URBAN DEVELOPMENT AND URBAN PLANNING IN CONTEMPORARY CHINA—A CASE STUDY OF CHENGDU

by

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ABSTRACT

China has been confronting an unprecedented urban development ever since the initiation of economic reforms and the ‘open door’ policy in the 1980s. The urbanization in China has its very own characteristics due to its special political structure and cultural and historical background. Meanwhile, China has faced the transition from a centrally planned economy to a free market economy. Facing the rapid urban growth and socio-economic change, however, the urban planning in China is actually far behind the development pace and needs reforms in both institutional and philosophical aspects. In addition, urban planning should have innovation to guide the unexpected fast urbanization process and to achieve a sustainable development in the new century. In this paper, the urban development and urban planning in contemporary China will be examined by the case study of Chengdu—one of the largest metropolises in Western China. In this research, historical materials were collected to show the historical background of China and Chengdu’s changing urban development and urban planning practices from 1949 to 1976. Statistical data and government documents were collected to assess the economic development and demographic transition in Chengdu. In addition, GIS (Geographic Information System) were using in this study for spatial analysis. Land use and urban planning maps were applied in ArcGIS to reveal the detailed urban land use changes and urban growth patterns in Chengdu in the past two decades. Also, some important urban development projects and programs are discussed and illustrated by photos in this study as the results of the urban planning and various government strategies. The purpose of this research is to show the result of the ‘Go west’ program that launched by the national government in 1999, also, to reveal the great economic and urban development potential of western Chinese cities in the near future. The case study of Chengdu will provide a better understanding of the driving forces behind urbanization in contemporary China and the factors shaping this process. A better understanding of the economic and urban development in western China could improve the government’s decision-making process for lessen the differences between eastern and western China in the future.

CHAPTER 1

INTRODUCTION

China has had unprecedented economic growth and urban development during the past three decades. In the process of economic development and urbanization in China, the emergence of development imbalance became a big issue. Since 1978, China has brought forward the 'Open Door' policy to its east coast cities to improve the economic development, and also brought out the strategy of unbalanced development. The unbalanced development strategy was intended to establish a number of economically vigorous "industrial bases" along China's eastern coast, by virtue of this region's superior location and associated comparative advantage, and then spread development momentum into its hinterland (Cheng, 2008). Along with the economic reforms in coastal China in the 1980s and the implementation of unbalanced development strategy, the differences between eastern, central and western China became evident. Since the late 1980s, increasingly widening income gaps between coastal and inland provinces have created widespread public concerns toward the unbalanced strategy.

The government policies deeply influenced the quality of the investment environment, the locations of foreign investment, and the widening disparities of regional economic development. Thus, in 1992, ten cities along the Yangtze River, various border cities, and all the capital cities of inland provinces were targeted as new open cities, and enjoyed China's favorable policies that encourage FDI (Foreign Direct Investment). Since 1999, the Chinese government has implemented a series of comprehensive

preferential policies to encourage economic development in China's central and western areas. The new policy, known as the 'Go West' Program, consisting of increased government investment, enhanced infrastructure improvements, and enlarged fiscal transfers in western China, was designed to shorten the gap between eastern and western China ultimately. As the result, the cities in western China have played a more important role in national economic development. Along with the saturated emerging markets in the eastern coastal cities and largely increasing financial input in western China, China's development is has rapidly expanded to the west. This thesis needs to answer the following questions. What are the new development process and patterns of the western cities in economy, population and land use? What are the main driving forces behind the rapid changes and how they influence the new development tendencies of the western cities? Chengdu, the capital city of Sichuan province and one of the largest metropolises in western China, serves as the thesis' study area.

The 'Go West' program not only brings opportunities to western China, but also challenges to the urban planning of all Chinese cities; Chinese cities are faced with the issues of massive rural-urban migration, environment pollution and historical heritage loss. In this research, Chengdu's urban development and urban planning practices since 1949 are examined through the detailed analysis of economic structural changes, rural-urban migration, urban land use changes, and government policies in urban development and economic growth; in order to evaluate the influences of government policies and strategies in Chengdu's urbanization and modernization process. Historical materials, government documents, and official statistical data are collected and analyzed to explore

the economic structure changes and demographic transition. By using GIS (Geographic Information Systems), land use and planning maps are collected and used in ArcGIS to support a detailed spatial analysis of Chengdu's land use changes and urban growth patterns. In addition, some important urban development projects and programs are discussed and illustrated by photos as the results of the urban planning and various government strategies. As a general background, Chengdu's urban development and urban planning system are also evaluated thoroughly.

Owning to data limitations, there are some difficulties in the performance of this research. For instance, some of the statistical data lack consistency. For a type of data like land use, the category and unit of the land use changes are different from year to year, which caused a great problem in the accuracy of analysis. Due to various standards and frameworks used in creating the spatial data, the geographic data that was collected from different departments cannot be used together, resulting a spatial analysis challenges. What is more, much of the data are not accessible, because of the security concerns by the Chinese government. Nevertheless, due to the lack of studies in western China, this study makes a great effect for a better understanding of the urbanization patterns of Chinese cities, and created a comprehensive image of Chengdu's urban growth and urban planning for future studies of the western Chinese cities.

Chengdu municipality is characterized by a vast territory, abundant resources, a large population and a long history of civilization (Figure 1). Chengdu was not only rich in natural resources for different dynasties but also significant owing to its strategic location for national defense. In the last two decades, Chengdu has undergone a rapid

economic development that has led to an impressive process of urbanization. To stimulate economic development, a great number of special economic zones and high-technology industrial parks were established to attract FDI over the past twenty years. Along with economic growth, the urban population of Chengdu has increased from 1,125,000 in 1949 to 7,020,000 in 2010; the urbanization level of Chengdu has also risen dramatically from 22.4 percent to 63.2 percent during the same period.

Several factors have shaped Chengdu's economic and urban growth during its transition from a centralized economy to a market economy, including urban planning programs, changing economic structure, and massive population migration. Government policies always have had great influence in the process of the city's development, and urban planning is one of the most important tools to support the government's decision-making to guide urban development, the changes of urban planning strategies of Chengdu need to be studied. Although coastal cities receive the lion's share of FDI, the new wave of industrial estate development and joint venture industry in Chengdu indicates significant land development both in city structure and function (Schneider, Seto, Webster, 2005); which also shows the dramatic economic growth and economic structure changes during the process of changing land use. The massive rural urban migration in Chengdu has stimulated the process of urban growth and urban expansion patterns in the past decade. The case study of Chengdu provides a better understanding of the dramatic urbanization process that is occurring in contemporary China, especially in western China.

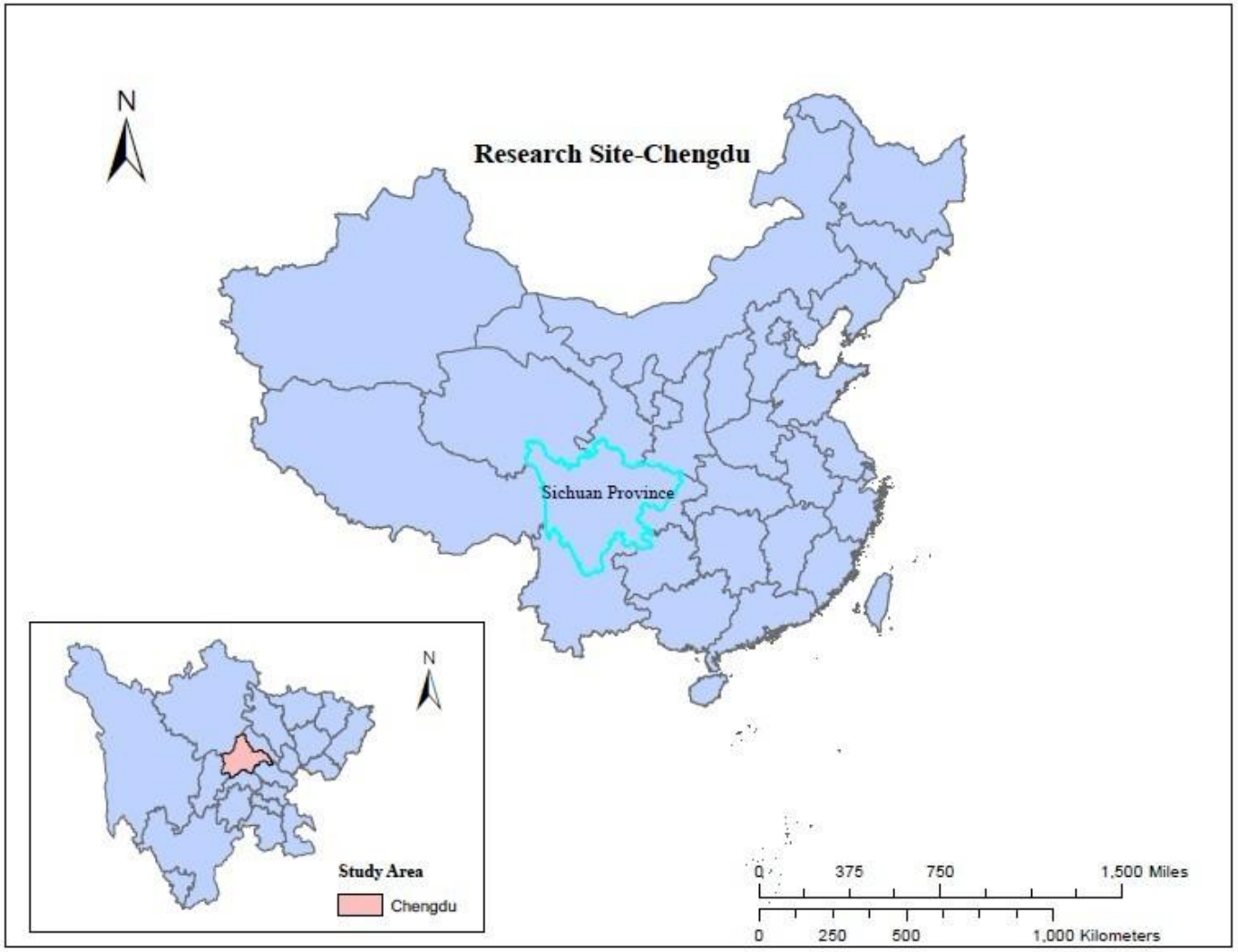


Figure 1: Research Site—Chengdu (By author)

Despite the regional disparities, western China also faces the unbalanced development between rural and urban areas. Like most parts of western China, the territory of Chengdu municipality includes a large rural area. The rapid growth of provincial capitals and the relatively slow growth of the rural economy in many areas of west China have led to increasing social and economic disparities between urban and rural populations (Hong, 2004). Previous studies on China's urban development are mainly focused on eastern China; however, as western China plays a more and more important role in China's current and future development, this region needs more attention by scholars. At present, as the core of Sichuan Basin, and being one of the earliest open cities in western China, Chengdu has become the economic and cultural center of Sichuan Province and southwest China. According to its Master Plan from 2003-2020, Chengdu is now targeted as a technical center, business center, and financial center, as well as the hub of communications and transportation for the southwest China region. Chengdu, combined with Chongqing municipality, has become the strongest force for the 'Go West' program.

