An and other insurance companies are also working hard to come up with smart applications for insurance, such as precision marketing, smart pricing, smart loss determination, and smart quick claims (Gao & Zhou, 2020).

The financial and IT industries are deeply integrated. China's large banking institutions have successively established resource integration with domestic IT

companies. Among them, the Agricultural Bank of China and Baidu Technology Co., Ltd. jointly established a financial technology joint laboratory, trying to build customer portraits, precision marketing, customer credit evaluation, risk monitoring, and robot advisory. The intelligent banking system is used in six ways, including intelligent customer service (Z. Zhang, 2021).

The Bank of China (BOC) and Tencent jointly proposed building cloud finance, smart finance, and technology finance. Hua Xia Bank and Tencent Technology Company announced a partnership in areas such as public cloud platform, big data intelligent precision marketing, financial anti-fraud laboratory, artificial intelligence cloud customer service laboratory, and so on. Beijing's smart finance industry is growing quickly, and the public-private partnership (PPP) system makes the best use of technology (Gao & Zhou, 2020).

Smart financial technology strengthens financial supervision means, will strengthen the application practice of regulatory technology, and actively uses big data, artificial intelligence, cloud computing, and other technologies to enrich financial supervision means and improve the ability to identify, prevent, and resolve cross-industry and cross-market financial risks (Tao, 2018).

In the research summary of smart stores, OMO (Online-Merge-Offline) has become the new normal for retail development. In recent years, the total e-commerce transaction volume in China has grown slowly, and the competition for online transactions is fierce. Based on this phenomenon, many e-commerce companies have

begun to move their products offline. So, before the idea of "new retail" was proposed, e-commerce companies like Alibaba and JD.com already had offline stores, built their own stores, or worked with other brands (China Construction Information Technology editor, 2019).

### **Smart security**

The two papers are included in Smart Safety, concerning the construction of laws and regulations for smart fire protection systems, and the research clarifies the power and responsibility boundaries of the government, society, and enterprises. At the same time, insurance companies are brought in as third-party regulators to check the safety of smart fire protection systems on a regular basis (C. Chen, 2021). This helps businesses be more self-disciplined.

The concept of data sharing is proposed in terms of technical architecture and business management, and the participation of the whole population is advocated. The smart fire protection system will use sensors to monitor companies and communities in real time and share the collected data in real time at the network level; classify, analyze, and store data through the processing layer; and use terminal applications to provide data according to user needs. decision support In terms of business management structure, smart fire protection is divided into prevention and control, two main requirements. Specifically, it is led by the government with the participation of the whole population (Peng, 2020).

The risk of smart fire protection construction is mainly due to the imperfect construction of systems and laws and regulations in the management and application of smart fire protection, which leads to a series of problems. These include inadequate performance of social management functions and lack of overall planning; no unified planning for construction pace in various regions; inconsistent direction and low efficiency of technological innovation; lack of performance of supervision functions and imperfect regulations and systems; lack of communication mechanisms between departments: smart fire protection construction It involves the joint construction of multiple departments such as fire protection, safety supervision, public security, transportation, water supply, radio, and television; the construction of smart fire protection lacks corresponding norms; the performance of economic adjustment functions is inefficient, and the government investment model is single and lagging; Inadequate performance of service functions, a weak construction foundation, and a weak talent foundation (Lu, 2019).

There are areas of omission in smart safety, including takeaway and food safety supervision. From 2010 to 2015, the online food ordering industry has grown rapidly from a budding service platform to one covering over 100 million people. During this period, a variety of takeaway platforms have sprung up. In order to quickly seize the market and cultivate user stickiness, third-party platforms have adopted high subsidies and vigorously publicized and accepted merchants to register online with low or even zero thresholds to expand their scale. This means that there aren't enough laws and

rules in the online food ordering industry, and it's not clear who is responsible for what, how things should be done, and how rights can be protected (Wang, 2018).

In terms of information security, each subsystem of a smart city is interconnected, and information is shared with the outside world through Internet terminals. So, the Internet will make the holes in the system even bigger, and there will be a risk that data security and privacy will be compromised (Yang, 2018; H. Zhu, 2019a).

False information interference and hidden dangers of information leakage Since the security of shared information isn't guaranteed, there will be false and wrong information, which will hurt the user experience and the quality of information flow in smart cities. This will also make smart cities less influential and important (Shi, 2018).

### **Smart education**

The characteristic of smart campus is to provide a more convenient, friendly and service-oriented campus environment through the Internet and sensors. Since 2006, Tsinghua University, Peking University, Beijing Institute of Technology and other colleges and universities have jointly built an RFID smart library system. Students from various colleges and universities can automatically apply for reading books from colleges and universities in Beijing through the system and will be transported to the corresponding student colleges through unified management of the system. from the library. The Smart Library Level Measurement Report pointed out that the current level

of construction of smart libraries is still low, and its testing standards and management models are still blank (J. Zhang et al., 2021).

Regarding the lack of industry supporting services in the development of smart education. Among them, there is a lack of relevant management talents in the field of smart libraries. Unlike traditional library administrators, who need to be trained to classify and organize books, smart librarians rely more on systems and AI algorithms, combined with manual management. Therefore, it is necessary to further explore how smart librarians should formulate corresponding human resource development and occupational time norms. In addition, the awareness of the brand building and publicity strategy of the smart library is weak. At present, the smart library system in Beijing is only open to some college students, lacking the concept of social participation and social management. Many people have only heard of the concept of smart library, but still use the functions of traditional libraries. Finally, the library cannot directly produce high-value reports, and the participation of private technology companies is low. Therefore, the government should take the lead and actively mobilize the participation of society and enterprises (Shi, 2018).

### **Smart livelihood**

Wu (2021) found that the construction of smart people's livelihoods in Beijing has already taken shape at this stage. In 2016, the Haidian District of Beijing quit the one-stop service window, and one window can solve all problems. The one-stop

service window can handle 625 business attacks (Du et al., 2020). It is made up of 29 departments, such as the reform committee, the district cultural committee, the health department, and the commerce department.

The All-in-one card function is enhanced. Beijing has realized the sharing of medical information resources with different provinces and regions. Most of China's first- and second-tier cities now use the electronic medical record system. Zhejiang, Jiangsu, Shanghai, and other places have realized the sharing of electronic medical records. The shared electronic information archives can help patients. Cross-province medical treatment at any time can give patients continuous care, improve the efficiency of medical staff, and make it easier for medical staff to talk to each other and learn (D. Lu, 2019).

Regarding smart medical care, since 2010, the national financial department has allocated funds to strengthen the informationization of the medical system and promote the construction of three-level information platforms at the national, provincial and district levels. Beijing Smart Medical System and IBM have jointly built a medical information resource integration system, which covers five major information systems: medical service, public health service, drug supply, medical security, and administrative management, and jointly realizes the rational allocation of medical resources. facilitate the public's medical experience (H. Wang, 2019).

The research on the construction of smart communities found that Beijing has built a multi-level intelligent and efficient smart community convenience service

system, and community residents can directly meet the various service needs of residents through a combination of online and offline. The construction of Beijing's 15-minute service circle covers 60% of the city's communities. The community establishes a portal website, which can directly realize the appointment, preliminary review, and acceptance of business processing, and residents no longer need to go to the business processing location for business processing. Regarding the development status of the old-age and disabled security systems, the trend of population aging in China is accelerating, and the problem of population aging is becoming increasingly prominent. The number of elderly care institutions in Beijing is seriously insufficient, so home-based elderly care and community elderly care have become one of the mainstream elderly care methods. The smart elderly care community provides community health services, including physical examinations and emergency treatment for the elderly; the warm home service construction provides daycare and entertainment services for the elderly and the disabled, including cinemas, canteens, and business services. facilitating business for the elderly and the disabled (Teng, 2018).

The establishment of a smart community medical service system, community hospitals, and other types of public and private hospitals will resume the resident health service system. The Beijing Health Cloud and Community Health Cabin were designed with a system that allows people to easily check on their health in the community, receive health tips and advice from professional medical staff, and manage health services in a comprehensive manner (H. Wang, 2019).



Improve the volunteer service system. At present, the smart community has cooperated with major universities and public welfare organizations in Beijing. Establish and organize volunteer service platforms, including free clinics, health lectures, community services, and cultural performances. Combine the best parts of different industries to help improve the smart community pension system and make services more all-encompassing (Zhai, 2019).

About the risks of smart medical care. The problem of information security in the medical system has always been the biggest hidden danger. Due to the expansion of the shared service area for health data, the increase in the channels for accessing data, and the increase in the amount of information, information security problems will arise. Combining the patient's personal information and physical condition, it is possible to organize telecommunication fraud and so on. The construction of a smart medical system requires a lot of human and financial support, and medical information requires a lot of database construction, upgrade, and maintenance work, and the cost is relatively high. Often, a hospital's data in a week will reach dozens of terabytes of data, and there is currently no clear definition of who pays for data storage and maintenance. Finally, the evaluation system for smart medical care has not yet been perfected. The establishment of the current smart medical system provides information sharing and multi-channel service sources. But the public doesn't have a way to give feedback on smart medical care, so it can't evaluate smart medical care in different places (Li, 2017).

The urban-rural digital divide hinders the development of smart education. China's urban and rural medical resources are uneven, and the development of rural medical care is obviously lagging that of the cities. Even though the resume of the smart medical system can improve information sharing, the system mainly serves hospitals and people in urban areas, and there are problems of lack of resources and insufficient information construction for some people in rural and suburban areas.

### **Smart environment**

The current situation of smart environment construction in Beijing mainly focuses on strengthening the governance of the urban environment through intelligent hardware systems. These include real-time environmental monitoring, pollutant detection, etc. The introduction of the smart environment system can upgrade the previous single urban environmental detection for a few concentrated pollutants such as inhalable particulate matter, nitrogen oxides, and sulfur dioxide to a comprehensive detection of air, water, and solid pollutants as well as noise and light pollution. effectively achieve city-wide coverage, major public areas, and surrounding businesses and universities.

Beijing's automated monitoring and management capabilities have improved. In 2005, the State Council proposed a series of policies to strengthen environmental protection. Subsequently, Beijing established a comprehensive environmental

monitoring system, including the whole process of detecting pollution sources to moving pollution sources, and ensured accurate data and methods. science.

There is still a gap between the development of high-tech and the world, and the detection equipment technology can already detect noise, industrial pollution sources, and environmental pollution sources, and it has become more refined. But there is still a big difference between the detection technology in Europe and the United States, and the listed indicators of new pollutants can't be found because there isn't a way to find them.

There is a misunderstanding of the core concept of smart environmental protection. At present, the smart environment mainly relies on technological updates to improve environmental detection, resulting in a large number of financial subsidies being applied to upgrade hardware and improve applications. This kind of excessive first-time and construction has led to a waste of money and resources for environmental governance, but the effect that should have been achieved hasn't spread, and the technology hasn't gotten a performance boost to match.

Smart environmental detection facilities are damaged. Since the detection of major pollutants has been implemented 24 hours a day, some companies that violate the regulations destroy environmental monitoring sensors and modify sensor data to avoid responsibility. Such behaviors seriously affect the sustainable application of smart environmental systems. Similarly, the law enforcement and disposal capabilities are weak. At the moment, environmental protection departments are not very good

at enforcing the law. Environmental law enforcement and waste disposal need to be done faster and with more force.

Beijing has the advantage of having sufficient funding for smart city development because it is China's capital and economic and political center. The focus of smart city development is concentrated on the improvement of technology and policies in the field of smart transportation, with the establishment of district and municipal laws and regulations. There is close cooperation with high-tech technology companies in the field of smart finance. The smart people's livelihood is concerned with the improvement of medical and elderly care in the community, and the building of a one-stop service center provides convenient services for the people. Universities within Beijing cooperate in smart library projects, but the popularity and utilization rate are low. A smart environment mainly focuses on the detection of pollutants and the improvement of relevant laws and regulations. However, there is still a gap between relevant environmental monitoring technology and international standards.

#### 5.1.2 Shanghai

In the literature search of Shanghai smart city development, 22 literatures were included in the search. Through the word frequency analysis of NVIVO, the words and word frequencies ranked 1-10 in the included literature were obtained. Among them, Intelligence as a subject word appeared a total of 367 times, followed by data service appear 203 times. Artificial intelligence appears 116 times, information

network 185 times. From this, it can be concluded that the development status of smart cities in Shanghai focuses more on technology and information services.

*Table 8, Word frequency of selected journals in Shanghai*

	Word	Frequency
1	Data Services	203
2	Artificial Intelligence	116
3	Intelligent Network	85
4	Information Technology	85
5	Transportation	71
6	Security	69
7	Emergency Response	69
8	Pensions	66
9	Museums	62
10	E-Government	58



As shown in Figure 21, the co-word analysis of the total literature, according to the co-word table, the correlation of Shanghai smart city can be concluded as follows: The most frequent words in the co-word network of Shanghai smart city literature are in the blue part of the figure below, including data, sensors, information technology, talent team, enterprise, and management resources, respectively, from which it can be concluded that each unit of smart city development is closely integrated. The technological dimension in the development of smart cities is the most closely related to other dimensions, so data, sensing, and information technology are words with high density. Conversely, words such as tourism, finance, logistics, and teachers are marginal words with fewer co-words. Therefore, through the relationship and density of co-words, marginal words with fewer co-words reflect less attention to this field in the literature. At the same time, Shanghai can see that in the development of smart cities in Shanghai, the spatial structure of smart cities and the side in the field of smart education is generally lower.

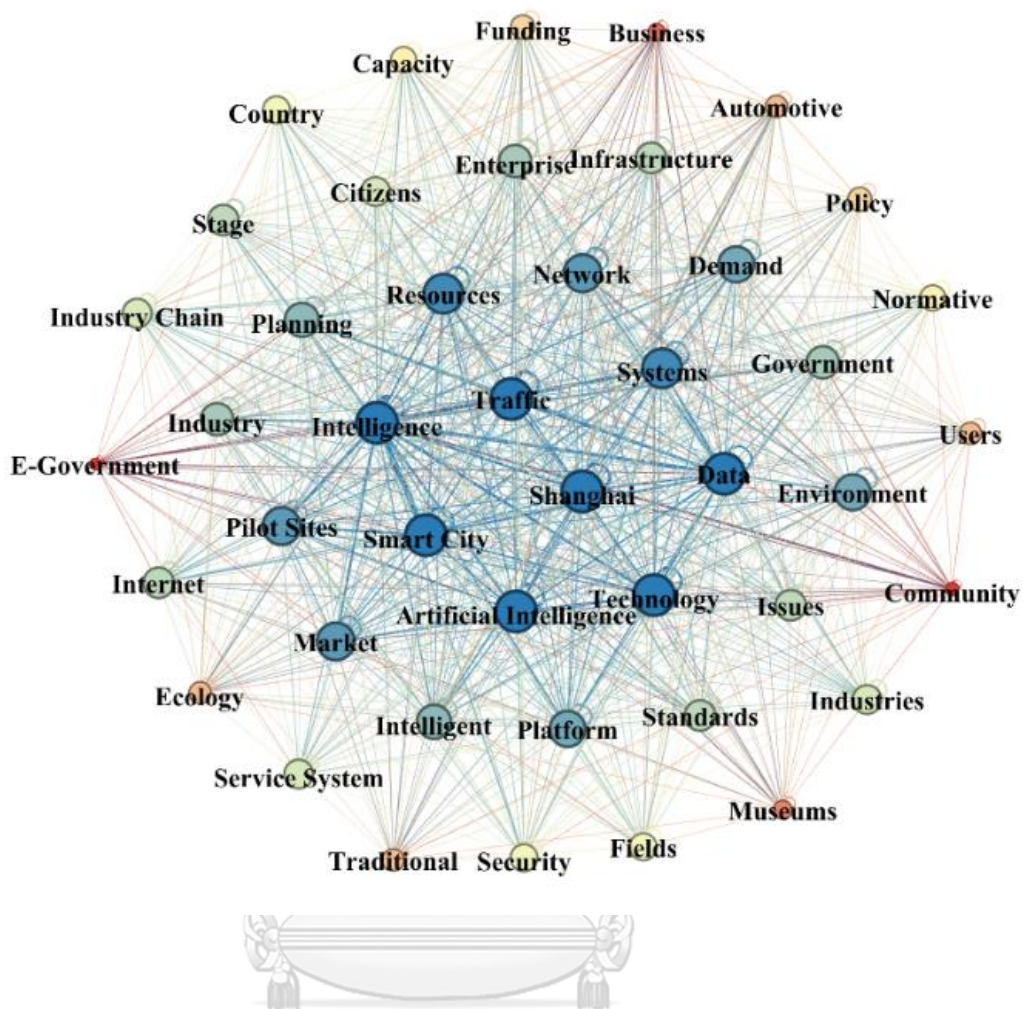


Figure 21, Shanghai smart city literature common word network map

Table 9, The selected journal based on the smart city aspect in Shanghai

No.	Author	Title	T	EC	S	ED	L	EN
		Shanghai Intelligent						
1	Jin (2021)	Transportation Co., Ltd. to help build a smart city	√*	√				
2	Luo (2018)	Smart City and Transportation	√*					√
3	Zhang (2018)	Analysis of the development of intelligent communication in the application of smart cities	√*	√				
4	Zhu (2017)	Intelligent scheduling system for shared vehicles in smart cities	√*					√
		Smart cities in the AI era						
5	Wu (2019)	accelerate evolutionary upgrades	√	√*				
6	Wang (2018)	The Rise of Smart Cities	√	√*				



7	Dong (2019)	Study on the Innovation of Smart City Operation and Management Model	√*	√
8	Wang (2017)	Study on Countermeasures of Smart City Construction	√*	√
9	Yuan (2018)	Create a smart city ecosystem	√*	√
10	Ma (2017)	Smart City - Shanghai as an Internet Giant	√*	√
11	Ni (2017)	Shanghai:Strengthen the security of big data in smart cities	√*	√
12	Liao & Lou (2017)	Projection tracing evaluation model and empirical study of smart cities	√*	√
13	Tang (2021)	Research on Smart City Evaluation System Based on Hierarchy of Needs Theory	√	√*

14	Zhu (2019)	Study on the Quantification of Smart City Policies and Network Structure	√*	√
15	Zhu (2016)	Study on the Equalization of Basic Public Education Services in Shanghai in the Process of Smart City	√*	√
16	Chen & Xu (2019)	Analysis of urban refinement management in the context of smart city - Shanghai as an example		√* √
17	Dai & Ding (2019)	Effectiveness, Problems and Suggestions for Countermeasures of "Smart City" Construction in Shanghai	√	√*
18	Liu (2019)	Play the advantages of mainstream media to help	√	√*

		the construction of smart city		
19	Lu (2019)	Experimenting with the identification of non-traditional security threats in smart city construction	√	√*
20	Binghailangyu(2016)	Experiences and Insights of Smart City Construction: The Practice of Barcelona, Singapore and Shanghai as Examples		√ √*
21	Xie (2019)	Research on the evaluation of public information service quality in smart cities from the perspective of information ecology		√ √*
22	Yang (2018)	A comparative study on the construction path of mega smart cities in China		√ √*

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Note: T: Transportation	EC: Economy	√*: Main filed
S: Security	ED: Education	√: Sub filed
L: Livelihood	EN: Environment	

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The table above illustrates some of the main papers of the smart city different dimension in Shanghai. As shown in Table 9, a total of 22 papers from Shanghai were included in this study. The table shows that most of the literature covers multiple research areas and covers six dimensions of smart city research.

### Smart Transportation

The status quo of Shanghai's smart transportation development shows a steady development trend. By way of illustration, Jin (2021) shows how the data for smart transportation has entered the solutions of smart transportation management, smart intersections, intelligent tunnels, intelligent parking, and intelligent network link solutions have entered the solutions of smart transportation management, smart intersection, smart tunnel, smart parking, and smart network connection have entered the stage of practical application. Shanghai's laws and regulations on smart transportation have continued to improve. Since the promulgation of the "Shanghai Intelligent and Connected Vehicle Industry Innovation Project Implementation Plan" in

2017, Shanghai has perfected, supplemented, and revised the law many times. And they do a lot to get people involved. For example, they publish a "Draft for Comments" to get public feedback and organize experts to help write the plan (Jin, 2021).

Shanghai is the national intelligent networked vehicle pilot demonstration area. Since the project was first proposed in 2015, more than 200 intelligent driving test scenarios have been built there, and more than 150 domestic and foreign automakers have used them to test their cars (Luo, 2018).

An example of this is the study carried out by Zhang (2018), in which the infrastructure requirements of smart cities are high, and Shanghai has more stringent requirements for the construction of communication infrastructure and other facilities, and the infrastructure of urban wireless LAN, urban broadband, and urban cloud database are more complete. Shanghai has constructed a comprehensive ecological layout of the Shanghai intelligent automobile industry chain. Among them, in the first part of the industrial chain, it has the Shanghai Volkswagen production base to produce new energy vehicles. The Shanghai GM production base and the Tesla production base an automobile industry cluster with Jiading District and Pudong District as its core will be formed. Deepen regional cooperation and jointly build a national smart vehicle development strategy. Shanghai strongly backs the Yangtze River Delta's (Y. Zhang, 2018) integrated automobile development strategy.

Regarding the development of smart public transport, Shanghai has developed a unique smart public transport cloud service platform plan. Currently, the cloud

platform is jointly completed by Shanghai Comprehensive Transportation Big Data Sharing Center, Shanghai Smart Travel Service Mobile Application, and Shanghai Traffic Supervision and Decision Service System. The emergence of the smart transportation cloud has realized the unified management of transportation big data resources, and the transportation service has become more refined. Based on an analysis of "big data" like business operation data, road traffic data, and passenger flow distribution, the cloud platform can be used to make a customized plan for travel planning.

Smart travel and other mobile applications make traveling more convenient for users. Shanghai has strengthened the application coverage of the Shanghai Transportation Card to cover the payment and rental services of inter-city transportation such as subways, light rails, taxis, shared bicycles, and buses. At the same time, the city service function of Alipay and the use of the Shanghai Pass Card (ETC) will be further developed. This card has 5 million daily active users on average. In the later period, Shanghai made a special service by combining WeChat city service with Alipay and bank card binding smart travel through core services. The service was changed to offer the same one-stop function of smart travel in multiple ports, which can cover all aspects, including payment, reservation, traffic information query, and information retrieval of nearby office areas, restaurants, and entertainment areas (M. Zhu, 2017).

There are risks in smart transportation in Shanghai, and the core technology of smart car development still relies on the technology of overseas companies, such as

in the fields of processors and intelligent computing platforms. In addition, although the Shanghai smart car industry has shown a trend of regional cooperation, it has essentially led to the problem of resource dispersion and separate development. Shanghai Jiading District, Feng Xian District, and Jinqiao District have gradually developed a competitive trend and have not yet shown the effect of coordinated development. Insufficient industrial support in the development of the smart car industry Compared to the background and Shenzhen's strong development of special funds, Shanghai has not yet put out specific policies to support smart transportation.

### **Smart economy**

The development status of smart finance in Shanghai At present, financial IC cards and mobile payment services have become the focus and hotspots of the application of Internet of Things technology in Shanghai's financial industry. A financial IC card, also known as a chip bank, is a bank card with a chip as a medium. It has a large storage capacity and can store information such as keys, digital certificates, and fingerprints (Y. Wu, 2019).

Wu (2019) mentioned that mobile payment based on the mobile phone mainly replaces the ordinary SIM card on the mobile phone with a multi-functional application smart card function. Using RFID radio frequency identification technology, the user's bank account or credit card number is linked to their mobile phone number, allowing mobile phone users to use mobile terminals to pay for the goods or services they

consume. The Internet of Things technology has developed significantly. In the Internet of Things application, the visual tracking of each link and process can improve work efficiency, optimize resource allocation, and reduce costs. The Internet of Things can help financial institutions combine biometric identification and RFID technology to create a non-disruptive service solution for VIP customers to promote the rapid identification of VIP customers. This enables strong supervision and paperless management (T. Wang, 2017).

Wang (2018) and Dong (2019) discovered the transformation of Shanghai's smart banks to more comprehensive interconnection. Comprehensiveness is reflected in both breadth and depth. From the customer perspective, Shanghai Smart Bank first emphasizes the integration of online and offline and integrates business applications, marketing leads, and unfinished links generated by customers through electronic channels. Smarter customer insights. Customer insight comes from more intelligent analysis of more comprehensive data, thus improving customer service experience and building network customer retention and precision marketing capabilities. (Dong, 2019; M. Wang, 2018) To get customer insight and all-around improvement, smart outlets have to think about their appearance, layout, customer flow, business hours, channel configuration, handling efficiency, marketing methods, privacy protection, system interface, dispute resolution, staff quality, technology applications, etc.

At present, Shanghai Smart Bank is mostly used as a single pilot by the bank, without considering the successful experience to be further promoted in other outlets



and has not further integrated the overall middle and back offices. To improve channel effectiveness and business efficiency, smart outlets need a step-by-step process that goes from planning to piloting to promoting.

### Smart Security

In terms of smart security, we found the information trend of smart security in Shanghai. The Emergency Response Law of the People's Republic of China promulgated in 2007 clearly stipulates that the local people's governments at or above the county level shall establish or determine a unified emergency information system for their respective regions to collect, store, analyze, and transmit relevant emergencies. Information on the incident At the Central City Work Conference that ended on December 21, 2015, the construction and improvement of the urban safety and emergency response systems were discussed, and a good remedy was given for the lag of the urban emergency response system (Yuan, 2018).

The risks existing in smart security are first, although emergency decision-making with intelligence as the core has been paid attention to in the urban emergency management system, how does the intelligence flow in the rapid response management system and how does the urban emergency management department conduct emergency information? Communication and coordination are not yet clear. That is, the overall thinking and macro-grasp of the city's emergency decision-making intelligence system are still insufficient. From a practical point of view, it is hard for the

emergency linkage systems built in most cities to connect with each other, and they are not very good at gathering information, processing information, or responding to emergencies (Y. Liao & Lou, 2017; Ni, 2017).

At the same time, the clustering of the Internet of Things in Shanghai and the distribution of cloud computing have increased data pressure, and the consequences of security incidents such as data damage, loss, and theft in the smart city environment are more serious.

### **Smart Education**

Regarding the development of smart education in Shanghai, the government has attached great importance to education information, accelerated the improvement of laws and regulations, and set up special development funds. In the 2014 Shanghai Action Plan for Promoting Smart City Construction (2014-2016), smart education was listed as a key special fund (Tang, 2021).

Smart museums and AI museums promote the development of smart education in the era of artificial intelligence. The Shanghai Museum has drawn up a Classification Scale for the Applicability of Collection and Exhibition Materials by testing more than 200 kinds of exhibition materials for standardization and quantitative protection (H. Zhu, 2019b).

The cultural and creative industries are developing rapidly. For the innovative development of traditional culture, including the production of souvenirs around

cultural relics, short videos and cartoons, education and business are combined. Combining cultural and creative products with the Internet has made it possible for the younger generation to pass on and build on traditional Chinese cultural resources. This is also one of the manifestations of Chinese cultural confidence. Contemporary young people have greatly welcomed museums' cultural and creative products. The performance on the online e-commerce platform is even worse. According to the 2019 Ali retail platform data, nearly 9 million consumers have purchased related cultural and creative products, an increase of four times the amount compared to a year ago (K. Zhu, 2016).

There are deficiencies in the development of smart education. At present, the construction of smart education focuses on the construction of hardware such as environmental facilities, system platforms, digital resources, and smart campuses at the information level, and the application of new technologies such as artificial intelligence and blockchain is still insufficient. Not enough is known about smart education, and most people only know about building an information-based environment and resources, ignoring the fact that smart education is built in a way that is systemic, complex, and smart.

### Smart livelihood

Shanghai's smart livelihood, the government's digital governance capabilities are strengthened, and Shanghai is strengthening the construction of smart government services. Based on the practical exploration of Internet + government affairs, Shanghai has established the Xuhui District Administrative Service Center and the Urban Grid Comprehensive Management Center. The service center focuses on the process of online service and on-site service, opening the business links between online and offline, front and back, and between departments; supporting the review and reform work; and the construction of a single window so that people can travel less and do things quickly. Excellent service and good experience. The management center has centralized 21 departments, opened 145 service windows, and can handle 352 administrative approvals and service items, forming an ecological chain of service enterprises and providing efficient, convenient, and transparent one-stop services for enterprises and citizens. While e-government realizes more alliances between the government and social organizations such as citizens and enterprises, new technologies also enable the government to provide services on demand. At present, the arrangement of electronic public service oriented by citizens' needs has received more attention (L. Chen & Xu, 2019).

Despite the necessity or pressure of the existence of smart people, the country with the largest elderly population in the world is also one of the fastest growing countries. As early as the end of 2008, China's population aged 65 and above had

reached 110 million, accounting for 8.25% of the total population. This figure exceeded the population aging standard set by the United Nations International Population Association. Shanghai is a country with a deep aging population in China. A few years ago, one of the big cities became an aging society. As the trend has continued to grow, the problem of aging has become a social focus in Shanghai in recent years. In Jing'an District and Hongkou District, as of the end of 2015, the proportion of the elderly population aged 60 and above reached 33.8% and 33.6%, and the elderly population aged 65 and above accounted for 22.4% and 21.4%, respectively (Dai & Ding, 2019). So, there is a lot of pressure on the Shanghai community pension, and there is a lot of demand for smart medical care and smart communities.