Urbanization has been traditionally defined as the process of city formation and city growth. It is the process of movement of people from rural areas to urban places where they involve non-agricultural activities. As one of the countries with the longest history of civilization, the Chinese tradition of urbanization can be traced back to 2500 BC. By the time of the Shang Dynasty (1600-1066 BC), an extensive network of towns had appeared, and located at the fertile and temperate areas in the east central part of China. During the Spring and Autumn Period (770-476 BC), commercial activities

prospered by reason of the development of the transportation system, especially the construction of the Grand Canal. This led to a big increase in both the number and size of cities. Many individual towns occupied an area of 25 km^2 or more, and a much broader regional distribution of towns was established. The Qin Dynasty (221-207 BC) marked the turning point of China's urban development, by founding a feudal empire in which power was centralized, establishing an autocratic and administrative hierarchy, and dividing China into 46 states and almost 900 counties. By building the hierarchy, the urban areas were separated from the rural regions and cities started to develop. In the Tang (618-907) and Song (960-1279) Dynasties, the urban population growth rate was faster than the rate of growth of the nation's total population. Ancient urban growth in China reached a peak in the Tang-Song period. Xi'an, in the Tang Dynasty, was one of the world's largest cities. The urban population proportion of 10 percent remained almost the same from the Tang Dynasty to the Ming Dynasty (618-1644), and there was a slight decline during the Qing Dynasty (1645-1911) and the Republic of China's ruling period (1912-1948) due to the war (Zhang Xingquan, 1991).

The process of urbanization in developing countries can be observed by the increase in the number and size of cities. In 1949, China started its socialist era that signaled a major shift in its urbanization process. From 1949 to 1998, the numbers of cities grew from 132 to 668, an increase of more than five times (Table 1). At the beginning of the socialist period in 1949, 10.6 percent of China's 542 million people lived in urban places. By 1979, influenced by the effects of the "Great Leap Forward" and "Cultural Revolution", the number of the urban population only increased to 975

million and occupied 19 percent of the total population. While China has undertaken reforms on its centrally planned economic system since the late 1970s, combined with the 'Open Door' policy, urbanization has experienced continual changes. By 2005, the urban population had reached 562 million, amounting to 43 percent of the total population (L. Zhang, 2008).

Table 1: The growth of Chinese cities
(Source: China Statistical Bureau, 1999)

Year / Number Of Cities		1949	1978	1998
Extra-large (>1million)		5	13	37
Large (0.5-1million)		7	27	48
Medium (0.2-0.5)		18	60	205
Small (<0.2million)		102	93	378
Region	Eastern	69	69	300
	Central	50	84	247
	Western	13	40	121
Total		132	193	668

In present day, China is still the biggest developing country with the largest population and rapid urbanization process. Due to the economic reform and 'Open Door' policy, China has witnessed an extreme economic growth and rapid urban development

since the 1980s. Today, China is the world's fastest growing economy, with real GDP growing continuously at the high rates around 9-12 percent per year for more than 15 years. Nevertheless, China's urbanization level is still persistently lower than the world's average. Therefore, this study presents a special angle of urban economic geography to assess China's contemporary urbanization and urban planning.

CHAPTER 2

A HISTORICAL REVIEW OF URBAN DEVELOPMENT AND URBAN PLANNING IN CHINA

Urban Development in China Since 1949

Although China's modern urban development started just 100 years ago, through archaeological records, primarily from excavations at Anyang in the lower Wei River valley, China's urban history can be traced back to the late Shang Dynasty, or about 1600 BC in the North China Plain. More reliable information dates from about a thousand years later, during the period of small principalities known as the Western Zhou (Friedmann, 2005). There are some compelling reasons to look at China's urban transformation and urban development. Firstly, China is one of the oldest civilizations in the world, and thus, historical background is one aspect that makes China's urbanization very unique. Secondly, China is the largest socialist and developing country, and its special social-political system has deeply influenced the urban development process and patterns that are totally different from those in the West. Thirdly, due to its relatively stable political situation, rapid and sustainable economic growth and industrial development, China has already emerged as one of the major economic powers not only in Asia, but also in the world. Therefore, as the largest developing country in the world, Chinese cities have undergone a dramatic transformation since the foundation of the People's Republic of China in 1949. To look at this process in detail, the urban development of China since 1949 can be divided into three stages: a. Mao's period

(1949-1976), b. Post Mao period (1978-1995), c. the period since 1995. To provide a better understanding, the development history of China since 1949 could also be subdivided into the three steps: the socialist urbanization; the reform-era urbanization combing socialism and capitalism; and then the globalization and the modern urbanization in present China.

Mao's Period (1949-1976)

The People's Republic of China (PRC) was proclaimed in 1949 after the end of the civil war with Chiang Kai-shek's Republic of China. Once order was restored, the new regime set up a course of centrally planned 'forced march industrialization'. The early years of China saw a huge influx of population into the cities. The urban population almost doubled from 1949 to 1960, and reached 19.7 percent from 10.1 percent. Nevertheless, the early development was soon followed by a stressful period of de-urbanization, which stabilized the urbanization level until the early 1970s. There are several important events that had great influence on China's urban development.

The First Five-Year Plan (1952-1957): China followed the Soviet Union's model of economic growth, characterized by heavy emphasis on the development of city-based industries, de-emphasis of urban housing and tertiary services, and strict control of rural-to-urban migration. The level of urbanization was kept below 20 percent prior to the 1978 reforms (Ma, 2002). This low level of urban growth lends support to the development of industrialization with controlled urbanization. This period laid down the basic spatial framework of China's urban development according to the centrally planned economic

policy that remained effective until the 1978 reforms. During this period, the government settled a large number of national projects in Chengdu and its suburban areas; this helped to accomplish the preliminary industrialization, and also improved the urbanization in Chengdu significantly. By the end of 1957, the total population of Chengdu had already reached 5,942,000, and had an urbanization level at 23.3 percent (Chengdu Statistic Yearbook, 2004).

Great Leap Forward (1958-1960): Since the First Five-Year Plan, political and economic events have made Chinese urbanization unique from other socialist nations. One of the important historical events is the Great Leap Forward that produced industrialization based on iron and steel production. During that time, the entire nation was mobilized to reach unrealistically high targets of economic production. Hundreds of thousands of peasants came to the cities and suburbs to work in poorly equipped factories, leading to a brief period of 'over-urbanization' and 'spurious urbanization' (Zhou, Ma, 2000). The Great Leap Forward disturbed the trajectory of the social economic development, and brought a large number of the agricultural population into the city; however, the industrial production was decreasing dramatically during that period.

Third Front Construction (1964-1980): Another important industrialization process connected to urban development in China is the Third Front Construction. This is the period from 1964 until the economic reform in the beginning of the 1980s, and the government focused on preparing for war, and locating industry projects close to raw

materials. Third Front Construction arranged the nation into first, second and third lines, concentrating especially on constructing the third line area, which resulted in a spatial strategic transfer in the development of the industrialization process. The launch of the Third Front Construction initiated a process of decentralizing urban industries and people from the densely populated coastal provinces to more widely dispersed and isolated sites in the interior (Zhou, Ma, 2000). During that time, the Chinese government invested heavily in the central and western areas, and built the region's initial modern industrial base. For instance, starting in the late 1970s, the movement of "Third Front" firms from extremely remote locations to more central locations drove the development of the ring of peri-urban satellite cities around Chengdu (Webster, Cai, 2004). The promotion of industrialization during the Third Line construction at Chengdu improved Chengdu's urban development to some extent and also helped the establishment of a basic industrial system in Chengdu.

The Cultural Revolution (1966-1976): Chairman Mao conceived and launched the Cultural Revolution. He looked to the peasants as a source of revolutionary creativity and a reliable base for broad and lasting support of China's 'permanent revolution'. As a result, the political chaos during this period made a significant process of de-urbanization. About 26 million rural migrants were sent back to the countryside, and around 17 million urban youths were forced to go 'up to the mountains and down to the countryside' to labor alongside peasants (Oakes, 2006). What is more, a large number of urban elites were also sent to the countryside to learn the virtues of hard work from the peasants. In the meantime, many factories and industrial workers were forced to move

from the eastern part of China to widely dispersed mountainous regions in the western interior. It was not until the 1978 reforms that the level of urbanization began to increase steadily without violent disruptions. Thus, urban development in China during the pre-reform age had the characteristics that differ from other socialist countries in the world. The de-urbanization since 1949 through controlling the rural-to-urban migration and sending people to the countryside had several reasons: The economic development level of socialist China was relatively low; agricultural productivity was also low and needed as many workers as possible to support the large population. In addition, the secondary and tertiary industries in China fell behind the times. Therefore, under the centrally planned-economy, due to the lack of food and commodities supply, the cities could not support large populations. Nevertheless, confronting the threats from the countries nearby, the pace of urban growth had been slowed down, and the priority of the development of heavy industry was much higher than the construction of the cities.

Post-Mao Period (1978-1995)

The Cultural Revolution ended after Mao's death in 1976. The regime changes initiated in 1978 have brought a new mechanism for urban development in China. Deng Xiaoping's administration started to implement economic reforms and put forward the 'Open Door' policy to change China's economy from a centrally planned system to a free market system. This transition was a great breakthrough for economic growth and urban development in China (Yeh, Wu, 1999). In 1988, Deng Xiaoping explained, "the coastal areas, which comprise a vast region with a population of 200 million, should accelerate their opening to the outside world, and we should help them develop rapidly first;

afterward they can promote the development of the interior". The unbalanced regional development strategy led to a rapid urbanization process in coastal China, and helped China to achieve great economic development in the past thirty years. Also, during this period, the municipal regions were enlarged greatly due to the policy of 'Shi dai Xian' (city leading counties), by which the surrounding county areas were merged into the urban areas. The economic reform shifted China from a rural-based economy to one that is increasingly urban-based with growing employment in manufacturing and service-oriented jobs (Pannell, 2003). Increased labor demand in urban areas has resulted in a rapid rural-urban migration wave, which significantly raised the urbanization level in China, especially in the coastal regions, during this period.

The Rapid Growth Period (1995-present)

The dramatic urban development in coastal China widened the economic gap between coastal and interior regions. The central and western regions lagged far behind not only in resource allocation from the central government but also in sectoral transformation. Living standards in the interior region fell further behind of eastern coastal areas. To shorten the gap, Chairman Jiang Zeming embarked on the 'Go West' Program. He proposed the Western Development Strategy during the Ninth National People's Congress in March 1999, formally spelling it out in two speeches duing June 1999. He declared: "…In continuing to accelerate the development of the eastern coastal region, we should lose no opportunities to speed up the development of the central and western regions. From now on, this should become a major strategic task for the party and the state, and should be placed in a more noticeable position." By June 17th, at the

Conference on the Reform and Development of State-Owned in the Five Northwestern Provinces in Xi'an, Jiang first used the phrase "great western development", which marked the birth of the western development policy (Lai, 2002). The promotion of this policy would certainly help to reduce the economic disparity and to accelerate the urbanization process in western China (Lin, Chen, 2004).

Coinciding with the economic reform, globalization became one of the main driving forces behind China's rapid urbanization. The Chinese market started to open up to international trade and foreign investment. Seeing an opportunity for growth in massive urban markets, the world economy also opened up for China's exports (Chow, 2003). Special Economic Zones were identified first in China's east coast to attract foreign investments due to their accessibility; various factories were funded by international companies and located in coastal China due to the preference policy and the cheap labor force. More and more products with the tag "Made in China" sold all over the world. As China continues to become an important member in the global economy, urban growth is accelerating. As shown in the table below (Table 2), by 2000, China's urbanization level had increased more than 10 percent since the economic reform. The urbanization level increased extremely fast among those coastal cities, such as Shanghai, Guangdong, Zhejiang and Fujian.

Table 2: The urbanization level changes from 1982-2000
(Source: Jianfa Shen, 2006)

Estimated national and provincial levels of urbanization 1982-2000(%)

Region	1982	1985	1990	1995	2000
Shanghai	60.28	63.21	69.05	81.63	88.31
Beijing	66.92	68.3	70.91	75.78	77.55
Tianjin	70.40	72.46	74.05	74.87	71.99
Guangdong	19.76	24.68	36.82	54.25	55.66
Liaoning	43.41	48.57	51.02	53.90	54.91
Heilongjiang	41.13	44.49	48.33	49.90	51.53
Jilin	40.62	44.37	47.62	50.37	49.66
Zhejiang	26.35	31.91	36.67	41.15	48.67
Inner Mongolia	29.57	32.21	36.60	38.56	42.70
Jiangsu	16.21	19.94	24.84	31.10	42.25
Fujian	21.71	25.27	29.20	36.45	41.96
Hainan	12.68	na	24.44	31.14	40.68
Hubei	17.75	22.53	28.78	35.35	40.48
Shandong	19.54	25.33	30.35	36.63	38.15
Shanxi	21.54	27.33	29.85	32.12	35.21
Xinjiang	29.10	33.19	33.31	33.57	33.84
Chongqing	15.10	na	na	na	33.09
Ningxia	23.04	24.08	28.95	31.70	32.44
Qinghai	20.99	28.44	30.92	31.77	32.44
Shaanxi	19.47	23.78	25.70	27.72	32.15
Guangxi	12.12	14.47	17.51	24.09	28.16
Jiangxi	199.93	21.33	23.00	25.15	27.69
Hunan	14.56	16.86	19.84	23.53	27.50
Sichuan	14.45	16.97	19.65	24.95	27.09
Anhui	14.51	16.01	19.34	23.29	26.72
Hebei	14.04	17.14	19.19	22.29	26.33
Guizhou	19.39	21.05	21.02	23.31	23.96
Gansu	15.72	18.31	20.73	22.13	23.95
Henan	14.83	15.67	17.53	21.17	23.44
Yunnan	13.27	15.85	17.75	20.10	23.38
Tibet	9.70	9.63	11.01	13.77	19.43
China	21.39	24.72	28.27	33.28	37.04

A Historical Review of Urban Planning Development in China

China's modern urban planning started in 1949, and its development and change could be studied from the following different periods.

Mao's period (1949-1976)

During this period, China's urban planning followed the Soviet Union model. Urban planning was mainly focused on physical planning. The main task of urban planning was to choose the best location for industrial development projects. The analysis of China's urban planning for this period could be divided into three sub-stages.

1949-1953: After the founding of the People's Republic of China in 1949, China was facing a poor economic situation with a seriously damaged urban infrastructure and social system. Under these circumstances, economic recovery and urban reconstruction were priorities for the government. Hence, urban planning was not a priority over this period.

1954-1965: After a few years of recovery, the Chinese government decided to follow the USSR's development model—emphasizing balanced development, with the theory of arrangement of socialist production. The National City Planning Bureau was established within the ministry. As the first central urban planning institution, the 'centrally planned economy' became the principle of the Chinese economic and urban development. Because the Chinese planners were educated from professionals from the Soviet Union and followed the USSR's path, urban planning in China mainly focused on

the physical planning for economic development and industrialization projects rather than on the quality of urban life. Basic sanitation and utility facilities in urban areas were constructed, and also the Central Financing and Economic Development Committee in charge of economic-social development plans were established. During the First Five-Year Plan period, urban planning programs were dominated by pure physical construction and engineering design, planners were mostly architects, and the municipal governments had much less power than central government ministries. In fact, urban planning at that time mainly served industrial development; thus, planning was primarily concerned with the distribution and development of industry (Dwyer, 1986). Planning rationale was guaranteed by an overall socialist planned ideology and the main technical function of physical planning was to implement an economic arrangement, or to materialize national economic strategy (Wu, 2007). During the Second Five-Year Plan, the Great Leap Forward occurred, which led to some serious economic problems. City planning, which led to the production of blueprints, became the scapegoat of economic failure. In the later half of this period, the government had faced a difficult time owing to its unseasonal three-year natural hazards from 1960-1962, and the broken relationship with the Soviet Union, economic and urban development had decreased dramatically. There was no infrastructure and housing construction, and planning department had not played a part in the government in that period (Zhang 2002). Hence, city planning was abandoned during that time.

1966-1976: From 1966-1976, China had the Cultural Revolution, which almost destroyed China's entire economic and political foundation and isolated China from the

outside world. Planners, as well as other professions, were viewed as useless or even harmful to proletarian politics by the party-state. Planners and professions were forced to receive reeducation in factories and farms. In addition, planning institutions and activities were eliminated in most cities for ten years.

Post-Mao period (1978-1995)

After Mao's death, Deng Xiaoping ended the Cultural Revolution. By then, Deng initiated reforms to try and speed up economic development and fundamentally change the bad economic situation. Planning activities began to recover, the planning profession started to rebuild, revise and develop master plans, which improved the development of many cities and towns in the 1980s. Also, urban planning in China at that time was guided by ten major goals that divided into three groups (Bor, 1989):

a. The first priority was the stabilization of China's fast-growing population. By 2011, China has a population of more than 1.3 billion. The second priority was the development of industry with the necessary infrastructure. The third priority was to provide more and better housing.
b. The next group of four goals aimed at dispersed urbanization. The growth of large cities was to be restrained and deflected to satellite new towns. The growth of small and medium sized towns was to be encouraged. The polarization between town and country was to be reduced. Cities should be planned as an integral part of their region.
c. The last group of three goals is concerned mainly with environmental development issues. The quality of air and water was to be improved. Historic

sites and buildings should be conserved and restored. Tourism, both domestic and foreign, should be increased.

As a result of these initiations, a significant revival of urban planning has taken place in accordance with national priorities that have been revised to emphasize urban housing and the necessity for better living conditions generally (Dwyer, 1986). In 1979, the government announced a national urban policy that emphasized controlling expansion of large cities, rationally promoting the development of medium-size cities, and actively encouraging growth of small towns. In the beginning of 1984, the State Council created the City Planning Ordinance, which established basic norms for planning and specified the requirement that all municipal and country governments should have master plans to guide their physical development. Planning as a government function increased rapidly. As a result, within that year, nearly 83 percent of all cities and more than one half of all counties had completed plans (Leaf, 1998). Furthermore, there is another significant event during this period—the creation in1989 of the City Planning Act of China. This Act, consisting of six chapters and 46 articles, was endorsed by the Eleventh Meeting of the Standing Committee of the Seventh Session of the National People's Congress on December 26th 1989 and became effective on April 1st 1990 (Ng, Wu, 1995). This act not only consolidated various practices listed in previous planning-related regulations, but also formalized and systematized various levels of plan formulations which had been introduced by provincial and local authorities in order to cope with problems emerging from economic reforms introduced in 1979. One of the main objectives of the act was to enhance the established policy of 'keeping strict control over the size of large cities and

rationally developing medium-sized cities and small cities, so as to promote a rational productivity and population structure'.