The traditional pension model of separation of medical care and nursing cannot meet the elderly's health monitoring needs. The aging problem makes the separation of medical care and nursing care no longer meet social development needs. The particularity of the physical condition of the elderly and the long-term management of various chronic diseases require the medical industry and the elderly. The care industry breaks down barriers between industries and shares resources so that different industries can work together (J. Liu, 2019a).

There are spatial and behavioral distances between citizens and the government. Moreover, there is also a distance between technical facilities or platforms and citizens. Information technology does not realize the function of supporting, anytime, anywhere, individual needs. The abstract, citizen-centered e-

government and service design are insufficient. It also needs to face the specific citizens and move toward optimizing governance and services centered on the citizens' daily needs.

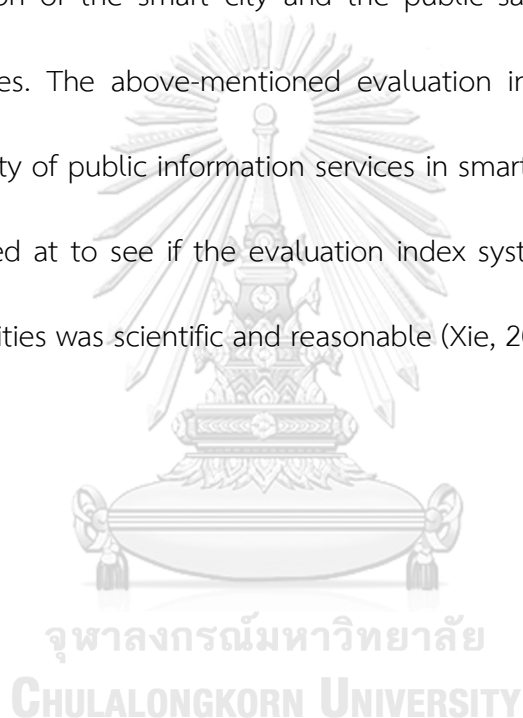
### **Smart Environment**

Regarding the status quo of smart environment development in Shanghai, Lu (2019) mentioned that the majority of research focuses on the principles of setting up a monitoring and alarm system for integrated pipe corridors. More specifically, they mainly focus on using green spaces supported by big data research. The frequency and number of visits to Shanghai Green Park are calculated by locating the APP and checking the number of visits. While improving the monitoring and alarm system of the intelligent integrated corridor (Z. Lu, 2019b), it was found that the most people visit parks in Putuo District, Huangpu District, and Yangpu District.

For the population expansion and traffic congestion that occur in the rapid growth of global cities, in Hongkou District and Jing'an District, the two most densely populated districts in Shanghai, the number of hospitals, schools, and population density have a low share (Bing, 2016; Yang, 2018b).

Research on this is the study carried out by Xie (2019) in which the public information service platform is analyzed from an ecological perspective. Smart city construction and the widespread use of new information technologies have changed the way traditional public services work in cities. More and more city departments are

starting to build public information services that are supported by new-generation information technologies. The quality of these services shows how well and how many public services the relevant city departments can provide in the new environment. The service quality reflects the ability and level of public services provided by the public sector in the new environment of the smart city and has an important impact on the construction of the smart city and the public satisfaction of public sector information services. The above-mentioned evaluation index system was used to evaluate the quality of public information services in smart cities, and the evaluation results were looked at to see if the evaluation index system for public information services in smart cities was scientific and reasonable (Xie, 2019).



### 5.1.3 Guangzhou

In the literature search for Guangzhou smart city development, 19 articles were included in the search. Through the word frequency analysis of NVIVO As shown in Table 10, the words and word frequencies ranked 1–10 in the included literature were obtained. Among them, information was 158 times and information was 156 times. From this, it's easy to see that scholars' research on Guangzhou's "smart city" has the most frequent and widest range of words about government leadership and technology.



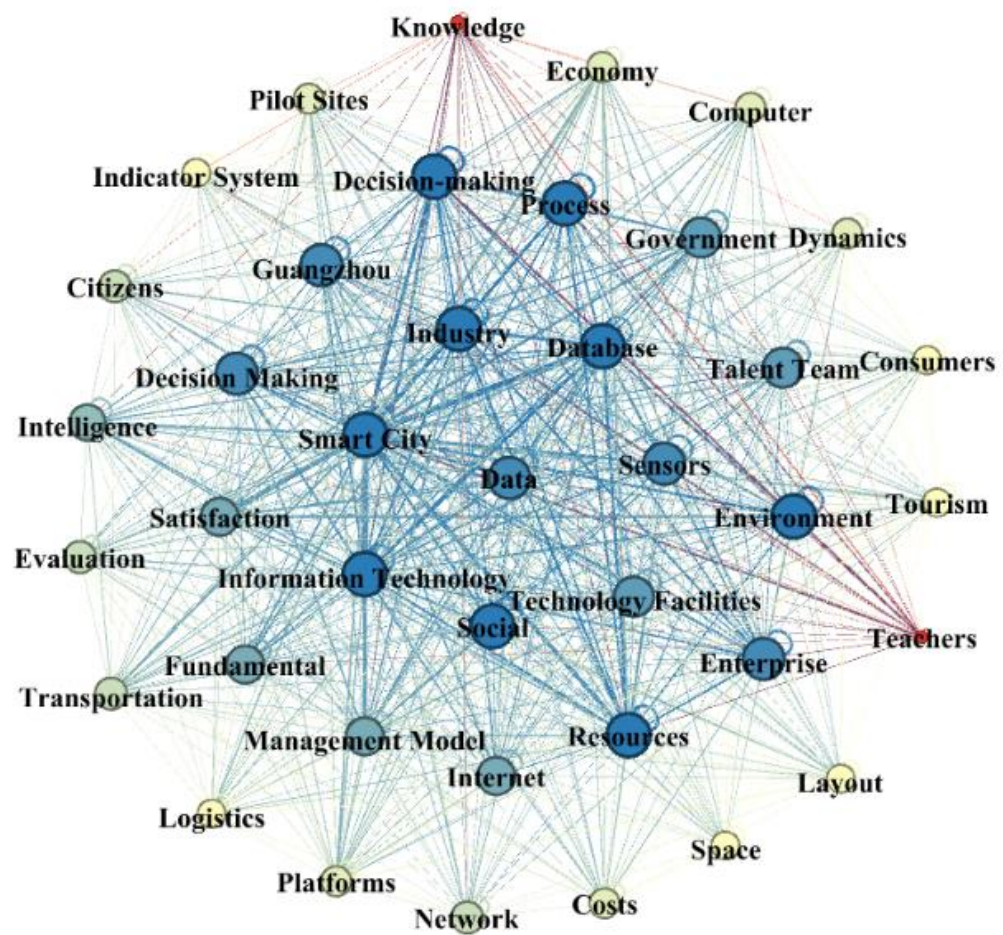
*Table 10, Word frequency of selected journals in Guangzhou*

	Word	Frequency
1	Informatization	158
2	Leadership Organization	156
3	Financial Incentives	111
4	Smart Security	78
5	Public Services	73
6	Logistics Services	67
7	Emergency	66
8	Water Environment	63
9	Policy & Regulation	62
10	E-Government	61



On the contrary, concerns such as ecological environment and environment are ranked 11th and 14th, respectively, appearing 63 times and 52 times. In the top 20-word frequencies, it can be found that Guangzhou mainly focuses on the technological development of smart cities but lacks attention to areas such as government affairs, education and transportation.

As can be seen from the figure (below), the co-word analysis of the total literature, according to the co-word table, the correlation of Guangzhou smart city can be concluded as follows: According to the Guangzhou co-word map, the blue part contains words such as smart city, technology, information, information equipment, and database as core co-word words. In the field of smart cities, Guangzhou's technology sector is most closely linked to other industries. On the contrary, the co-word correlation between consumers, citizens, transportation, and knowledge is low. It can be concluded that the development status of Guangzhou's smart city lacks exploration in the field of people's livelihood. There is a lack of attention to the needs of consumers and citizens in constructing smart cities.



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Chulalongkorn University

Figure 22, Guangzhou smart city literature common word network map

Table 11, The selected journal based on the smart city aspect in Guangzhou

No.	Author	Title	T	EC	S	ED	L	EN
1	Zhang et al. (2020)	Comparative study on the level of development of smart cities	√*			√		
2	Mo et al. (2018)	A study on the spatial characteristics of bike-sharing trips in a smart city - A case study of Tianhe Central District, Guangzhou	√*					√
3	Li (2017)	Smart City Transportation Development Technology" in Guangdong and Hong Kong, Smart biking as gendered	√*					√
4	Christensen H.R. (2020)	innovations and smart city experiment?: The case of Mobike in China	√*					√
5	Du (2020)	Evaluation of the Development Status of China's Smart Cities		√*		√		

6	Yang (2018)	A comparative study on the construction path of mega smart cities in China	√*	√
7	Li & Zheng (2020)	Analyzing and evaluating of the urban transit excess commuting: a case study of Guangzhou City	√	√*
8	Dai et al. (2020)	Policy Framework and Mechanism of Life Cycle Management of Industrial Land (LCMIL) in China	√*	√
9	Wang (2020)	Deepen the reform of the power system to promote the development of smart cities	√*	√
10	Zhang & Sheng (2018)	Guangzhou Smart City Development Status Study	√*	√
11	An et al. (2021)	Inclusive Design in the Context of Smart Community	√	√*

		Guangdong Mobile's industry			
12	Wu & Gu (2016)	application solutions in smart cities	√	√*	
13	Zhu (2019)	Study on the Quantification of Smart City Policies and Network Structure	√		√*
14	Zhang (2017)	Study on the Role of Government in the Construction of Smart City in Guangzhou		√	√*
15	Bao & Zhang (2021)	Research on the influence of talent housing policy on urban human capital level from the perspective of smart City		√	√*
16	Bai et al. (2022)	Policy Framework and Mechanism of Life Cycle Management of Industrial Land (LCMIL) in China			√* √
17	Lou (2017)	Smart City Evaluation Model and Empirical Study		√	√*

18	Yang et al. (2016)	Design and demonstration of smart water-supply system in Guangzhou City of China	√	√*
19	Liu (2020)	Study on the Measurement Method and Application of Smart City Construction Process in China	√	√*

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Note: T: Transportation  
 EC: Economy  
 ED: Education  
 EN: Environment  
 S: Security  
 L: Livelihood

√\*: Main filed  
 √: Sub filed

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The table above illustrates some of the main papers of the smart city different dimension in Guangzhou. In total, 19 literatures were included in this study. The table shows that the literature mostly covers the six dimensions of smart city research.

### Smart Transportation

The development of smart transportation in Guangzhou has legal and policy support. Specially put out by the State Council, the Thirteenth Five-Year Plan for the

Development of a Modern Comprehensive Transportation System made it clear that the future development of the transportation sector should focus on promoting intelligent reform of the transportation industry (S. Zhang et al., 2020).

Guangzhou has successively issued opinions on gradually piloting and piloting the demonstration operation policy of intelligent networked vehicles (autonomous driving) applications in different mixed driving environments and carrying out demonstration operations of intelligent networked vehicles (autonomous driving) applications in different mixed driving environments (Wei et al., 2018).

Recent cases reported by Christensen H.R. (2020) also support the development of smart transportation status in the case of Chinese motorcycles, as a smart city experiment to examine smart bikes. 2016. The Chinese motorcycle company launched their first bikes on the streets of Shanghai and Beijing, and since then, smart bikes have spread like wildfire, especially in Guangzhou, China (Christensen, H.R., 2020).

However, there are still challenges in smart transportation technology. Currently, the detection of road anomalies in Guangzhou is mainly carried out by the method of manual survey. The sensor systems that detect road conditions and driving behavior are only installed on high-end models, and the three major map navigation software of Sogou, AutoNavi, and Baidu do not yet have the function of detecting abnormal road conditions, which means they cannot meet the needs of the public for road detection (P. Li, 2017).

## Smart Economy

In the era of the smart economy, the development of the Internet of Things is mature. The development of smart agriculture in China is mainly based on the construction of an e-commerce ecosystem in rural areas, and this e-commerce ecosystem is based on the integration of online and offline models and just fits the market needs of consumers. Taking advantage of the Internet to build a complete agricultural product management system, implement differentiated marketing, and conduct adequate publicity through online and offline channels are the conveniences brought by the era of the smart economy (Yang, 2018c).

Regarding the construction of the smart tax evaluation system in the taxation field, since the Internet + strategy has been elevated to the national strategy, the State Administration of Taxation has timely launched the Internet + Taxation Action Plan. gradually realize the full coverage of the online taxation business, thereby improving the efficiency of the taxation business and innovating the management model, meeting the taxation needs of taxpayers at different levels, and improving the tax compliance of the whole society (Yang, 2018c).

The transformation of Guangzhou's physical retail industry with the improvement of intelligent technology applications such as artificial intelligence, big data, cloud computing, the Internet of Things, and blockchain in the retail industry, various applications of intelligent terminals have begun to integrate into consumption.



In the lives of users, it has promoted the disappearance of the barriers between online and offline (Li J. & Zheng P., 2020).

But the smart economy is also hurt by a lack of talent, especially in new fields and old fields where innovation is still important. To develop professional management talents for characteristic agricultural products, managers need to understand the traditional management methods, marketing modes, and logistics modes and closely integrate new marketing modes and logistics modes (Dai B. et al., 2020).

### **Smart Security**

Due to the increasing fire load year by year, Guangzhou's fire safety is facing enormous pressure. Guangzhou's smart fire protection system has established a sound and scientific system. In December 2011, the State Council emphasized in the Opinions on Strengthening and Improving Fire Protection Work that it is necessary to adhere to scientific and technological support, use advanced technology and equipment to improve the level of informatization of fire protection work, and vigorously enhance fire prevention and firefighting and rescue capabilities. Since then, the Guangdong Provincial Government issued the Guangdong Digital Government Reform and Construction Plan, and since then began the digital government reform. On this basis, the Guangzhou Fire Department built a smart fire protection application that uses firefighting technology, informatization, dramatization, and intelligence to cover all

fields and links of social fire management and firefighting emergency rescue (N. Zhang & Sheng, 2018).

The Nansha District of Guangzhou City plans to build a smart city operation command center and a cross-departmental collaboration platform supported by information-based business collaboration so that the region's normal urban management and emergency management can be seamlessly connected. However, due to the different fire protection standards, coordinated emergency response is limited. China has not yet formed a unified smart fire protection construction standard, management regulations, and operating platform. In the process of cross-regional, cross-industry, and cross-departmental data and information exchange, data barriers and data islands vary (C. Wang, 2020). As a result, some valuable monitoring data and early warning information cannot be fully utilized, which seriously restricts social fire safety management's collaborative emergency response capability. Smart firefighting also lacks senior professional and technical talents and compound talents, which makes it harder to build a smart firefighting system (An et al., 2021).

### **Smart Education**

Guangzhou Smart Education has introduced artificial intelligence technology. Artificial intelligence technology intervenes in the education and teaching process. Personalized teaching has led to the structure of teaching activities. The initiative Students' initiative processes are further stimulated, and teachers step back from the

curtain. Behind the scenes, its role has also changed from focusing on teaching to focusing on learning.

Teachers are transformed from collectors of student data to individualized instructors for students. In the traditional teaching method, teachers' understanding of students is mainly through direct interaction with students and collecting information through personal experience. The information obtained in this way is deficient in reliability, validity, and comprehensiveness, which leads to problems such as poor understanding of students by teachers, lack of an effective basis for personalized guidance, and difficulty in accurate educational decision-making.

Teachers in various colleges and universities cooperate with each other. An example of this is the study carried out by Wu & Gu (2016), in which the development of long-distance communication technology has made the connection between teachers closer and the cooperation between teachers across time and regions has become possible. In addition, human-machine symbiosis has become the norm now for promoting teachers to maximize their advantages and promote the transformation of Guangzhou's smart education to focus on teamwork through focusing on labor. However, there are still deficiencies in the content of smart education. Due to the reliance on digital devices for teaching, students have more opportunities to access the Internet and are more likely to be tempted by external information to invest in games and social interaction, thereby reducing the quality of learning. Smart education

(S. Wu & Gu, 2016) is now focused on how to make courses interesting and come up with a scientific way to track and evaluate them.

### **Smart livelihood**

The construction of smart people's livelihoods in Guangzhou mainly focuses on smart tourism and a convenient network service platform. The modern development status of smart tourism in Guangzhou From the point of view of how the tourism industry works, it is very large and connected. Smart tourism is the result of a high level of integration between scientific and technological information and tourism. This has led to a huge step forward in the development of tourism (H. Zhu, 2019c).

Guangzhou, a livable city, integrates technologies such as the Internet, Internet of Things, and cloud computing. In order to build a smart city, many senior talents are needed as the foundation. So, Guangzhou City has talent policies to attract and keep talented people, and one of them is the talent housing policy. It is an effective way for local governments to solve talent's living and working problems, as well as an important way for many cities to improve their workforce structure (BaoLin & Zhang, 2021).

The Guangzhou Smart Tourism Scenic Spot the Guangzhou Chimelong Tourist Resort cooperated with the mobile company in 2013 to build a mobile base station to achieve full wireless network coverage. In the scenic spot, mobile devices can be supported to connect to WiFi to surf the Internet, enabling free Internet access in the

scenic spot. Service information, the comprehensive coverage of tourist attractions and related information on the Internet, can allow tourists to search for information about scenic spots anytime, anywhere. It is not only to provide tourists with convenience, but also to meet their needs in terms of eating, living, traveling, shopping, and entertainment (J. Zhang, 2017). A total of 4,000 monitors on redundant roads have been deployed in the smart park, and staff are on duty to observe video surveillance 24 hours a day. If emergencies happen, they can be found and dealt with quickly to keep the scenic area safe.

### **Smart Environment**

Guangzhou Smart Environment focuses on the control system and the water supply system. Since 2010, the central and local governments have continuously introduced relevant policies to guide and encourage the construction of smart cities, from top-level design to specific applications. The Notice on Launching National Smart City Pilot Work was made public on December 5, 2012 (Lou, 2017).

The construction of smart cities has significantly reduced urban environmental pollution, which can reduce urban environmental pollution by 9% to 24% on average. Although the role of smart cities in reducing environmental pollution has weakened since the impact of environmental protection policies in 2013, the pollution reduction effect is still very significant (Y. Liu, 2020a). The construction of smart cities uses modern information technology to promote the innovation of urban development

models, generates technological effects, configuration effects, and structural effects through innovation, and then reduces urban environmental pollution through the above three effects (Yang J. et al., 2016).

Medium-scale smart cities have aggravated environmental pollution, while large-scale smart cities have obvious pollution reduction effects. The strengthening of government intervention has weakened the pollution-reduction effect of smart city construction.



#### 5.1.4 Shenzhen

A total of 17 papers were included in the research on Shenzhen's smart city. Table 12 provides the word frequency in selected papers of Shenzhen smart city development. In Shenzhen's smart city development literature, information resources, talent team, and environmental protection in the top 10 are high-frequency words, appearing 97 times, 64 times, and 52 times, respectively. It also appears in Shenzhen's word frequency table as a high-frequency word, but Shenzhen's smart city development focuses more on the development of information and resource integration.

*Table 12, Word frequency of selected journals in Shenzhen*

	Word	Frequency
1	Information Resources	97
2	Resource Integration	72
3	Talent Team	64
4	Ecological Environment	63
5	Scenic Area	56
6	Environments protection	52
7	Intelligent technology	43
8	Government Leadership	43
9	Economy	39
10	Low and regulations	36

According to co-word figure 23, it can be clearly seen that the central blue area concentrates related words such as resources, information, data, and systems. Although the frequency of some words in the word frequency table is low, they belong to co-words with high correlation. The green part of the second circle can be seen, including infrastructure, public policy, and service platforms. The smart city construction services involved in this field belong to the second level. Finally, the related words with only a few co-words in the smart city co-word map of Shenzhen are parks, ecology, government affairs, and economy.

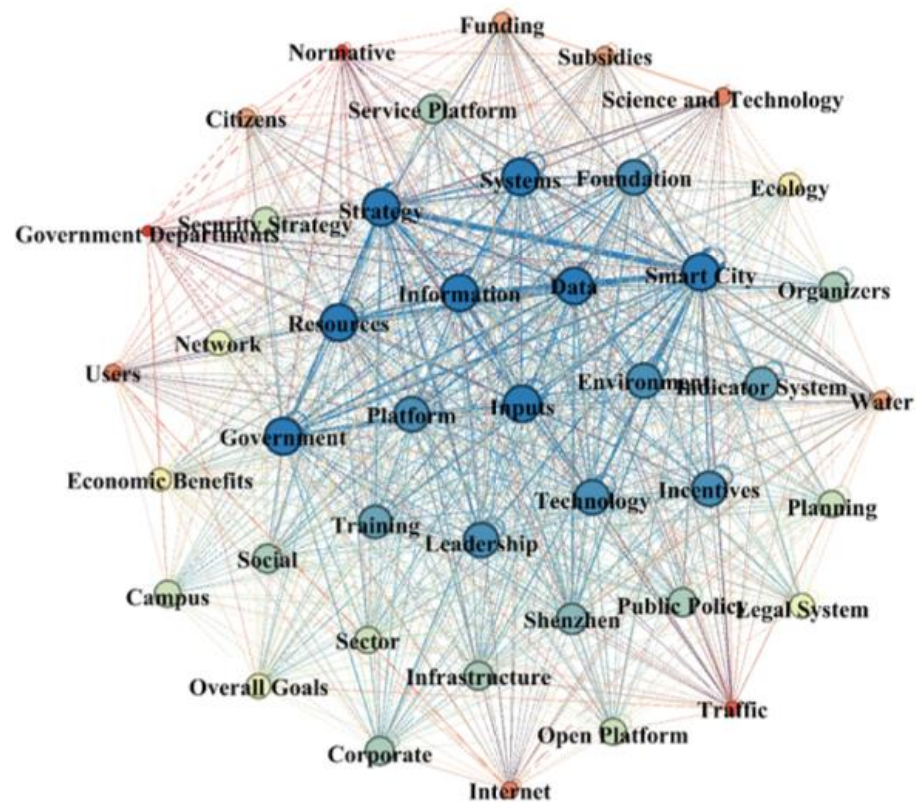


Figure 23, Shenzhen smart city literature common word network map



Table 13, The selected journal based on the smart city aspect in Shenzhen

No.	Author	Title	T	EC	S	ED	L	EN
1	Zhao (2021)	Study on the Current Situation of Smart City Development in Shenzhen	√*					√
2	Liu et al. (2016)	Intelligent transportation should play a pioneering role in smart cities	√*			√		
3	Zhang (2020)	Research on the construction path of new intelligent cities	√*			√		
4	Zhang (2018)	Analysis of the development of intelligent communication in the application of smart cities		√*				√
5	Fang (2017)	Shenzhen Smart City Development Study		√*				√
6	Liu (2020)	The construction of smart cities in the Greater Bay Area, to promote the development of AI security innovation in the early pilot area				√*		√

7	Ding (2019)	Digital Security,Artificial Intelligence- Shenzhen Smart City Development		√*	√
		Study on the measurement method			
8	Liu (2020)	and application of smart city construction process in China	√	√*	
9	Zhang (2019)	Shenzhen Education Cloud Construction Integrated into Smart City		√*	√
		Research on the design of campus			
10	Zhang (2020)	smart bus based on the background of smart city	√	√*	
		Construction of New Smart City Powered by Informatization —Effects and Thinking of COVID-19 Epidemic on Urban Development			
11	Wang (2020)	Play the advantages of mainstream	√		√*
12	Liu (2019)	media to help the construction of smart city	√		√*

13	Rao (2017)	Big data to help Shenzhen smart city construction	√	√*
14	Zhang & Guan (2020)	Research on the construction of public services under the vision of smart city	√	√*
15	Chen (2018)	Smart City Total Ecology Solution Helps Pearl River Delta Development	√	√*
16	Guo (2021)	Research on the construction of Shenzhen smart city based on citizens' perception	√	√*
17	Liao (2018)	Shenzhen New Intelligent City Construction Study	√	√*

Note: T: Transportation    EN: Environment  
 EC: Economy    ED: Education    S: Security    L: Livelihood    √\*: Main filed  
 √: Sub filed

The table above illustrates 17 selected main papers of the smart city in different dimension of Shenzhen. A total of 17 papers covered six dimensions of smart cities, but less literature covered smart education and smart economy.

## Smart Transportation

Recent cases reported by Zhao (2021) also support the development status of smart transportation in Shenzhen. It has an obvious special zone style. However, the development of smart transportation in China is relatively late. But at present, in Shenzhen, the traffic information service platform, the Internet of Things technology, the travel service APP, and the intelligent management technology of public transportation have begun to be fully promoted. Shenzhen adopts the model of special zone regulations + government regulations + normative documents, and the special zone regulations mainly clarify the basic principles of ICV management (Zhao, 2021).

The coordinated development of urban transportation, urban social economy, and spatial structure is the goal of Shenzhen's development, but there are blind spots in the integrated planning of land use and transportation system. M. Liu and colleagues, (2016). The corresponding urban construction, planning, and design are inapplicable and cannot truly assist the disabled. Therefore, there is a need for the disabled and the marginalized and disadvantaged groups in cities (M. Zhang, 2020a).

## Smart Economy

Shenzhen's smart logistics industry is developing rapidly, and the new retail model is more intelligent. In 2020, the market size of China's intelligent logistics industry will reach \$585 billion. Big data is improving storefront efficiency and logistics timeliness (Guo, 2021). Following the policy guidance of the central government, the Opinions on Promoting the Coordinated Development of E-commerce and Express Logistics issued by the General Office of the State Council in 2018 pointed out that it is necessary to continue to implement the Internet+ Circulation action plan and continuously improve the level of coordinated development of e-commerce and express logistics. At the same time, the retail industry has seen multiple developments, transforming from traditional households, units, communities, and businesses to online platforms in different vertical fields. However, there are still deficiencies in the smart retail industry and logistics industry (Fang, 2017). The current level of logistics information in smart logistics is generally low. According to statistics, it takes five or six times for the goods to reach the driver in the whole process of logistics. Information closure leads to idle waste of resources and low logistics efficiency. Different logistics information platforms have great obstacles to resource sharing; government departments cannot share logistics information; JD.com, SF Express, and other companies use big data, cloud computing, robots, and other intelligent technologies to continuously refresh the speed of logistics; but due to the scale of most logistics

companies Many logistics companies are struggling to change because they are small and don't have good logistics information technology to help them.

### **Smart Security**

The current status of smart security development in Shenzhen is characterized by clear national policy guidance and a diversified platform for resuming information resources. Under the guidance of the national strategy, in 2012, the Ministry of Housing and Urban-Rural Development promulgated the National Smart City (District, Town) Pilot Indicator System (Trial), and in 2015, the National Standardization Management Committee formulated emergency management as a three-level standard for management and service (Y. Liu, 2020c).

Shenzhen established an information platform and built an urban public emergency management platform based on sharing geospatial and government affairs information resources. The scope of urban information around emergency management is expanding, mainly including basic urban information, monitoring and detection information, decision support information, and functional management information (Y. Liu, 2020b). However, Shenzhen's smart security is facing challenges such as the increase in risk incentives and the frequent occurrence of emergencies. The urban emergency management information system has to deal with a wide range of topics, business integration, and different types of needs (Ding, 2019).

## Smart Education

The construction of smart education in Shenzhen is an inevitable choice for colleges and universities to cope with the challenges of internet education. Relying on Shenzhen University and Guangdong Province colleges and universities, industry 4.0 is implemented by colleges and universities. Colleges and universities build smart campuses. Encourage the integration of online and offline teaching, as well as teaching evaluation based on big data, cultivate intelligent talents, and realize a wide range of teaching based on aptitude and personalized talent training (H. Zhang, 2019).

Based on the comparative experiment, the implementation status of smart education showed that the learning in smart classrooms showed a high degree of enthusiasm and there was a certain improvement in behavioral participation. The smart teaching mode adopts corresponding teaching modes for different teaching content. These teaching modes mostly rely on technical equipment, which increases human-computer interaction and, at the same time, improves the participation and interest of learners. The construction of smart classrooms also improves students' satisfaction with the classroom. The questionnaire results showed a significant difference in learner satisfaction between the two classrooms.

At present, smart education in Shenzhen still has the problem of matching technology and management, which is difficult for front-line teachers to adapt to. The construction of smart campuses is not placed under the development trend of international information and the goals of economic and social development, and it is

considered from the overall background of the training needs of innovative talents. The use of smart education network teaching resources is insufficient. In classroom teaching, courseware is mainly displayed with pictures and a small number of dynamic videos. When teachers use these resources, there is no unified download platform, and teachers prepare by themselves, and the quality and quantity cannot be guaranteed (M. Zhang, 2020b).

### Smart livelihood

Shenzhen's information resources system is relatively well established. As early as 2006, Shenzhen issued the Interim Measures for the Management and Management of Information Resources Sharing in Shenzhen. Ten years later, on December 21, 2016, the Shenzhen Municipal Government's data open platform was officially released, marking an important step in Shenzhen's construction of a new smart city. The platform centralizes and freely opens government data resources to citizens, and is a unified data access portal open to the public (J. Liu, 2019b).

Shenzhen's smart environment construction has high resident satisfaction. According to the empirical research of Wang (2020), it is concluded that the perceived quality, perceived value, and development level of smart cities are significantly positively correlated with the satisfaction of citizens in smart city construction; smart city citizens complain, smart city expectations, and smart city construction citizens The negative correlation with satisfaction is significant (WANG, 2020).