The Post Reform period (1995- present)

The core of Deng's economic development strategies is to rethink the successes and failure of the past thirty years and to utilize the ideas of the balanced development—'common prosperity'. The dramatic development in littoral areas helped to build the foundation of the later policy to implement regionally coordinated development. The average national economic growth rate was more than 8 percent from 1990 to 1999. This rapid economic development led to rapid urbanization. About 150 million people have migrated from rural to urban areas in the past two decades, and urban population has grown from 19 percent of the total population in 1980 to 29 percent in 1994 and more than 30 percent in 1998. By 2010, 666.57 million people or 49.68 percent of the total population lived in urban China. During the past fifteen years, China has undergone a remarkable economic growth. The rapid process of urbanization is unprecedented, too. Thus, the shortcomings of the conventional urban planning system have been revealed during the economic reforms. Inadequate development controls have led to the diminishing effectiveness of urban planning. Therefore, the government realized that the urban planning should enhance economic competitiveness, branding places, and serving local investment. Urban planning is required to change its functions from supporting state projects to regulating undesirable land development (Yeh, Wu, 1999). To deal with those challenges, there are several recent changes in the urban planning system as compared to the 1989 City Planning Act. The new practices include urban district planning, detailed

development control plan (DDCP), proposal of zoning ordinances and other land leasing plans. Political elites and professionals also started to make suggestions for the planning system, along with gathering advice from consultants rather than just from the government departments and national planning standards.

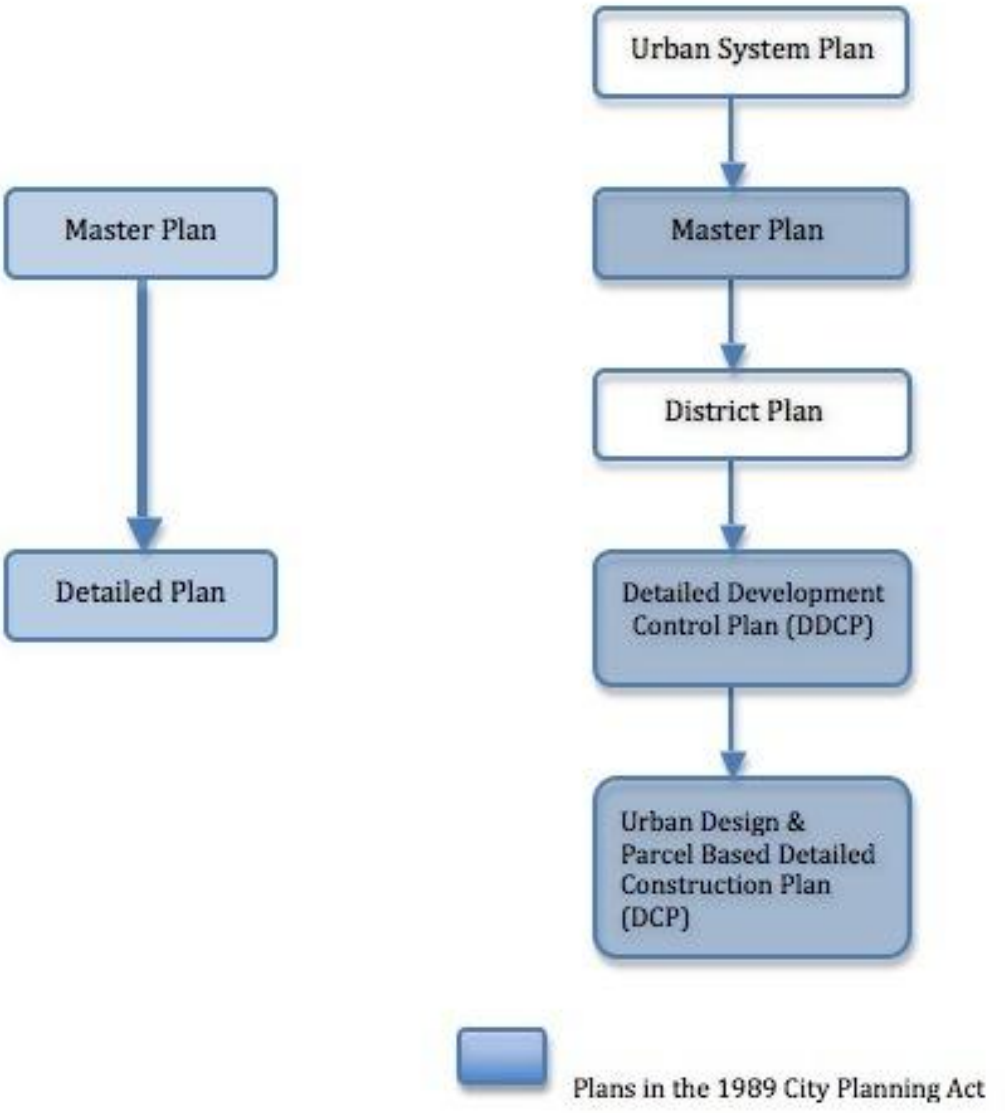
The Changing Urban Planning System in China

The 1989 City Planning Act, consisting of six chapters and 46 articles, is one of the most important planning acts brought about by the Eleventh Meeting of the Standing Committee of the Seventh Session of the National People's Congress. As illustrated by the 1989 City Planning Act, the function of urban planning is to define the size and economic orientation and structure of a city, to realize the goal of economic and social development of the city, to prepare 'rational' city plans and carry out the construction to meet the needs of development for socialist modernization (Article 1-City Planning law of the PRC, 1989). In this act, urban planning contains two tiers—the master plan and the detailed plan. The top tier is the master plan that outlines the general land use pattern of the city. Below the master plan is the detailed plan for the area that faces immediate development or is specified in the master plan (Table 3). However, the 1989 City Planning Act has many shortages, therefore, along with the rapid economic and urban developments in China, there are some improvement for the urban planning system (Figure 2). For instance, urban system plan is a type of urban plan to coordinate the growth of cities and towns within the city-region. As the master plan of the Act only covers the central city and sometimes even only the city proper of the central city, urban

system plan is used to arrange infrastructure projects in the city-region where the master plan does not cover. Urban district plan can be prepared after making the master plan to further control land uses at the district level, as well as to coordinate various infrastructure and public facilities in the district (Yeh, Wu, 1999).

Table 3: Two Tiers of urban planning in China
(Source: Yeh, Wu, 1999)

The Urban Master Plan	--The designated function of a city --The development goal and target planning size of the city --The standards, norms and criteria for the main constructions in the city and --The land use structure, functional land use differentiation and the general layout for various types of constructions --The comprehensive transport system, water space and green space system, sectoral planning and planning for short-term constructions.
The Urban Detailed Plan	--Based on the urban master plan or urban district plan to stipulate the detailed plan for the various construction projects within the short-term development area of the city. --The urban detailed planning should include the boundaries of each construction project within the planned plot, control indices such as building density and building height, general layout plan, utility engineering plan and three dimensional site plan.



Past Urban Planning System Present Urban Planning System

Figure 2: The Changing urban planning system in China
(Source: Yeh, Wu, 1999)

As an important tool for the government to help guide urban development, the urban planning system is always changing. Especially after China's economic reform,

confronting the transitional economic system, city planning has survived market-oriented reform, and has taken into account on-going social and economic changes (Xie, 1993). The market reform has led to changes of hierarchy and function of planning system. In addition, during the era of economic reform, there is always a changing relationship between urban development and local government. Government strategy is the basic determination of the direction of the urbanization process. Under the transitional economy, the local government starts to gain more power during its own urban planning. In other words, the decision making process is decentralized into localities, either municipalities or urban districts, through economic reforms (Table 4). Therefore, the impact of local urban planning has increased during the past thirty years, which provided land use rights, consequently increased the housing and allowed the opportunity for urban planning to evolve toward a more realistic and locally-oriented practice.

Table 4: The hierarchy of China's urban planning system
(Source: Tingwei Zhang, 2002)

National Institution	-- Ministry of Construction
Provincial Institution	-- Department of City Planning in the ministry -- Department of Construction in Provinces -- City Planning Division in the department commission
Municipality Institution	-- Bureau of City planning in cities or office of city planning in bureau of construction in small towns
Urban District	-- Bureau of city planning in urban districts in cities

CHAPTER 3

RESEARCH SITE: CHENGDU

Geographic Locations and Physical Environment

In this research, Chengdu has been chosen as the study area. Chengdu is the capital of Sichuan Province, the wealthiest and most populous province in southwest China. Sichuan is situated in the upper reaches of the Yangtze River, and surrounded by mountains. The terrain is complex with mountainous and plateau areas accounting for 78.82 percent of the region. Sichuan province is located at the edge of the Aihui-Tengchong line—an imaginary line that divides the area of China into two roughly equal parts. It stretches from the city of Aihui to Tengchong County (Figure 3). The area west-northwest of the line has a population density of only 11 people per square kilometer; this area occupied about one-quarter of the land area of China but with less than 1 percent of the population. The northwest region in total supports about 4.5 percent of the population, mostly in a few basins and scattered oases (Naughton, 2007). The Sichuan Basin, located at the west part of this line, is one of the areas containing a large population. Chengdu is located at 102°54′~104°53′ E, 30°05′~31°26′ N, with a 192 kilometer longitudinal distance from east to west and a 166 kilometer longitudinal distance from south to north. The total area of Chengdu is 12,121 km^2, and occupies 2.55 percent of the province's total area.

In 2008, the urban area of Chengdu was 2176 km^2 and the built up area was 427.65 km^2, with a total urban population of more than 11 million (2009 Chengdu

Yearbook). Geographically, the city of Chengdu is located at the central basin of Sichuan Province, surrounded by mountains and hills; its fertile soil and rich hydrothermal condition are beneficial to agriculture, which has led Chengdu as one of the richest parts of inland China. However, Chengdu is situated along the exit where the Minjiang River passes across Changping Mountain, and the Minjiang River flows rapidly. In summer, it is in the rainstorm belt. According to the historical record, before Dujiang Weir was built, people in Sichuan had to fight floods, which made permanent contributions to the earliest upsurge of primitive agriculture. Later, when Libing became governor of Shu, he led to build Dujiang Weir. From the historical record that: "blocking river as a dam", it was clear that at that time, that the Dujiang dam was not only for preventing floods, but also for blocking the river to build water conservancy that could contribute to the irrigation of three more counties. This transition stood for the development of productive forces and agriculture (Cheng, Zhong, 1997).