However, there are still many deficiencies in the data of the Shenzhen Municipal Government Data Open Platform. First, the data capacity and quality are low, and the availability is not high. In addition, policies and regulations are not perfect, and third-party supervision and evaluation are lacking. At the same time, Shenzhen's e-government construction found that its main problems lie in the lack of an overall and unified operational plan, the lack of information resources and sharing mechanisms among various departments, and the defects of management systems and mechanisms that cause difficulties in cross-departmental government affairs coordination (D. Rao, 2017; M. Zhang & Guan, 2020).

### **Smart Environment**

However, there are still deficiencies in the information infrastructure of the smart environment, shortcomings in information collection, and a low degree of sharing. In urban hydrology, water environment, and water safety, information collection is insufficient. Most of the monitoring of working conditions of other reservoirs, seawalls, and river embankments has not been constructed or adopted relatively backward manual observation methods. At the same time, due to the lack of unified standard specification and design, the information collected by the established water and rain conditions, water level, flow and other sites has led to various monitoring information scattered in different business departments and a lack of sharing, resulting in data fragmentation and information islands. The business

coverage is insufficient, the function is single, and the established business application system involves few applications such as water environment and water ecology, especially for water control and quality improvement, engineering regulation, and other businesses, and has not yet formed a special support management system (P. Chen, 2018).

The problem of incompatibility between water management and information technology development is serious. State Grid will build a nationwide smart grid in 2020 and invest 4 trillion yuan in infrastructure construction. The traffic control department has established a complete road traffic detection system through video surveillance, individual soldier positioning, 122 police reception, GPS police vehicle positioning, signal control, and cluster communication. In contrast, the development of intelligent water affairs is relatively slow, which is extremely inconsistent with the supporting role of water resources in urban development. Water affairs management needs to be linked up with other urban management departments as soon as possible (Guo, 2021; G. Liao, 2018) in order to improve the city's overall service capabilities.

### 5.1.5 Summary of smart city development in first-tier cities

There are two primary development models of smart cities: "top-down" and "bottom-up." The former is that the government first locates and formulates relevant plans and then cooperates with enterprises, civil organizations, and the public to realize a smart city, for example, Beijing, Shanghai, and Shenzhen. This model uses new technologies to provide better public goods, solve problems in cities, and make cities more competitive and attractive.

The latter refers to the cooperation between enterprises and the government and is the first to carry out related smart city construction work. For example, Guangzhou relies on Tencent and Guangzhou colleges and universities to provide essential support for smart cities. It reflects a solid leading role and the characteristics of the "bottom-up" model. Various colleges and universities provide urban solutions for constructing Guangzhou's smart city. The government has put out policies to help with this, and they have worked together on overall planning and high-level design.

In developing China's smart cities, the rapid development of China's information technology will change the form, type, and core competitiveness of cities through smart cities. Technology will increasingly change production relations and people's lifestyles and subvert the original urban layout. For example, autonomous driving technology in Shanghai will affect the shape of the urban road network, the Internet of Things will put forward new requirements for urban infrastructure, and technologies

such as AR and VR will promote the formation of interactive spaces. At the same time, new retail in Shenzhen and Guangzhou will also affect the city's commercial space.

On the other hand, the development direction of smart cities is highly related to the characteristics of the city itself. The city can even complete the selection of urban residents by shaping its characteristics. For example, industrial cities emphasize the improvement of the degree of industrial interconnection, and service-oriented cities emphasize the quality of living. The improvement of college-intensive cities emphasizes the development of the sharing economy.

In addition, smart cities will be applied to more and more aspects of urban construction and people's lives, which can significantly improve urban competitiveness and quality of life. For example, smart livelihood services in Beijing and Shanghai can make public services easier to use, lower the cost of living, create high-quality job opportunities, make public spaces more appealing, and offer more places for cultural and recreational activities.

Shenzhen's smart development is mainly divided into three stages: in 2010, Shenzhen proposed the goal of building a "Smart Shenzhen" and formulated the "Smart Shenzhen Planning Outline (2011-2020); in 2013, the Shenzhen Smart City Research Association was established; In 2015, the world's leading urban information and communication infrastructure will be built, and the city's perception capabilities, network transmission environment, and information processing capabilities will be comprehensively improved. On the one hand, Shenzhen's smart city development

achievements lie in its leading domestic informationization development index; on the other hand, its smart industry ecology is at an advanced domestic level, and its innovation capability in various technical fields is strong. According to a study by the China Internet Network Information Center (CNNIC), Shenzhen is the most connected city in China with an Internet penetration rate of 86.2%.

In the 2016 China "Internet + Smart City" index by Tencent Research Institute, Shenzhen ranked first. This is shown by the fact that Shenzhen is an important base for China's electronic information industry, that the "Internet +" business format is always changing, that the Internet of Things, big data, cloud computing, artificial intelligence, and other technological fields have strong innovation capabilities, and that the Internet industry is worth more than 300 billion yuan.

The pioneer of smart public services in Shanghai. Shanghai's intelligent development can be broken down into three stages: in 2011, the "Twelfth Five-Year Plan for Shanghai's National Economy and Social Informatization" was proposed to fully promote the building of Shanghai's smart city; in 2016, the "2016 Action Plan" was released to guide and promote 50 key special projects; and in 2015, the Shanghai Economic and Information Development Research Center released the "Shanghai Smart City Development Level Evaluation Report."

Shanghai has strong private capital capabilities, and the smart industry has gradually developed into a strategic leading industry in Shanghai. On the one hand, Shanghai's technical level, capital market, and human resources are relatively strong,

and enterprises are more proactive. On the other hand, policies encourage innovation and experimentation and set up relevant evaluation standards, among other things, to provide measurement standards for building smart cities and basic information for their long-term growth.

The characteristics of Shanghai's smart city development are mainly reflected in two aspects: one is smart public services, and the field of intelligence mainly focuses on citizens' clothing, food, housing, and transportation, such as medical care, education, travel, etc., reflecting great market-leading advantages; second, Shanghai is a smart city. The city's forerunner, Shanghai's economic development level, is relatively high, and the public's cognition and acceptance ability are relatively strong. Because of this, many projects start in Shanghai, and it is used as a testing ground and model in many fields across the country.

Beijing's big data platforms, smart transportation innovations, and the government's role are strong. Beijing's development as a smart city is mostly based on how the government positions itself and makes plans. Businesses, non-governmental organizations, and the public then work together to make the city smart. Enterprises and private institutions spontaneously cooperate with the government and take the lead in the layout of relevant facilities and form a certain cooperation platform. Provide better public goods through new technology, solve urban problems, and improve competitiveness and attractiveness. Efficiency and quality optimization, providing value-added services that can meet higher demands. Top-down "top-level design +

industry response"; Bottom-up "industry leadership + government cooperation". "Top-down" and "bottom-up" models are the main models.

Actively mobilize technology and scientific research institutions and actively participate in large Internet companies such as Baidu, Alibaba, Tencent, and JD.com. In addition, Tsinghua University, Peking University, Renmin University of China, and other universities also have strong cooperative relations with enterprises and governments, and a multi-party cooperation model has gradually formed under the government's guidance. During the building of Smart Beijing, smart transportation was seen as an important part and was constantly improved by using new technologies and models to make the traffic environment better and the traffic flow more smoothly.

Guangzhou is a cloud computing base. Guangzhou is home to 80% of colleges and universities and 70% of scientific and technological personnel in the province, and the total number of college students at these schools ranks first in the country. Under the top-level design of the smart city, the Guangzhou market is more dominant. Guangzhou's cloud computing applications are the best in China, and the city is trying to build a world-class cloud computing industry base. It is taking the lead in making Guangzhou an Asia-Pacific "smart city" with international influence.

### Characteristics of intelligent development of Chinese cities

There are certain rules in the construction of smart cities in terms of city types. Therefore, by comparing with foreign cities, the future development direction of China's smart cities can be further clarified in line with their characteristics. Regarding smart cities worldwide, Beijing belongs to the political center and is a government-led smart city. As the country's political center, it has the advantages of government coordination and leading promotion. Guangzhou is a manufacturing and trade center with a strong manufacturing industry, high-tech enterprises, and many students in school, and has advantages in the technical field. Shenzhen is a leading city in scientific and technological innovation, with a large proportion of young people in the city, and the city has leading enterprises with great advantages in innovation and research and development. Shanghai is a commercial and financial center. As the country's economic and financial center, it is easy for enterprises to participate in the construction of smart cities, and the development of smart businesses has great advantages. So, these two cities have become the first and best places in their countries to try out smart public services.



Table 14, Smart City development commonalities and differences table

	Beijing	Shanghai	Guangzhou	Shenzhen
<b>Communalities</b>		Research		
	Top down	institute and technology companies	One Stop Service Center	Sufficient talents
	Adequate financial support	Smart Fire	Water, air and noise testing	Information Security Protection
	Smart Transportation	E-government	AI education	Livelihood
	Financial product	Smart Museum	Smart car	Internet popularity
<b>Differences</b>	One-stop service center	Smart community pension	Privacy protection	Smart Park

In conclusion, table 14 shows the current status of smart city development in China's first-tier cities is similar, but it also has some emphasis. The top-down model emphasized in Beijing, Shanghai, Guangzhou, and Shenzhen is due to the fact that the first-tier city governments have provincial-level autonomy and ample financial support. However, in the process of development, the purpose of smart cities is still to alleviate the existing urban diseases in the city. For example, Beijing has increased the development of smart transportation, established a sound information platform, a smart traffic detection system, and detailed laws and regulations. Shanghai focuses on e-government and the development of smart community projects to address medical and elderly care issues. Shenzhen and Guangzhou vigorously develop talent policies, so most of the population in Guangzhou and Shenzhen is the floating population and young people. So, it has become the home of Internet companies and focuses more on how to use the Internet and technology, like 5G, IOT, and the growth of the smart retail industry.

## 5.2 Smart city policy status

A policy text is a public policy document, a form of expression in which policymakers require certain groups or organizations to abide by specific codes of conduct to achieve their policy intentions (Li & Lan, 2007). Through the study of policy texts, it is possible to understand and grasp the purpose of a policy subject in forming a certain policy as well as the degree of emphasis on related issues in this field.

The table below illustrates the policy texts related to smart cities in China's first-tier cities as the research object and conducts an in-depth analysis of the smart city policy system by manually collecting 54 samples.

Table 15, Beijing smart city policy

Title (Chinese)	Title	Timeliness	Release Department	Release Date
北京市经济和信息化局关于组织开展北京市智慧城市标准体系框架征	Notice of Beijing Municipal Bureau of Economy and Information Technology on Organizing the Collection of Beijing Smart City Standard System Framework	currently valid	Beijing Municipal Bureau of Economy and Information Technology	2022.03.21

集工作的通知				
北京市文化和旅游局关于征集智慧旅游应用场景实践案例的通知	Notice of Beijing Municipal Bureau of Culture and Tourism on Collecting Practical Cases of Smart Tourism Application Scenarios	currently valid	Beijing Municipal Bureau of Culture and Tourism	2022.03.14
北京市住房和城乡建设委员会关于印发《北京市房屋建筑和市政基础设施工程智慧工地做法认定关键点》的通知	Notice of the Beijing Municipal Commission of Housing and Urban-Rural Development on Printing and Distributing the Key Points for the Determination of Smart Site Practices for Housing Construction and Municipal Infrastructure Projects in Beijing	currently valid	Beijing Municipal Commission of Housing and Urban-Rural Development	2021.09.28

北京市大数据工作推进小组关于印发《北京市十四五时期智慧城市发展行动纲要》的通知	Notice of the Beijing Big Data Work Promotion Group on Printing and Distributing the Beijing 14th Five-Year Plan Period for Smart City Development Action Outline.	currently valid	Office of Beijing Big Data Work Promotion Group	2021.03.05
北京市大兴区人民政府关于印发《大兴区新型智慧城市总体规划(修订版)》的通知(2021)	Notice of the People's Government of Daxing District, Beijing on Printing and Distributing the Master Plan for New Smart City in Daxing District (Revised Edition) (2021)	currently valid	People's Government of Daxing District, Beijing	2021.01.25
北京市文物局转发市老龄委《关于开展智慧助	The Beijing Municipal Bureau of Cultural Relics forwarded the notice of the Municipal Commission	currently valid	Beijing Municipal Bureau of Cultural Relics	2020.12.30

老系列公益视频和小程序宣传推广的通知》的通知	on Aging On Launching the Publicity and Promotion of Smart Helping the Elderly Series of Public Welfare Videos and Mini Programs.			
北京市教育委员会关于同意智慧环保北京实验室立项建设的通知	Notice of the Beijing Municipal Education Commission on Approving the Construction of the Smart Environmental Protection Beijing Laboratory	currently valid	Beijing Municipal Education Commission	2020.10.13
北京市东城区人民政府办公室关于印发《东城区智慧教育三年发展规划(2020—	Notice of Beijing Dongcheng District People's Government Office on Printing and Distributing the Dongcheng District Smart Education Three-Year Development Plan (2020-2022)	currently valid	Beijing Dongcheng District People's Government	2020.09.29

2022)》的通 知				
北京市卫生健康委员会关于组织申报智慧健康养老产品及服务推广目录(2020年版)的通知	Notice of the Beijing Municipal Health Commission on Organizing the Application for the Promotion Catalogue of Smart Health Care Products and Services (2020 Edition)	currently valid	Beijing Municipal Health Commission	2020.06.18
北京市广播电视局关于北京市智慧广电重点实验室第一批认定名单的通知	Notice of the Beijing Municipal Radio and Television Bureau on the first batch of accreditation lists of the Beijing Smart Radio and Television Key Laboratory	currently valid	Beijing Radio and Television Bureau	2020.01.03
北京市海淀区人民政府办公室关于	Notice of the Office of the People's Government of Haidian District, Beijing, on	currently valid	People's Government of	2019.11.18

<p>印发《海淀区推进智慧审批试点及深化推广工作方案》的通知</p>	<p>Printing and Distributing the Work Plan for Promoting the Pilot and Deepening Promotion of Smart Approval in the Haidian District</p>		<p>Haidian District, Beijing</p>	
<p>北京市卫生健康委员会关于开展第三批智慧健康养老应用试点示范的通知</p>	<p>Notice of the Beijing Municipal Health Commission on Launching the Third Batch of Pilot Demonstrations of Smart Healthy Elderly Care Applications</p>	<p>currently valid</p>	<p>Beijing Municipal Health Commission</p>	<p>2019.07.15</p>
<p>北京市大兴区人民政府关于印发《大兴区新型智慧城市总体规划》的通知</p>	<p>Notice of the People's Government of Daxing District, Beijing on Printing and Distributing the Master Plan for New Smart City in Daxing District</p>	<p>currently valid</p>	<p>People's Government of Daxing District, Beijing</p>	<p>2018.05.15</p>



北京市十三五时期智慧交通发展规划	Smart Transportation Development Plan in Beijing's Thirteenth Five-Year Plan Period	currently valid	Beijing Municipal Commission of Transportation	2017
北京市大数据工作推进小组办公室关于印发《北京新型智慧城市感知体系建设指导意见》的通知	Notice of the Office of Beijing Big Data Work Promotion Group on Printing and Distributing the Guiding Opinions on the Construction of Beijing's New Smart City Perception System	currently valid	Office of Beijing Big Data Work Promotion Group	2021.03.22
北京市海淀区人民政府印发《海淀区智慧海淀建设项目管理办法(修	Notice of the People's Government of Haidian District, Beijing on Issuing the Administrative Measures for Smart Haidian Construction	currently valid	People's Government of Haidian District, Beijing	2017.06.21

订版)》的通知	Projects in Haidian District (Revised Edition)			
北京市延庆区人民政府办公室关于印发北京市延庆区智慧延庆建设项目管理办法的通知	Notice of the Office of the People's Government of Yanqing District, Beijing on Printing and Distributing the Administrative Measures for Smart Yanqing Construction Projects in Yanqing District, Beijing	currently valid	People's Government of Yanqing District, Beijing	2016.03.29
北京市社会建设工作办公室、北京市经济和信息化委员会、北京市民政局关于认定2014年北京市星级	Notice by the Beijing Municipal Office of Social Construction, the Beijing Municipal Commission of Economy and Information Technology, and the Beijing Municipal Civil Affairs Bureau on Recognizing the 2014	currently valid	Beijing Civil Affairs Bureau	2015.02.11

智慧社区的 通知	Beijing Star-rated Smart Community			
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Source: PKU LAW, 2022

### 5.2.1 Beijing

The results of proportion of smart city policies in Beijing are shown in Table 16. From the perspective of policy tools, the supply type occupies 45.3%, with 43 codes, followed by the environmental type, which occupies 42.1%, with 40 codes. Among them, the utilization rate of demand-based policy tools is the lowest, accounting for 12.6% and 12 codes.

Table 16, The proportion of smart city policies in Beijing

Policy Tool		Total
<b>Type</b>	Supply-Based (45.3%)	95
	Demand-Based (12.6%)	Items
	Environmental Based (42.1%)	
Infrastructure (6 Items)	Government Procurement (3 Items)	Target Planning (9 Items)
Talent input (9 Items)	Regulations (3 Items)	Financial Support (8 Items)

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Information	Outsourcing (2 Items)	Regulations	(9
Support (20 Items)		Items)	
Organizational	Tax Incentive (4 Items)	Evaluate	
leadership	(8	standard	(14
Items)		Items)	

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### Supply-oriented policies are overused

Promoting smart city construction mainly requires a top-down upgrade from government departments, including providing necessary funds, educating and training personnel, and developing information technology capabilities. In Beijing, smart city policies account for 43% of the total, which is the same as environmental policies. Among the supply-oriented policies, technology and talent account for the most considerable proportions. Among them, science and technology policies occupy 20 of them, and talent policies occupy 9. When supply-oriented policy tools are used a lot, they can help bring together forces from all parts of society, like scientific research, organization, and infrastructure, to help smart cities be built in a healthy way.

### Technology Policy

According to the Beijing Municipal Education Commission (2020), establish the Smart Education Think Tank in Dongcheng District. Invite experts and scholars from universities and scientific research institutions to provide theoretical guidance and advice and form a working mechanism for expert demonstration and review. Combine

other education demonstration areas and national level informatization teaching experimental areas to establish smart regional education. The ecological coordinated development community forms a regional exchange and sharing mechanism of mutual learning and mutual learning.

### **Talent Policy**

According to the Beijing Municipal Education Commission (2020), Increase talent attraction and training and publicity. Increase support and training for key technical talents such as artificial intelligence, big data, integrated circuits, software, and information services, introduce global innovation leaders, and build a high-level smart city construction and management talent team. Organize smart city exhibitions or summit forums with international influence to promote the landing of projects, funds and talents. Carry out activities such as smart city scenario application competitions, expand smart city innovation and creative resource drainage for the society, and enhance the public's awareness of smart city construction, engagement and gain (People's Government of Daxing District, Beijing, 2018).

### **Lack of demand-based policy tools**

The proportion of demand-based policies in developing smart city policies is only 12.6%. a total of 12 policies. This part of the policy tools mainly comprises government procurement, service outsourcing, incentive measures, and trade control, which adjust market demand and reduce market instability using notification policies.

Undoubtedly, actively developing and stabilizing the market with smart city construction as the main body and promoting the industrialization, marketization, and internationalization of smart city-related fields will directly affect the improvement of the development level of smart cities.

Due to the serious absence of demand-based policy tools, policymakers may not have paid enough attention to the role of the market. Of course, as mentioned above, smart cities need a top-down push from the government but increasing market demand can increase the sustainable vitality of smart city development.

#### **Government procurement policy**

Organize the bidding work and implement the district party committee and district government's requirements for government procurement and application promotion of new technologies and new products (services) and give priority to the procurement of new technologies and new products and information system integration services from enterprises in the core area.

#### **Incentives policy**

Embedding the Internet financial service platform to provide flexible financial support to promote the incubation of excellent innovation and entrepreneurship projects; to give full play to the ability of big data in precise investment promotion and enterprise services, and to promote the participation of financial institutions and

big data analysis companies in the process of investment promotion consultation and implementation. To accurately identify investment targets and accurately provide financial support.

Environmental policies are balanced, with a total of 40 coding policies. Among them, target planning accounted for 9, and laws and regulations accounted for 9. Most environmental policies are flat and evenly distributed.

### **Goal planning**

By 2022, a smart education ecosystem that is leading in China and has a certain international influence will be built, and the development goals of three perfections, two highs and one big proposed by the Ministry of Education and the Smart Education Demonstration Zone will be fully implemented and completed. Based on the construction tasks, we will first realize the innovative demonstration of smart education to help education modernization, lead breakthroughs in the modernization of education in Dongcheng District and promote the development of regional education quality and the overall level of education governance (Beijing Municipal Education Commission, 2020).

## Laws and regulations

Promote the establishment of legislation and standards. Promulgate local regulations such as the digital economy, clarify the obligations and responsibilities of all parties in the sharing, opening, and applying government data and social data, and create conditions for the safe and orderly flow of data throughout society. Research and formulate application rules and standard specifications for smart cities, break technical barriers through unified standards, and realize the interconnection of smart cities (Beijing Municipal Bureau of Economy and Information Technology, 2022).

Table 17, Shanghai smart city policy

Title (Chinese)	Title	Timeliness	Release Department	Release Date
上海市体育局 关于开展智慧 助老行动加强 老年人体育服 务的指导意义	Guiding Opinions of the Shanghai Municipal Bureau of Sports on Carrying out the Smart Helping the Elderly Action to Strengthen Sports Services for the Elderly	currently valid	Shanghai Sports Bureau	2021.01 .08



<p>上海市人民政府办公厅印发关于本市推进智慧气象保障城市精细化管理实施意见的通知</p>	<p>Notice by the General Office of the Shanghai Municipal People's Government on the Implementation of Opinions on Promoting Smart Meteorological Guarantee Urban Refinement Management</p>	<p>currently valid</p>	<p>Shanghai Municipal People's Government</p>	<p>2020.04.29</p>
<p>中国(上海)自由贸易试验区临港新片区管理委员会关于印发《中国(上海)自由贸易试验区临港新片区智慧城市建设项目管理办法》的通知</p>	<p>Notice of the Administrative Committee of the Lingang New Area of China (Shanghai) Pilot Free Trade Zone on Printing and Distributing the Administrative Measures for Smart City Construction Projects in the Lingang New Area of China (Shanghai) Pilot Free Trade Zone</p>	<p>currently valid</p>	<p>China (Shanghai) Pilot Free Trade Zone Lingang New Area Management Committee</p>	<p>2020.04.02</p>

中共上海市委、上海市人民政府关于进一步加快智慧城市建设的若干意见	Several Opinions of the CPC Shanghai Municipal Committee and the Shanghai Municipal People's Government on Further Accelerating the Construction of Smart City	currently valid	Shanghai Municipal People's Government	2020.02
上海市卫生健康委员会关于转发《国家卫生健康委办公厅关于印发医院智慧服务分级评估标准体系(试行)的通知》的通知	The Shanghai Municipal Health Commission forwarded the Notice of the General Office of the National Health Commission on Printing and Distributing the Standard System for the Classification and Evaluation of Hospital Smart Services (Trial).	.currently valid	Shanghai Municipal Health Commission	2019.04 .18
上海市教育委员会关于申报	Notice of the Shanghai Municipal Education	currently valid	Shanghai Municipal	2021.11 .02

2022年上海高校 智慧安防示范 校奖补资金的 通知	Commission on Application for the 2022 Shanghai University Smart Security Demonstration School Award and Subsidy Fund		Education  Commission	
上海市水务局 关于普陀区智 慧城水系综合 整治工程(三期) 初步设计批复 意见的函	Letter of the Shanghai Water Affairs Bureau on the preliminary design approval of the Putuo District Smart City Water System Comprehensive Improvement Project (Phase III)	currently  valid	Shanghai  Water Affairs  Bureau	2021.05  .12
上海市商务委 员会关于开展 智慧菜场试点 建设工作的通 知	Notice of the Shanghai Municipal Commission of Commerce on the pilot construction of smart vegetable farms	currently  valid	Shanghai  Municipal  Commission  of Commerce	2021.03  .31
上海市长宁区 人民政府办公	Notice of the Shanghai Changning District People's	currently  valid	Shanghai  Changning	2020.02  .27

室关于成立长宁区智慧城市建设领导小组的通知	Government Office on the Establishment of the Leading Group for Smart City Construction in Changning District		District People's Government	
上海市松江区人大(含常委会)关于松江区智慧公安建设情况的讨论意见	Opinions on the discussion of the Songjiang District People's Congress (including the Standing Committee) on the construction of smart public security in the Songjiang District	currently valid	Shanghai Songjiang District People's Congress (including the Standing Committee)	2019.11.18
上海市人民政府办公厅关于成立上海市智慧城市建设领导小组的通知	Notice of the General Office of the Shanghai Municipal People's Government on the Establishment of the Leading Group for Shanghai Smart City Construction	currently valid	Shanghai Municipal People's Government	2019.07.20

<p>上海市经济和信息化委员会 关于开展2019年度上海市信息化发展专项资金(智慧城市建设和大数据发展)项目申报工作的通知</p>	<p>Notice of the Shanghai Municipal Commission of Economy and Informatization on Launching the 2019 Shanghai Informatization Development Special Fund (Smart City Construction and Big Data Development) Project Application Work</p>	<p>currently valid</p>	<p>Shanghai Municipal Commission of Economy and Information Technology</p>	<p>2019.01.03</p>
<p>上海市卫生和计划生育委员会关于公布上海市卫生计生委智慧医疗专项研究项目立项项目的通知</p>	<p>Notice of Shanghai Municipal Health and Family Planning Commission on Announcement of Shanghai Municipal Health and Family Planning Commission's Smart Medical Research Project</p>	<p>currently valid</p>	<p>Shanghai Municipal Health and Family Planning Commission</p>	<p>2018.06.12</p>

<p>上海市人民政府关于印发《上海市推进智慧城市建设十三五规划》的通知</p>	<p>Notice of the Shanghai Municipal People's Government on Printing and Distributing the 13th Five-Year Plan for Promoting Smart City Construction in Shanghai.</p>	<p>currently valid</p>	<p>Shanghai Municipal People's Government</p>	<p>2016.09.19</p>
<p>上海市发展改革委关于组织开展互联网+智慧能源(能源互联网)示范项目申报工作的通知</p>	<p>Notice of the Shanghai Municipal Development and Reform Commission on Organizing the Application of Internet + Smart Energy (Energy Internet) Demonstration Projects</p>	<p>currently valid</p>	<p>Shanghai Development and Reform Commission</p>	<p>2016.08.04</p>
<p>上海市宝山区人民政府办公室关于成立宝山区智慧城市</p>	<p>Notice of the Office of the People's Government of Baoshan District, Shanghai, on the Establishment of the Leading Group for</p>	<p>currently valid</p>	<p>Shanghai Baoshan District People's Government</p>	<p>2016.05.17</p>

建设领导小组 的通知	Smart City Construction in Baoshan District			
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Source: PKU LAW, 2022

### 5.2.2 Shanghai

From the perspective of policy tools, the proportion of smart city policy tools in Shanghai is as follows: supply-based accounts for 52.7%, with 48 items, and environmental-based accounts for 36.4%, with 40 codes. Among them, the utilization rate of demand-based policy tools is the lowest, accounting for 10.9%, and 12 articles.

Table 18, The proportion of smart city policies in Shanghai

Type	Policy Tool			Total
Supply-Based (52.7%)	Infrastructure (13 Items)	Government Procurement (1 Item)	Environmental- Based (36.4%)	110 Items
	Talent input (2 Items)	Regulations (1 Item)	Target Planning (15 Items)	
	Information Support (25 Items)	Outsourcing (1 Item)	Financial Support (7 Items)	
			Regulations (7 Items)	

Organizational leadership Items)	Tax Incentive (9 Items)	Evaluate standard Items)
(18		(11

### The current situation of supply-oriented policies

Shanghai's supply-oriented policy tools should only be supported by science and technology, information technology, and organized and led. Among them, there is scientific and technological support, accounting for 25% of all policy codes in Shanghai. Shanghai attaches great importance to technological development. These include e-government, smart education, smart medical care, etc. In the related policies of organizational leadership, a total of 18 are coded. The primary goal is to improve the efficiency of e-government and government affairs in Shanghai. A management and supervision team has also been set up in the fields of care for the elderly and building urban infrastructure to oversee how projects are put into action and run.

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### Technology support

Full coverage of the informatization application of people's livelihood services, an important support for improving the quality of urban life and realizing the establishment of dynamic collection and online sharing of citizens' electronic health records; educational informatization, focusing on applications such as educational information resource sharing, e-school bags, and online teaching (Shanghai Sports Bureau, 2021).



There are 54 municipal departments, units, and the websites of district and county governments that have carried out barrier-free construction of the entire website or the homepage of the website; established traffic information based on a comprehensive information service platform for road traffic; a comprehensive information service platform for public transportation; and a public parking information platform application on the framework.

### **Organizational leadership**

According to the Shanghai Municipal People's Government (2020), optimize the organizational structure. Strengthen the overall coordination function of the city's smart city construction leading group (after this as the leading group), adhere to coordination and division of responsibilities. Set up special working groups in key areas such as government services, urban operations, and digital economy, which oversee the city. The leader acts as the convener to take the lead in coordinating and promoting the cross-departmental and cross-level informatization work in various fields. Give full play to the leading group office's overall coordination and service hub functions, do a good job in planning formulation, standard specification, project organization, statistical evaluation.”