Geologically, the west part of Chengdu is the hilly and mountainous region with a high altitude, and the east part of Chengdu is the main part of Chengdu plain with a much lower altitude (Figure 4). The plain, hills, and mountainous regions each occupy the total area by 40.1 percent, 27.6 percent, and 32.3 percent, respectively. From the surrounding mountains, the Yalong, Dadu, Ming, Tuo, Fu and Jialing rivers run from north to south and the Wu River from south to north. All of them, and many other smaller rivers, join the Yangtze River, and then run through the southern part of the basin (Goodman, 1997). The climate in this area is sub-tropical, and the average temperature is between 15.2 and 16.6 Celsius, and rarely falls below zero degrees Celsius. The annual precipitation is

around 873 to 1265mm. The combination of rich alluvial soils and a subtropical monsoon climate makes Chengdu plain the most fertile land in southwest China, suitable for the agricultural production of a large variety of crops. Also, with its rich water resources, the irrigation system supports Chengdu's agriculture and most areas allow double cropping, including paddy rice, wheat, and canola. The very rich Chengdu plain has a large part of its population in isolated farms and small hamlets surrounded by groups of trees and bamboo. Small settlements also appear to be characteristic of the zone where rich fields give way to dry crops. The unique natural environment, advanced monsoon climate, and various biotic resources and different types of landscapes make Chengdu a favorable location for both agriculture and tourism.

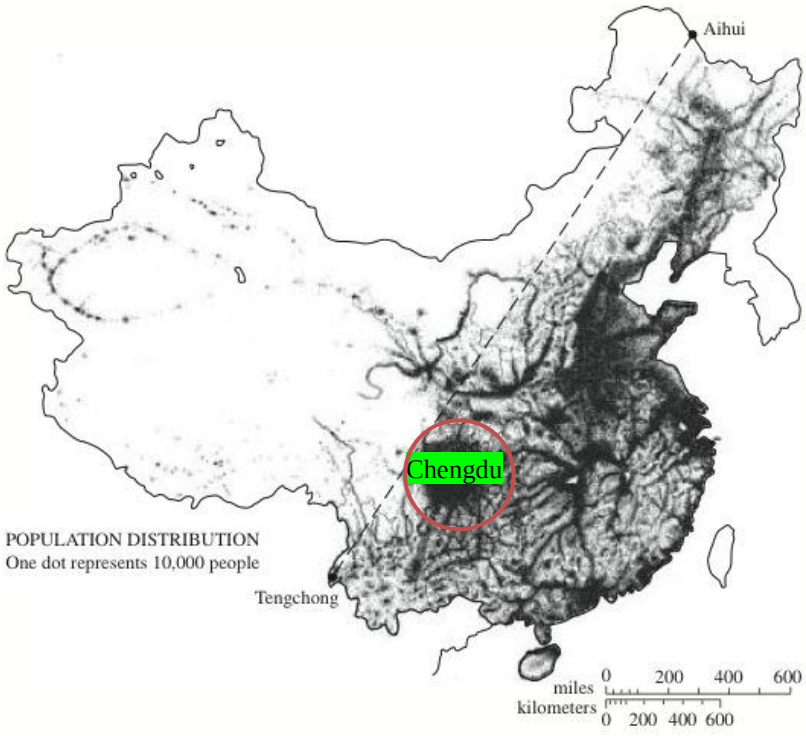


Figure 3: Aihui-Tengchong Line
(Source: Barry Naughton, 2007)

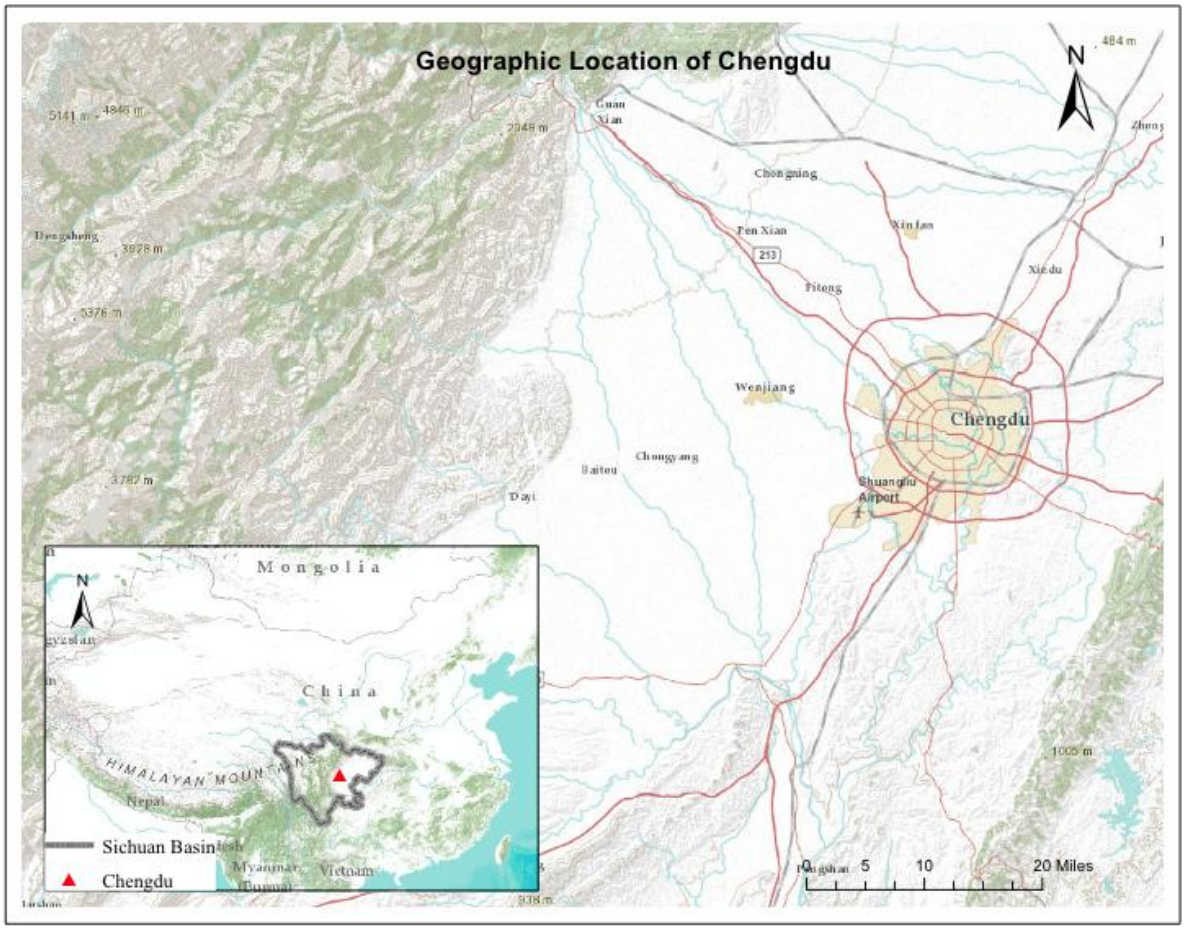
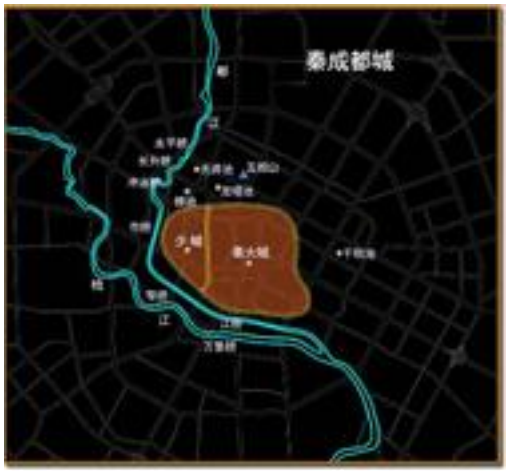


Figure 4: Geographic location of Chengdu (Source: ESRI)

Historical Background of Chengdu

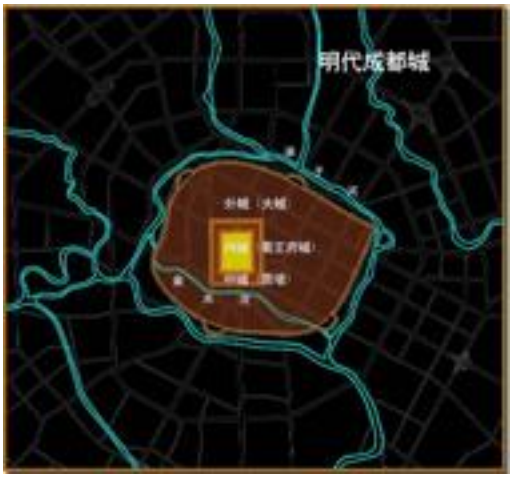
Chengdu is one of the oldest cities in China and its civilization can be traced back to 4500 years ago. Since 316 BC, Chengdu has been an important capital city in southwest China (Arthur Pang, 2008). The construction of Dujiang Weir, one of the biggest and oldest water projects from 1000 years ago, makes Chengdu an economic, political and cultural center in southwest China. Since Chengdu was first built as a capital city during the Qin Dynasty, over the centuries, the urban development of this city has followed traditional Chinese principles of layout. During the period of ascendancy of the Mongol Dynasty (1276-1368), the city had been almost destroyed by the invaders and extensively rebuilt after; then it expanded and the name of Chengdu has never changed (Figure 5). Therefore, it is among China's famous cultural and historical cities.

Due to its unique topographic factors, the Sichuan basin was relatively isolated from the rest of China, and until the late 1930s its main avenue of communication was only by river via the notoriously difficult Yangtze gorges. Chengdu's development was therefore influenced by its isolation for centuries. Chengdu's isolated location made it one of the most important strategic areas in western China during Mao's Period. During the 'Three Line Construction' period, various industrial projects had been moved to Chengdu and its surrounding mountainous areas for national defense purposes. Therefore, Chengdu's industrial level and urban construction had been promoted during that time.