### Status of demand-based policy tool

The proportion of demand-based policies in developing smart city policies is only 10.9%. A total of 12 policies. However, Shanghai's new demand policy mainly focuses on incentive measures, with a total of 9 policy incentives. There is a lack of policy on government outsourcing and procurement. The government procurement, service outsourcing and trade regulation policies are coded as 1 item each.

### Incentives

Organize the bidding process and follow the requirements of the district party committee and district government for the government to buy new technologies, new products, and new services. Give priority to buying new technologies, new products, and information system integration services from businesses in the core area.

Encourage Internet companies, such as banks and insurance companies, to assist logistics companies in promoting new types of logistics, such as socialized joint distribution and smart express boxes, as well as to promote the connection between the express industry and e-commerce platforms model application. service innovation in the aftermarket for cars and encourage the creation of new business models like car time-sharing leasing.

Encourage innovation in e-commerce. Furthermore, promote foreign trade and cross-border e-commerce pilots; support the development of e-commerce service platforms based on the actual needs of small and medium-sized enterprises; and

vigorously cultivate the platform economy. Encourage key manufacturing industries to leverage e-commerce to improve supply chain collaboration efficiency and innovate product supply and customer service interaction models. To encourage the integrated development of traditional business services, physical enterprises, and e-commerce firms, as well as the online and offline (O2O) interactive e-commerce model, which allows for the development of e-commerce industrial parks and demonstration bases. If electronic payment, credit services, security certification, and environments are all optimized, electronic invoices and contracts will be used more and become more popular.

Shanghai's environmental policies, a total of 40 coding policies, account for 36.4% of the total coding. Among them, target planning and assessment methods are the main ones, with nine target plans and 11 assessment standards and policies. Legal norms and financial investment accounted for 5 and 6, respectively. As for policy, the Shanghai government mainly does overall planning and then makes financial investments after formulating plans and inspection standards. In addition, environmental policies cover intelligent medical care, education, transportation, elderly care, and other public services that basically cover It also pays attention to protecting the environment by making sure the weather forecast and early warnings are accurate for the central city; the weather monitoring forecast covers the streets and towns; and the weather disaster risk early warning (Shanghai Municipal Commission of Economy and Information Technology, 2019).

### Goal planning

Adhere to the people-centered development idea, practice the important concept of people's cities being built by the people and people's cities being for the people, closely follow the needs of the elderly for high-quality physical fitness, vigorously implement national fitness for all, and actively respond to the national strategy of population aging. Find out what makes it hard for older people to use smart technology and figure out how to fix it. Also, strengthen and improve the smart assistance service in sports.

### Laws and regulations

The health and health commissions of all districts and the main medical entities should strengthen the guidance of the medical institutions under their jurisdiction to promote the work of the smart service classification evaluation standard system, and the National Health and Health Commission will carry out the evaluation work at selected times (Shanghai Municipal People's Government, 2019).

Table 19, Guangzhou smart city policy

Title (Chinese)	Title	Timeliness	Release Department	Release Date
广州市教育局 关于颁发首届 智慧教育成果 展示月活动证 书的通知	Notice of the Guangzhou Education Bureau on Issuing the Certificate of the First Smart Education Achievement Display Month	currently valid	Guangzhou Education Bureau	2021.12.31
广州市民政 局、广州市工 业和信息化局 关于发布《广 州市智慧养老 应用场景需求 清单(2021年 版)》的通知	Notice of Guangzhou Civil Affairs Bureau and Guangzhou Municipal Bureau of Industry and Information Technology on Issuing the Guangzhou Smart Elderly Care Application Scenario Requirements List (2021 Edition)	currently valid	Guangzhou Bureau of Industry and Information Technology	2021.11.15

<p>广州市住房和城乡建设局关于开展智慧工地试点项目工作的通知</p>	<p>Notice of Guangzhou Municipal Bureau of Housing and Urban-Rural Development on Launching Pilot Projects of Smart Construction Sites</p>	<p>currently valid</p>	<p>Guangzhou Housing and Urban-Rural Development Bureau</p>	<p>2021.07.16</p>
<p>广州市工业和信息化局关于委托广州市智能网联汽车示范区运营中心开展广州市智能网联汽车与智慧城市协同发展成果推广活动项目的公告</p>	<p>Announcement of the Guangzhou Municipal Bureau of Industry and Information Technology on entrusting the Guangzhou Intelligent Connected Vehicle Demonstration Zone Operation Center to carry out the Guangzhou Intelligent Connected Vehicle and Smart City Collaborative Development</p>	<p>currently valid</p>	<p>Guangzhou Bureau of Industry and Information Technology</p>	<p>2021.04.01</p>

	Achievement Promotion Project			
广州市教育局 关于印发《广州市教育局关于广州市中小学智慧课堂实验的工作指引》的通知	Notice of the Guangzhou Municipal Education Bureau on Printing and Distributing the Guangzhou Municipal Education Bureau's Work Guidelines on the Experiments of Smart Classrooms in Guangzhou Primary and Secondary Schools	currently valid	Guangzhou Education Bureau	2021.02.09
广州市财政局 关于通过广东政府采购智慧云平台电子卖场实施政府采购活动有关事项的通知	Notice of the Guangzhou Municipal Bureau of Finance on matters related to the implementation of government procurement activities through the Guangdong Government	currently valid	Guangzhou Municipal Bureau of Finance	2020.12.31

	Procurement Smart Cloud Platform Electronic Store			
广州市卫生健康委员会、广州市民政局、广州市工业和信息化局关于确定智慧健康养老项目试点单位名单的通知	Notice of Guangzhou Municipal Health Commission, Guangzhou Municipal Civil Affairs Bureau, and Guangzhou Municipal Bureau of Industry and Information Technology on Determining the List of Pilot Units for Smart Health Pension Project	currently valid	Guangzhou Bureau of Industry and Information Technology	2019.01.18
广州市教育局关于开展中小学智慧校园建设试点工作的通知	Notice of Guangzhou Municipal Education Bureau on Carrying out the Pilot Work of Smart Campus Construction in Primary and Secondary Schools	currently valid	Guangzhou Education Bureau	2012.04.13



<p>广州市教育局 关于广州市创 建全国智慧教 育示范区支撑 区、支撑校名 称征求意见的 通知</p>	<p>Notice of the Guangzhou Municipal Education Bureau on soliciting opinions on the name of the supporting area and supporting the school for the establishment of the National Smart Education Demonstration Zone in Guangzhou</p>	<p>currently valid</p>	<p>Guangzhou Education Bureau</p>	<p>2020.04.16</p>
<p>中共广州市 委、广州市人 民政府关于建 设智慧广州的 实施意见</p>	<p>Implementation Opinions of the Guangzhou Municipal Committee of the Communist Party of China and the Guangzhou Municipal People's Government on Building a Smart Guangzhou</p>	<p>currently valid</p>	<p>Guangzhou Municipal People's Government</p>	<p>2012.09.19</p>

Source: PKU LAW, 2022

### 5.2.3 Guangzhou

Demand-based policies accounted for 24.2% of the smart city policy development. A total of 24 policies. The use of demand-based policy tools in Guangzhou is twice that of Shanghai and Beijing. Among them, tax incentives are the main ones, and there are eight coding policies. Secondly, there are six articles on government procurement and trade norms. Outsourcing services account for 4, and Guangzhou encourages the joint construction of smart city construction with various enterprises. Encourage social forces to invest in and participate in digital construction and education services.

Table 20, The proportion of smart city policies in Guangzhou

Policy Tool		Total
Type	Supply-Based (58.6%)	99 Items
	Demand-Based (24.2%) Environmental- Based (17.2%)	
Infrastructure	(17 Government Procurement (6 Items)	Target Planning (5 Items)
Talent input	(3 Regulations (6 Items)	Financial Support (3 Items)

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Information	Outsourcing (4 Items)	Regulations	(3
Support (31 Items)		Items)	
Organizational	Tax Incentive (8 Items)	Evaluate	
leadership	(7	standard	(6
Items)		Items)	

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### Incentives

Cultivate and expand new e-commerce formats, support the development of digital advertising and other digital marketing formats, and promote the digital promotion of traditional local and time-honored brands.

### Laws and regulations

Entrust a third-party professional institution to carry out on-site evaluation and assessment according to the Guangzhou Smart Healthy Pension Pilot Project Entrustment Agreement signed by each pilot unit and the health department, and supervise the city's smart, healthy pension pilot project units. Units whose total annual performance assessment score is less than 80 points) shall make a citywide notification (Guangzhou Housing and Urban-Rural Development Bureau, 2021).

Table 21, Shenzhen smart city policy

Title (Chinese)	Title	Timeliness	Release Department	Release Date
<p>深圳市城市管理和综合执法局关于公开征求《深圳智慧城管二期规划(草案)》意见的通告</p>	<p>Announcement of Shenzhen Municipal Bureau of Urban Management and Comprehensive Law Enforcement on Publicly Soliciting Opinions on Shenzhen Smart Urban Management Phase II Planning (Draft)</p>	<p>currently valid</p>	<p>Shenzhen Municipal Bureau of Urban Management and Comprehensive Law Enforcement</p>	<p>2021.11.29</p>
<p>深圳市人民政府关于成立深圳市智慧城市和数字政府建设领导小组的通知</p>	<p>Notice of Shenzhen Municipal People's Government on Establishing Shenzhen Smart City and Digital Government Construction Leading Group</p>	<p>currently valid</p>	<p>Shenzhen Municipal People's Government</p>	<p>2021</p>

<p>深圳市商务局关于下达2017年中央服务业发展专项资金供应链体系建设项目(智慧供应链平台建设方向、物流标准化建设方向)资助计划的通知</p>	<p>Notice of the Shenzhen Municipal Bureau of Commerce on the issuance of the 2017 central service industry development special fund supply chain system construction project (smart supply chain platform construction direction, logistics standardization construction direction) funding plan</p>	<p>currently valid</p>	<p>Shenzhen Municipal Bureau of Commerce</p>	<p>2019.12.20</p>
<p>深圳市人民政府关于印发新型智慧城市建设总体方案的通知</p>	<p>Notice of the Shenzhen Municipal People's Government on Printing and Distributing the Overall Plan for the Construction of a New Smart City</p>	<p>currently valid</p>	<p>Shenzhen Municipal People's Government</p>	<p>2018.07.12</p>
<p>深圳市市场监督管理局</p>	<p>Notice of the Shenzhen Municipal Administration for</p>	<p>currently valid</p>	<p>Shenzhen Municipal</p>	<p>2017.12.26</p>

关于发布智慧中药房的通知	Market Regulation on the Release of Smart Chinese Pharmacies		Administration for Market Regulation	
深圳市经贸信息委关于邀请参加走出去服务中国行暨一带一路智慧城市高峰论坛的通知	Notice of Shenzhen Economic and Trade Information Commission on Invitation to Participate in Going Out to Serve China and Belt and Road Smart City Summit Forum	currently valid	Shenzhen Municipal Commission of Economy, Trade and Information Technology	2015.11.10
深圳市教育局关于印发《深圳市中小学智慧校园示范学校行动方案》的通知	Notice of the Shenzhen Municipal Bureau of Education on Printing and Distributing the Action Plan for Demonstration Schools of Smart Campus in Primary and Secondary Schools in Shenzhen	currently valid	Shenzhen Education Bureau	2015.07.14

<p>深圳市教育局关于开展第一批智慧校园示范学校评选工作的通知</p>	<p>Notice of Shenzhen Education Bureau on Launching the Selection of the First Batch of Smart Campus Demonstration Schools</p>	<p>currently valid</p>	<p>Shenzhen Education Bureau</p>	<p>2015.06.17</p>
<p>深圳市人民政府关于加快智慧城市和数字政府建设的若干意见</p>	<p>Several Opinions of Shenzhen Municipal People's Government on Accelerating the Construction of Smart City and Digital Government</p>	<p>currently valid</p>	<p>Shenzhen Municipal People's Government</p>	<p>2020.12.29</p>
<p>深圳市人民政府关于加快智慧城市和数字政府建设的若干意见</p>	<p>Several Opinions of Shenzhen Municipal People's Government on Accelerating the Construction of Smart City and Digital Government</p>	<p>currently valid</p>	<p>Shenzhen Municipal People's Government</p>	<p>2020.12.29</p>

Source: PKU LAW, 2022

#### 5.2.4 Shenzhen

Among Shenzhen's smart city development policies, supply-based policy tools are over-full, accounting for 67 coding policies, accounting for 69.1% of the total; demand-based policy tools are absent, with only ten codes, accounting for 10.3%; environmental-based policy tools are relatively weak. There are 20 articles, accounting for 20.6%.

Table 22, The proportion of smart city policies in Shenzhen

	Policy Tool	Total
<b>Type</b>	Supply-Based (69.1%)	97 Items
	Demand-Based (10.3%)	
	Environmental- Based (20.6%)	
	Infrastructure (15 Items)	Government Procurement (1 Item)
	Talent input (4 Items)	Regulations (2 Items)
	Information Support (35 Items)	Outsourcing (1 Item)
	Organizational leadership (13 Items)	Tax Incentive (6 Items)
		Target Planning (5 Items)
		Financial Support (4 Items)
		Regulations (8 Items)
		Evaluate standard (3 Items)



In the construction of smart cities, environmental policy tools are mainly reflected in the establishment of formal laws and regulations, standardizing strategic objectives, and strengthening assessment and guarantees, and have direct or indirect normative impacts on the construction of smart cities. The reason why we think that Shenzhen's environmental policy tools are weak is mainly based on two considerations. First, compared with the other two types of policy tools, environmental policy only accounts for 10%, and the gap between the use of supply-based policy tools and the number of policy tools is gradually widening.

Among the supply-oriented policy tools, Shenzhen vigorously develops technology and information level, and a total of 35 coding policies are the most complete and most comprehensive among first-tier cities. It covers all aspects, including accelerating the construction of big data centers, fast-tracking the construction of blockchain technology infrastructure, and implementing the Digital Citizen plan. In addition, Shenzhen pays attention to setting organizational leadership and infrastructure policies, improving e-government services, urban network coverage, and digitization.

### **Infrastructure**

Innovate the planning, construction, maintenance and management mode of public pipelines, integrate the information data of underground municipal infrastructure such as tap water, electricity, gas, sewage, communications, subways and

integrated pipelines, and build the city's comprehensive pipeline network information database and unified pipeline information platform.

### **Scientific and technological information support**

Build the city's intelligent center. Drive the optimization of departmental business processes with data, and establish an urban operation system with intelligent monitoring, unified command, real-time scheduling, and upper and lower linkages. Establish a city-wide emergency linkage mechanism to realize all aspects of emergency systems, information, resources, and plans. Connect (Shenzhen Municipal People's Government, 2021).

Shenzhen lacks demand-based policies, mainly focusing on incentives. Lack of policy formulation for government outsourcing and government procurement. Among them, a total of 6 policy measures are coded, mainly guided by government investment and a diversified investment and operation model that attracts extensive participation from social funds to promote the development of smart cities.

### **Laws and regulations**

According to the Shenzhen Municipal People's Government (2018), Strengthen network security management in key links such as planning and construction, operation monitoring, and reporting and rectification. Continue to crack down on cyber-criminal activities, strengthen network security inspections on key information infrastructure,

and regularly strengthen the development, utilization, and protection of personal information in key areas and industries. Inspect and further promote the publicity and popularization of network security knowledge and skills.

Construct a legal system that meets the needs of new smart city construction. Research and introduce regulations and systems such as data openness and sharing, data security, data protection, and data desensitization to standardize the rational use of data. Improve Shenzhen's new smart city construction standard system. According to urgent needs, based on the principle of building first, formulate standard specifications for service management of urban operation management center, unified data service interface, cross-departmental business coordination command process, etc. Promote the change of the concept of each department from the perspective of management and service objects, innovate work modes, optimize and re-engineer business processes, and establish and improve systems and mechanisms that are compatible with innovative management and improved services under the conditions of informatization.

## 5.2.5 Summary of smart city policy in first-tier cities

Table 23, Smart City policy commonalities and differences table

	Beijing	Shanghai	Guangzhou	Shenzhen
<b>Communalities</b>	Infrastructure	Information Support	Insufficient demand-based policies	Organizational Leadership Policy
	Technology Development	Supply-based policy overload	Lack of environmental-based policies	Talent Policy
<b>Differences</b>	information support	Goal planning	Laws and regulations	Infrastructure
	evaluate standard	tax Incentives	Organizational leadership	Outsourcing

**Pay attention to the development of science and technology**

First-tier cities attach importance to the comprehensive integration and in-depth promotion of new-generation information technology in various economic and social fields. Policy content focuses on urban operation and management, economic structure upgrading and development, and social lifestyle change. The second is

technological iteration—emphasizing the iterative development of new technologies such as artificial intelligence, big data, the Internet of Things, cloud computing, virtual reality, and 5G to generate new applications, models, formats, and new services.

### **Lack of departmental resource integration**

In the process of smart city construction, there is a lack of main departments to take the lead in the overall planning, and each main department is insufficient in the ability to integrate resources and build a co-construction system based on the construction of various scattered projects. insufficient integration and construction capabilities. In terms of smart applications, more attention is paid to the construction of smart government, and far less attention is paid to the field of smart society, and there is relatively little introduction of new technologies into the wider social and people's livelihood systems. In the use of policy tools, the problem of structural imbalance is the most obvious, with supply-oriented policy tools accounting for more than two-thirds of the total, showing the characteristics of excess supply-oriented policy tools, insufficient environmental policy tools, and a lack of demand-oriented policy tools.

### Unbalanced use of policy tools

In the process of using specific policy tools, there are obvious structural imbalances, and the government also pays attention to the investment of resources in the construction of infrastructure, which weakens the pulling effect of the market effect. Too much dependence on supply-oriented policy tools, lack of investment and operation agencies, and more government entities lead to the construction of various projects, emphasizing the government's direct investment in construction funds. In terms of the use of policy tools, cities in the first-tier city circle have comprehensively considered the diversity and complexity of policy tools, and all policy tools are used. However, there are still problems of over-use of supply-type policy tools and under-use of environmental-type and demand-type policy tools.

Challenges in developing smart cities include uneven urban informatization construction and constraints on information sharing; aggravated information security problems and increased risk of information leakage due to informatization construction; uneven coverage of the smart people's livelihood service system; most people's livelihood. The development of the field is focused on building information, but it lacks depth and breadth. There are barriers to sharing information between different city departments, and multi-department cooperation has not been achieved. The legal standards for building smart cities are low, and people don't take part in them much.

The problems existing in the development of smart city policy include that the policy structure of smart cities presents a two-wheel drive of supply-based and environmental-based policy tools, but demand-based policy tools are obviously absent. Supply-oriented policy tools are overflowing, so it is difficult to rely on the role of market players for comprehensive construction. Innovative policies, such as big data, data opening, artificial intelligence, and other national policies, and the number of cities' environmental policy tools are slightly lacking. With the lack of demand-based policy tools and the lack of means to adjust market demand, policymakers may not have paid enough attention to the role of the market.

Insufficient in information construction, Beijing's policy is mainly aimed at the popularization of smart education information and lacks attention to the construction of environmental information. In addition, Beijing lacks the formulation of laws and regulations for smart finance and market laws and regulations for the construction of smart finance. The shortcomings of Shanghai's information construction and departmental cooperation are the most obvious in the development of smart transportation. The development of smart cars in Shanghai is mainly in Fengxian District, Jiading District, and Jingqiao District. Smart cars haven't been made better, and the environment that helps them needs to be improved even more.

The target planning is ambiguous, and the innovation direction of smart fire protection technology in Beijing is inconsistent and inefficient. As a new concept, smart fire protection has a short construction and development time, and a complete system

has not been formed in terms of technology research and development and application. Lack of communication mechanism between various departments. The construction of smart fire protection involves fire protection, safety supervision, public security, transportation, water supply, etc., and no policy has been established to coordinate information construction and cooperation between various departments. In Guangzhou, smart fire protection standards differ, and coordinated emergency response is limited. There is a shortage of smart firefighting talents, and team building is limited.

Contradictions in policy planning in the development of smart education, the planning time for smart education is very short, three years in Shanghai and two years in Jiangsu. It is impossible to systematically complete the construction of smart education and achieve the goal of training smart education talents. After the construction of Shanghai's smart government system, the traditional office process was canceled, the public was forced to choose online applications, and there was a lack of consideration for some groups and vulnerable groups. The smart economy hasn't caught up with the building of network infrastructure in rural areas yet.

The city does not pay enough attention to the lives of some disabled groups, and it is difficult to guarantee their basic life rights. In China, most disabled people and other vulnerable groups hardly dare to go out. On the one hand, they feel the outside world is dangerous. On the other hand, the city lacks certain care in their life and management, which makes the rights and interests of these special groups not



guaranteed, which makes their daily life prone to greater difficulties and problems. Similarly, urban construction, planning, and design lack pertinence and cannot help the disabled. In super-large cities with a population of more than 20 million, such as Beijing and Shanghai, it is rare to see that disabled people can normally use barrier-free facilities such as signage systems and blind lane systems, as well as use public transportation to travel, which shows that the existing cities are barrier-free. There may be certain problems in the design of the accurate test, and it is difficult to meet the usage requirements and habits of the disabled group in China at this stage, and it does not help this group of people.

Urban construction supervision is not perfect, reducing the usefulness of urban barrier-free facilities. In Shenzhen, blind lanes are occupied, and chairs for disabled people are occupied, making it impossible for disabled people to use them. The imperfection of these services is largely due to the low attention paid to these vulnerable groups, such as the disabled, which in turn causes more inconvenience to the disabled and forms a vicious circle. The government also lacks relevant publicity and popularization work in policy formulation.

Aspects in the development of smart cities include uneven urban informatization construction and constraints on information sharing; aggravated information security problems and increased risk of information leakage due to informatization construction; uneven coverage of the smart people's livelihood service system, most people's livelihoods being The development of the field is focused on

building information, but it lacks depth and breadth. There are barriers to sharing information between different city departments, and multi-department cooperation has not been achieved. The legal standards for building smart cities are low, and people don't take part in them much.

The problems existing in the development of smart city policy include that the policy structure of smart cities presents a two-wheel drive of supply-based and environmental-based policy tools, but demand-based policy tools are absent. Supply-oriented policy tools are overflowing, so it is difficult to rely on the role of market players for comprehensive construction. Environmental policy tools are weak. Innovative policies, such as big data, data opening, artificial intelligence, and other national policies, and the number of smart cities' environmental policy tools are slightly lacking. With the lack of demand-based policy tools and the lack of means to adjust market demand, policymakers may not have paid enough attention to the role of the market.

Beijing's policy doesn't pay enough attention to the construction of environmental information, and its main goal is to spread smart education information. In addition, Beijing lacks the formulation of laws and regulations for smart finance and market laws and regulations for the construction of smart finance. The shortcomings of Shanghai's information construction and departmental cooperation are the most obvious in the development of smart transportation. The development of smart cars in Shanghai is mainly in Fengxian District, Jiading District, and Jinqiao District. Smart cars

haven't been made better, and the environment that helps them needs to be improved even more.

The target planning is ambiguous, various departments in Beijing's smart fire technology innovation are inconsistent, and the efficiency is low; smart fire protection has a short construction and development time, and a complete system has not been formed in terms of technology research and development and application. Lack of communication mechanism among various departments The construction of smart fire protection involves fire protection, safety supervision, public security, transportation, water supply, etc., and no policy has been established to coordinate information construction and cooperation between various departments. In Guangzhou, smart fire protection standards differ, and coordinated emergency response is limited. There is a shortage of smart firefighting talents, and team building is limited.

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## CHAPTER 6: CONCLUSION AND DISCUSSION

From the perspective of policy tools, through the statistical analysis of 51 smart city policies in first-tier cities in China, we found that smart city policies cover three types of policies: environment-based, demand-based, and supply-based policy tools. At the same time, there are different problems and challenges, such as a low level of legalization and not enough social forces taking part in smart city policies. Suggestions for improving these problems have been made.

### 6.1 Conclusion

This research enriches the perspective and content of smart city policy research and has positive significance for improving and optimizing the smart city policy system. In China's first-tier cities, smart cities have been developed with initial typicality and representativeness, and the study of smart cities in China's first-tier cities and other cities in China and other parts of the world has significant participation.

Through a comprehensive and systematic review of all smart city policies in China's first-tier city circles from 2018 to 2022, this paper uses the perspective of text analysis to conduct a typed analysis of 51 policies, conduct preliminary statistics, and comprehensively recognize and summarize the government's role in smart cities in first-tier city circles. The overall characteristics and problems of policy issuance. At the same time, combined with the perspective of policy tools, the content analysis

method is used to conduct quantitative analysis to explore the government's preference for policy tool selection and application objects, find deficiencies, and propose improvement paths.

Based on the two dimensions of basic policy tools and smart city application types, the quantitative analysis of smart city policies in the first-tier city circles is carried out, and two main conclusions are drawn. First, in constructing smart cities in the first-tier city circle, various policy tools are used, but there are structural imbalances. The use of smart city policy tools involves three categories: supply, environment, and demand; as well as infrastructure platform construction, technical support, and capital investment. Among them, the supply-oriented policy tools are overflowing, accounting for the total number of policy tools; the environmental-oriented policy tools are weak; the demand-oriented policy tools are absent. There is also an uneven use structure among the basic policy tools that fall into these three types of policy tools.

Second, policy tools cover most of the areas of government, market, and society in constructing smart cities, but there are biases in specific applications. The government of the first-tier city circle is working hard to build smart cities. To do this, they are putting a lot of effort into developing the smart industry, and most of their policy tools are focused on this area. They are also working on improving the smart government, but they pay the least attention to the smart people's lives.

Among them, the three fields' most frequently used policy tools are infrastructure platform construction, and the use of other tools is similar. characteristics and a lack of differentiation guidance.

In general, the smart city policy in the first-tier city circle has developed rapidly and has good momentum. The policy orientation is clearer, the text is richer, and the content is more comprehensive. It has played an important role in guiding and supporting the promotion and construction of smart cities. The development of smart city policies also exposes problems such as imbalanced coordination and coordination, the weak rule of law, unbalanced policy tools, and limited participants. The following sections propose corresponding improvement paths for these problems.

## 6.2 Discussion

### 6.2.1 Different patterns of smart cities

Beijing and Shanghai are the earliest first-tier cities in China and are supported by sufficient state funds. As an economic, political, and cultural center, Beijing has concentrated many local and migrant workers. As a port city, Shanghai has experienced rapid economic development and a high level of internationalization. Therefore, Beijing and Shanghai have concentrated many people, with a total resident population of 50 million local and non-local. As a result, the population density is high, and the aging situation is serious. The development of smart cities in Beijing and Shanghai focuses on the development of smart city governance and smart communities. Beijing and

Shanghai are trying to use smart communities to alleviate the pressure of old age and medical treatment caused by aging. Second, Beijing and Shanghai are working hard to build "one-stop service centers" that will give people a platform for e-government services that will meet their needs and help the people.

In the development of Guangzhou and Shenzhen, the number of residents in Guangzhou reached 18.68 million in 2020, while at the same time, Shenzhen's resident population was 17.67 million. At the same time, since Guangzhou and Shenzhen are coastal economic zones, the local population is also a migrant population, mostly young people from other cities in China. Therefore, more emphasis is placed on the development of science and technology. Chinese internet giants Tencent, NetEase, Alibaba, and Apple have all set up companies in Shenzhen.

#### 6.2.2 Supply-based policies excesses

Among the first-tier cities in China, all of them are provincial cities or special economic zones, except Guangzhou, as the provincial capital city. The government has sufficient financial strength and a talent base. In 2017, Beijing created a GDP of 4,027 billion yuan. In the same year, Shanghai had a GDP of 4.321 billion yuan, similar to that of Guangzhou and Shenzhen. Due to the strong economic strength of first-tier cities and the support of clear talent policies, they provide both talent subsidies and technology research and development subsidies. So, the development of smart city



policies in first-tier cities follows a top-down model, and most of the policy tools, like government leadership and financial support, are supply-based.

### 6.2.3 Lack of demand-based policies

Demand-based policies rely on market dominance. Due to the high cost of smart city applications in market-based operations, market-based development policies have funding problems in the early stages. In the early stages of smart city development, the use of smart applications is still concentrated. Because of urban infrastructure construction and urban management, there is no good combination of market and commercial operation. In addition, smart facilities all require high-cost research and development to a certain extent, and related products are relatively expensive when they are sold on the market in their early stages. A single customer can't buy and use a customized smart city product because they don't have enough money. For example, products related to smart communities are mostly used in smart city pilot projects and haven't caught on with a lot of people in the market.

Unbalanced policy tools Policy tools should be balanced, which does not mean balanced in numbers but should be balanced in the distribution of the details of the policy itself. According to the conclusions of the systematic review, smart city policy support for SMEs has not really been implemented. There is no corresponding smart city evaluation standard in the environmental policy tools. Since China's smart city ecology is the development direction set by the central government, local

governments develop places according to their own understanding. Due to the different economic levels of local governments and different understandings of smart cities, different standards have been developed for smart city application and management. In terms of legal standards for smart cities, China should implement national unified standards to improve the legal environment, promote the protection of smart city-related patents, and encourage small businesses to research and develop patented technologies. This would help smart cities grow in a healthy way.



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## VITA

**NAME** YIN MINGQING

**DATE OF BIRTH** 12 December 1997

**PLACE OF BIRTH** China

**INSTITUTIONS ATTENDED** Chulalongkorn University

**HOME ADDRESS** Ideo Mobi Tower A, 2097/246 Sukhumvit Rd./  
Bangchak/Phra Khanong District/Bangkok 10260

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