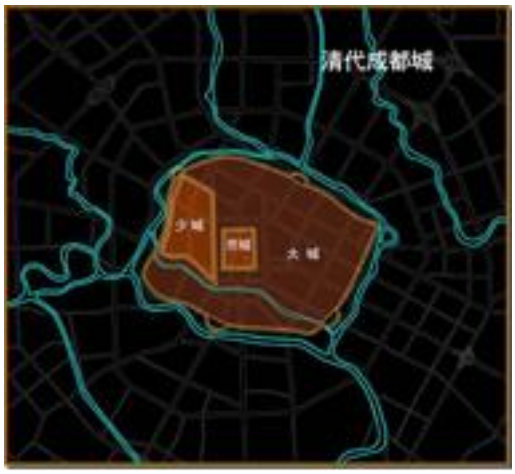


a. Qin Dynasty (221-207)

b. Tang Dynasty (618-907)



c. Ming Dynasty (1368-1644)



d. Qing Dynasty (1645-1911)

Figure 5: The historical evolution of Chengdu
(Source: Report of the Chengdu Government, 2008)

Political and Economic Background

Chengdu is the administrative and cultural center of Sichuan Province and the second largest city in western China. Currently, Chengdu has nine districts—Jiuniu,

Chenghua, Qingyang, Wuhou, Jinjiang, Gaoxin, Xiudu, Qingbaijiang, Longquanyi and Wenjiang; four satellite cities—Pengzhou, Dujiangyan, Chongzhou and Qionglai; and six counties—Pixian, Dayi, Xinjin, Pujiang, Shuangliu, and Jintang (Figure 6).

In terms of its great location, it is one of the earliest inland cities that started putting forward the "Open Door" policy after the growth of the coastal regions. It is also part of the government's regional strategy—using the metropolises as the centers to attract the investments, and to drive the economic development of surrounding small cities and towns. Since 1999, when the Chinese government started to apply the "Go West" program, Chengdu, as one of the biggest cities in western China, has benefited a lot from this policy. In addition, from 1999 until present day, the city has been targeted by provincial and national governments as the center for science and technology, high-level services, commerce, trade, and finance, as well as a leading hub of transportation and communication in southwest China. With the construction of some major railways—and their branches, Chengdu is becoming an important location with a high accessibility to connect eastern and western Chinese cities. In addition, with the national highways passing through Chengdu, the city has become a major logistics center for western China (Figure 7). In addition, with a close relationship between Sichuan Province and Chongqing, the Yangtze River forms the backbone of provincial waterway transportation, linking Chengdu with central China through Chongqing port. What is more, located at the east edge of the Qinghai-Tibet plateau, Chengdu is also the most important gateway to reach Tibet from eastern China. Thus, it plays a crucial role for the regional economic development of Tibet.

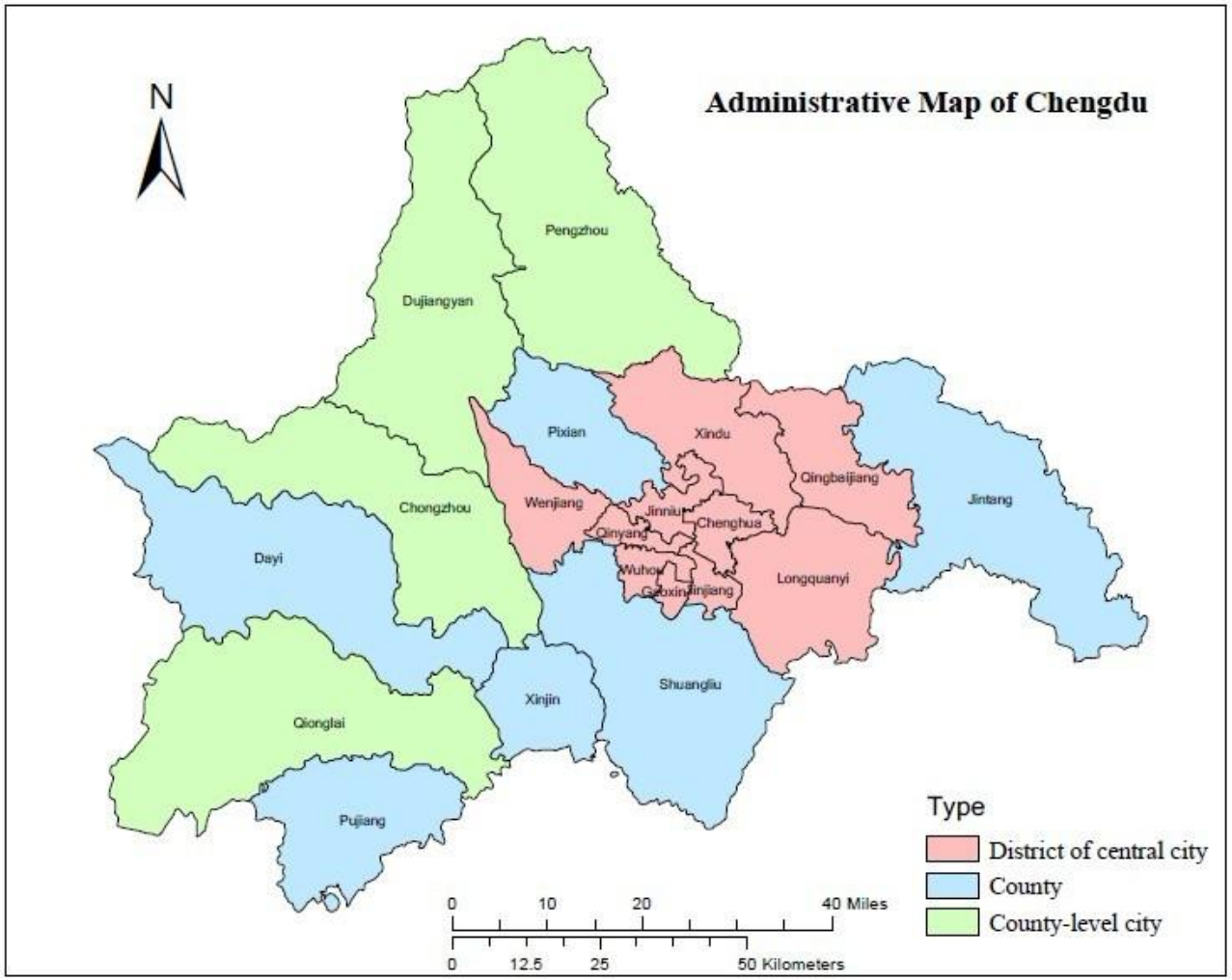


Figure 6: Administrative Map of Chengdu, 2011 (By author)

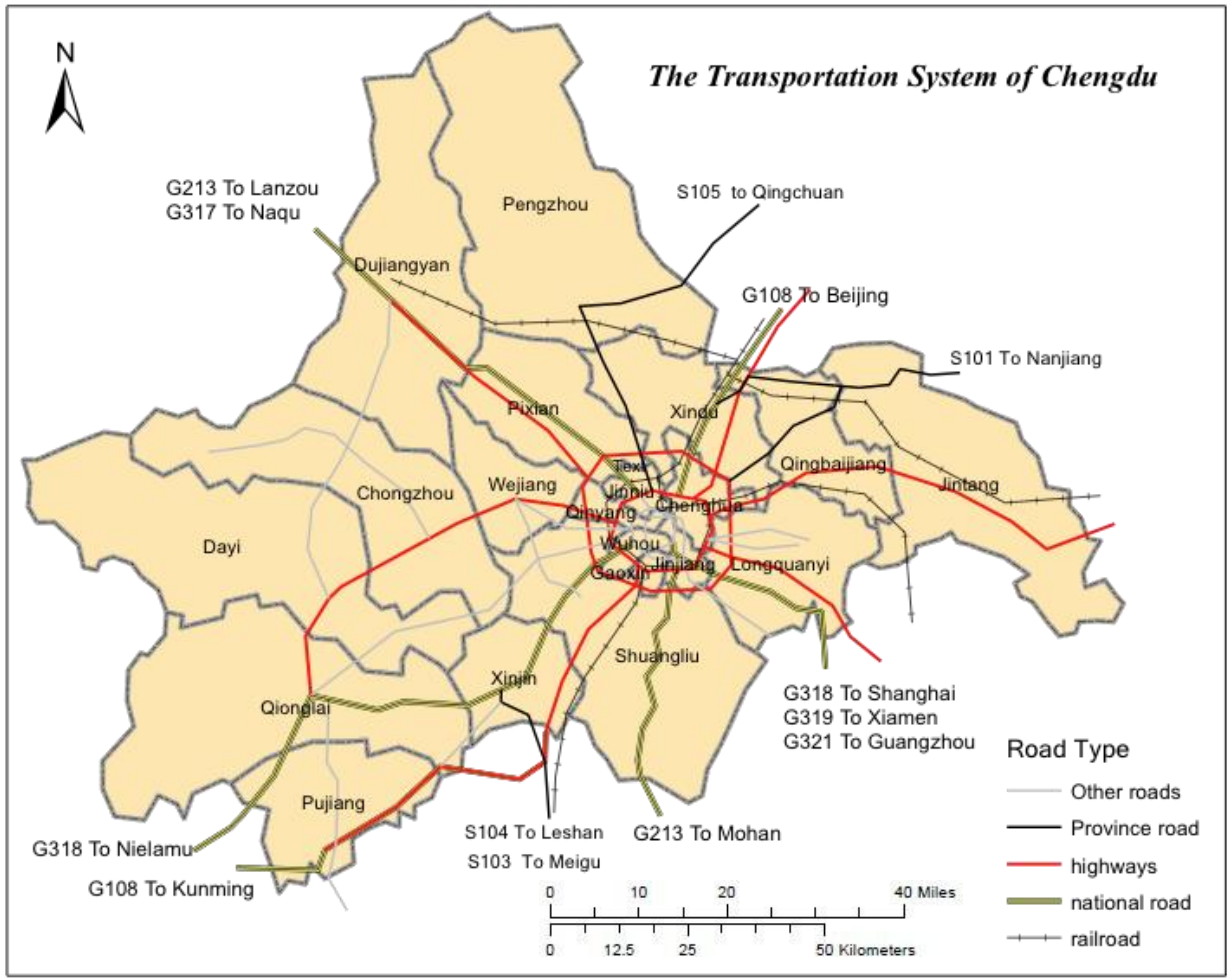


Figure 7: The transportation system of Chengdu (By author)

CHAPTER 4

ECONOMIC DEVELOPMENT AND DEMOGRAPHIC TRANSITION IN CHENGDU

The Economic Development Process in Chengdu

Before the establishment of the PRC, Chengdu's economic development level was extremely low. By 1949, the total output of industries and agricultural sectors was just 699 million RMB, and the output from the industrial sector was only 85.71 million RMB. In 1955, after the government's First Five-Year Plan, Chengdu was chosen as one of the priority development cities to focus on industrialization. Since then, Chengdu has started its industrial development and mainly focused on mechanical and electronic industries. By 1957, the total industrial output of Chengdu had risen to 380 million RMB. From 1957 to 1977, the economic development of Chengdu suffered from poor economic policies—the 'Great Leap Forward' and the political movement the 'Cultural Revolution'. The Cultural Revolution especially set back the process of Chengdu's industrialization. However, even though the Cultural Revolution heavily interrupted Chengdu's development, there were still some industrialization improvements brought about by the Third Front Construction between the 1960s and the 1970s. Chengdu, as the Third Front Construction, concentrated on non-productive, defense-related industries. The result was this industrialization did little to improve people's living standards, but it led to a great development in the military, aviation, weapons, communications and the mechanical and also metallurgy industries during this period.

From 1978 to 1985, Chengdu's economy developed with a stable pace, and the

urban economic system shifted step by step from the central-planned economy to a free-market economy. One result of the economic reforms was encouraging the development of autonomous enterprises. This was followed by tax reforms—a tax on profits. Another important event was the administrative merging of the Chengdu and Wenjiang regions in 1983. After this merge, Chengdu's administrative region grew by than two times (Figure 8). This could be seen as Chengdu's beginning as a metropolis, illustrating the practice of 'shi dai xian'-city leads counties. This reform of administrative management helped speed up economic development, and had a continuous influence on Chengdu's urban development after the 1990s.

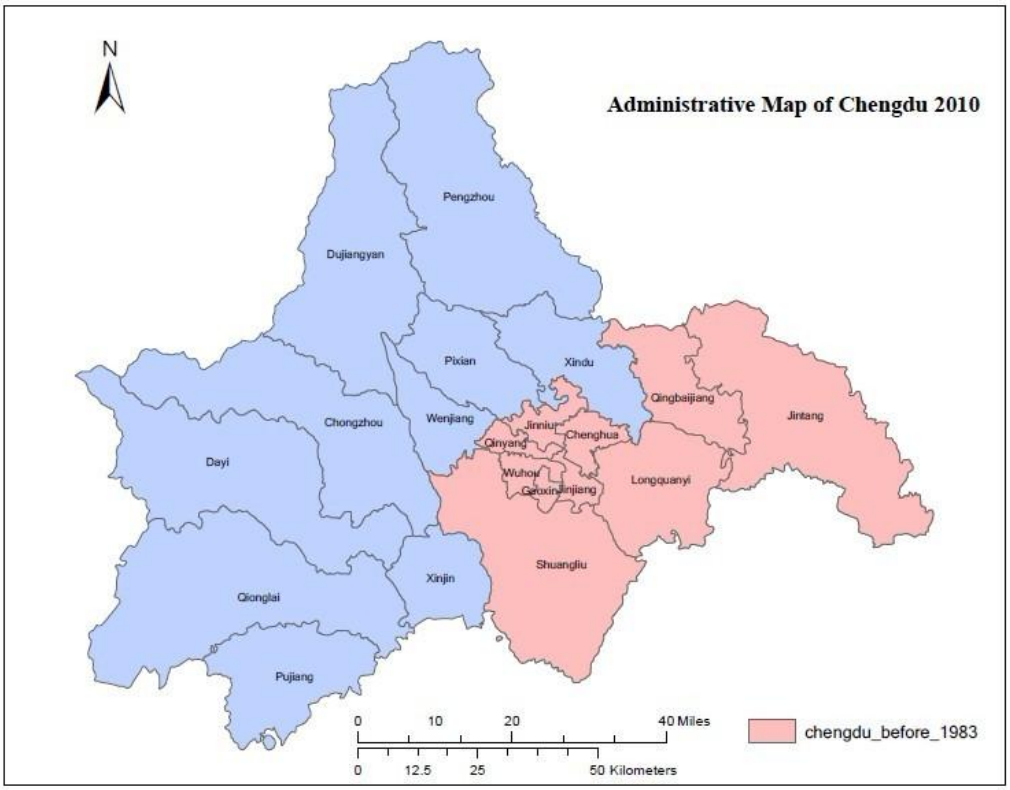


Figure 8: The merging of Chengdu and Wenjiang Districts
(Source: Chengdu Yearbook-the Land, 2000)

Since the 1990s, Chengdu has started a new economic development. In 1992, Chengdu was approved by the State Council as one of the open cities in inland China to have the same preference policies as those of the east coastal cities. Following this policy, Chengdu started to establish several economic and technology zones throughout its territory. These kinds of open economic zones have advantages in attracting foreign capital investment and domestic high technological industries. The new economic development policy has greatly stimulated Chengdu's urban growth.

The Influences of the 'Go West' Program

For years, investment opportunities in China seemed restricted to bustling coastal cities like Shanghai, Shenzhen, and Guangzhou. Through geographical advantages, preferential policies and more input from the central government, coastal cities' urban growth produced increasing disparities with interior cities incurring potential domestic instability during 1990s. In other words, the coastal-inland gap has been widened. Geographically, east coast areas have benefited from their spatial advantages. Depending on their ports, the coastal cities can promote ease of transit whether importing parts used in manufacturing in tax-free zones or exporting efficiencies because of their coastal connections to major shipping facilities. To the contrary, western cities needed to overcome their isolation from other major urban areas in eastern China, which attracted a large number of trained workers from western China. In July 1999, the central government proclaimed the 'Go West' program, signed a major escalation in resources distribution and the attention of the national development policy started to focus on

decreasing the development gap between the east coast metropolitan regions and the inland western provinces.

Emerging markets in the east coast have become increasingly saturated during the past decade. Meanwhile, the central government has largely increased financial inputs into western China. The improvement of infrastructure and favorable economic incentives has opened up opportunities in most of the cities. Benefiting from the Go West Policy, Chengdu has emerged as a center for high technology research and development. Investment opportunities have abounded in the city supported by highways, railroads, and airlines to destinations across China and overseas during the past ten years.

Globalization and Foreign Capital Investment

Along with globalization, challenges and opportunities were brought to the municipal government, and the economic development strategy needed to adjust gradually. Therefore, the economic trade changed from only importing products to importing high technology and advanced devices in order to improve the local productivity. As a result, Chengdu has gradually joined in global trade, and also joined in the global competition in the world market. By 2009, the total GDP of Chengdu had reached 450.26 billion RMB, which increased hundreds of times compared with 0.4 billion RMB in 1949, the comprehensive economic strength placed at fourth in all sub-provincial cities. Also, ever since Chengdu was targeted as one of the open cities in inland China in 1992, the import and exports of Chengdu have increased dramatically (Figure 9). In addition, Chengdu is the urban hub of a province with 43 universities, 184

government-connected research institutions, 1.2 million scientists and engineers, and the home of Sichuan University with 60,000 students, they provide a strong labor force of educated employees. Currently, Chengdu's dramatic economic development represents new blood in southwest China. By 2003, Chengdu successfully attracted major transnational corporations specializing in high technology projects, such as Microsoft, Intel, and Motorola (Walcott, 2007). The central government paid much attention to the Chongqing-Chengdu region, and tried to use these two metropolises as a staging ground for an economic experiment. The purpose was to reduce and eventually eliminate the wealth gap between China's booming coastal regions and its poorer interior, and also aligns with the 'harmonious society' priorities of China's president, Hu Jintao, and its premier, Wen Jiabao.

The consequences of Chengdu's economic and urban development brought by the 'Go West' program and the globalization process are obvious. Chengdu is now becoming one of the most popular investment destinations for foreign companies (Investment Business Weekly, 2008). According to the statistical data in 2008, foreign companies from all over the world invested or cooperated with local companies for 279 projects (Table 5). After Chengdu became an open city in 1992, the foreign companies that attracted to Chengdu were mainly from eastern Asia countries, and although the number of investment projects was large, the investment amount was relatively small. Currently, as shown by the report from *Chengdu Foreign Investor*, currently, there are companies mainly from Europe and North America, but also companies from East Asia that come and invest in Chengdu. According to the 2009 Chengdu Statistic Year Book, the

companies from America, Singapore, and Japan were the three main sources invested in Chengdu. Other countries such as Canada, France, and Britain and so on also play important role in Chengdu's economic development. Currently, among all inland Chinese cities, Chengdu is the busiest aviation hub, the second largest economy, the second largest foreign trade destination, the second largest banking market, and the third largest retail market.

Table 5: The changing number of investment projects and foreign capital investment in Chengdu in 1993, 1998, 2003 and 2008
(Source: Chengdu Statistical Yearbook 2009)

FDI/YEAR	1993	1998	2003	2008
Number of Investment Projects	819	131	203	279
Foreign Investment in Actual Use (Thousand dollar)	12,868	14,892	42,549	224,521

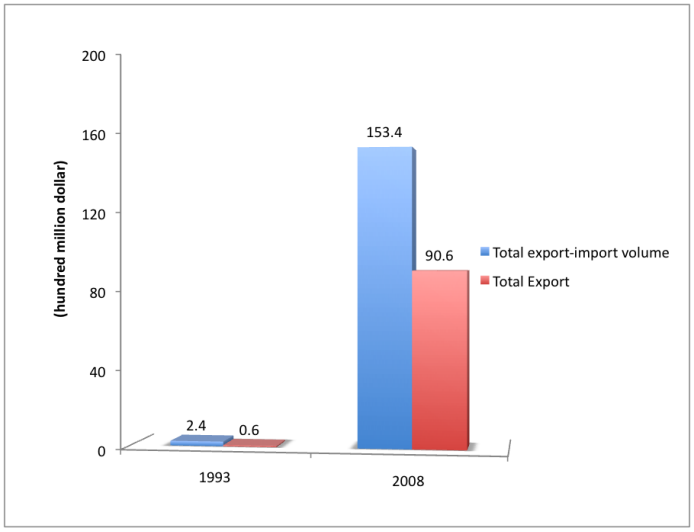


Figure 9: The import and export changes of Chengdu
(Source: Chengdu Statistical Yearbook 2009)

Structural Changes in Chengdu's Economy: GDP and Labor

During the economic development process, certain common patterns of structural change are observed. These changes are associated with the growth away from a predominantly agricultural economy to an industrialized and diversified economy. Productivity increases because existing jobs are upgraded and, equally important, because workers leave existing jobs in the traditional sector and move into modern sectors, where productivity and the potential for future growth is higher. Therefore, the long-term growth of output is closely associated with important structural changes, and can be traced both through the labor force and through the GDP. In this study, the simplest way to track these changes relies on classifying all economic activity into three sectors: primary (agriculture, including fisheries, forestry, and animal husbandry); secondary (including mining, manufacturing, construction, and utilities); and tertiary or service (including transportation, communications, household and business services, social services, and technology and education). Currently, along with China's rapid urbanization process, secondary and tertiary industries are becoming more and more important in its economic development, and this pattern of the changing economic structure can be found in most Chinese cities. However, for some of the metropolises such as Shanghai, Shenzhen, Beijing, the tertiary industry has already replaced the secondary industry in the urban areas. For instance, business services, social services and high technology industries are now playing a most important role behind the dramatic economic growth. In the case of Chengdu, the patterns are very similar, and could be traced through GDP and the labor force.

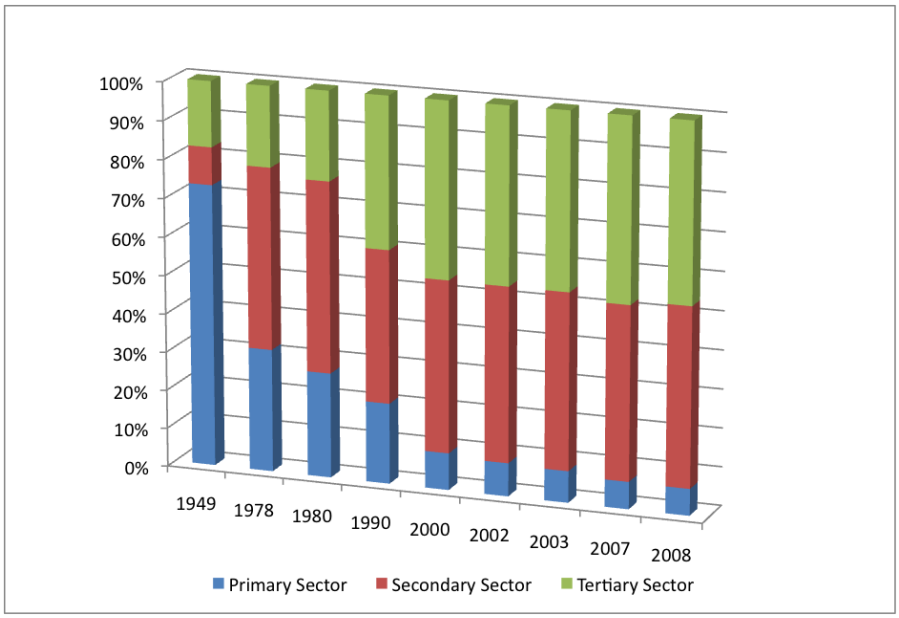
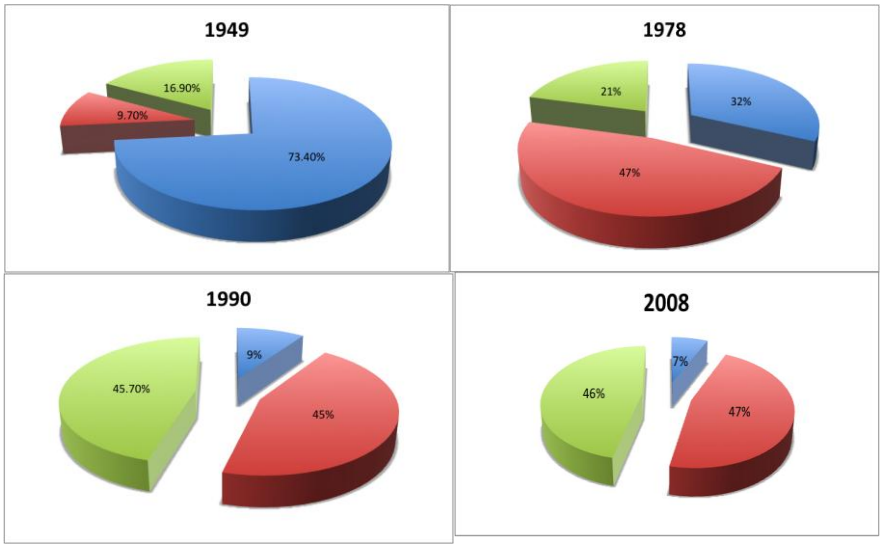


Figure 10: The ratio of changing occupational structure in Chengdu
(Source: Chengdu Statistical Yearbook 2009)



: Primary Industry : Secondary Industry : Tertiary Industry

Figure 11: The economic structure changes in Chengdu since 1949
(Source: Chengdu Statistical Yearbook 2009)

Within the economic structure of Chengdu, the large increases in the secondary and tertiary sectors are paralleled with the decline of the primary sector. From 1949 to 2008, the primary sector had decreased dramatically from seventy percent to less than ten percent. On the other hand, the tertiary sector increased from less than ten percent to fifty percent (Figure 10). At present, Chengdu's economy is based on secondary industry and tertiary industry (Figure 11). Especially at the urban core zones, tertiary services such as high technology industries, business services, and tourism have already become the main economic income. For the outer urban regions, secondary industry such as the manufacturing of shoes, medical supplies and food processing are leading economic activities.

The Economic Structure Changes In Three Circles

Chengdu's unprecedented economic development and increasing productivity are revealed in its three big circles known as urban core zone, the outer urban regions and rural areas (Figure 12).

First of all, although the populations of each circle are very similar, there are big differences in GDP among them. The first circle focuses on the service sector combined with high technology industry. Although it has the least population, the GDP of the first circle remains the highest. Meanwhile, even though the second and third circles have a higher population compared to the first circle, the economic development is based on labor intensive and resource intensive industry with lower GDP. The GDP and GDP per capita show a decreasing trend from the first circle to the third circle (Table 6); nevertheless, the population illustrated an opposite trend of increasing from

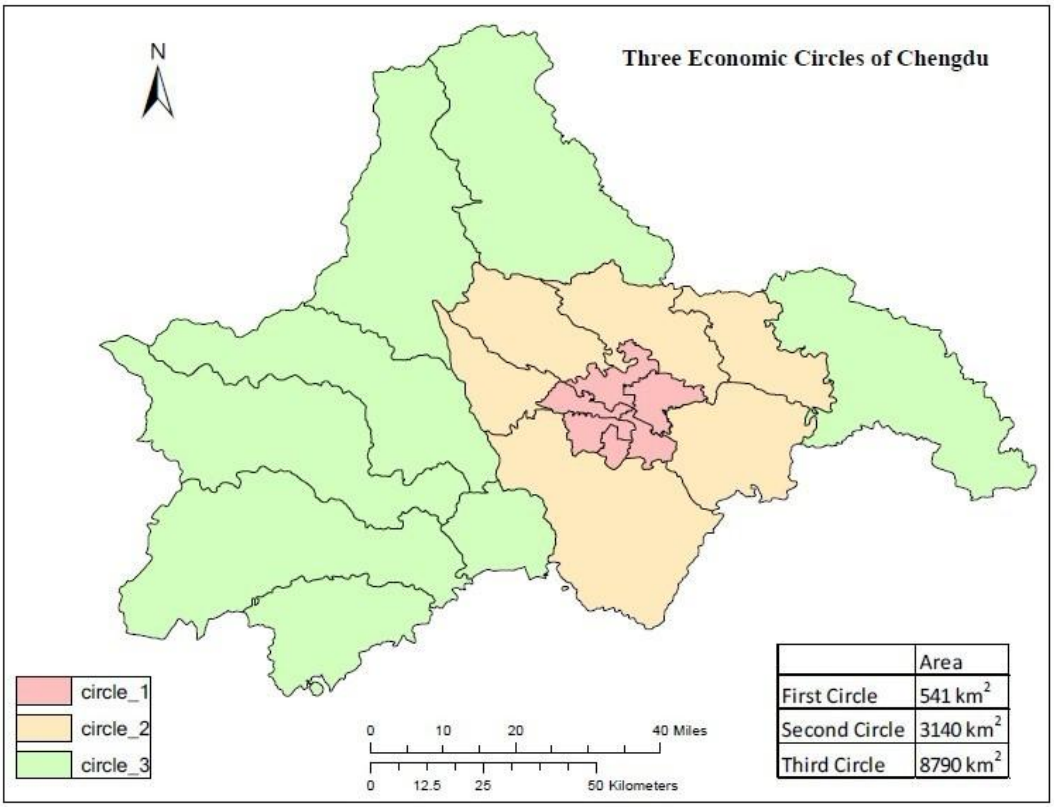


Figure 12: Three economic circles of Chengdu
(Source: Chengdu Transportation Planning, 2005)

Table 6: The GDP per capita of three circles in Chengdu in the year of 2005
(Source: Zhang, Ren, Huang, 2009)

	GDP (Billion RMB)	Population (Ten Thousand)	Population Density (person/km^2)	GDP per capita (RMB)
TOTAL	237.1	1,082.03	867	21,913
First Circle	126.53	292.04	5,398	43,325
Second Circle	63.7	329.71	1,050	19,623
Third Circle	45.87	460.31	523	9,966

inside out, reflecting Chengdu as a typical Chinese metropolis with counties and villages. To look at the population density in three circles, the first circle with the least area has the largest population; nevertheless, the third circle with the largest area has the least population density. The density in the first circle is more than ten times compared with the third circle, which shows Chengdu's high concentrated urban laborers and the high GDP the first circle has.

Secondly, the economic development leads to an industry structure pattern. Through rapid economic development during the past two decades, Chengdu's economic level has almost reached the same level as that of a city in a developed country. The occupational order of each circle is shown in table 7. Generally the tertiary sector dominates, followed by the secondary sector, and a decreasing trend in the primary sector. However, different from the cities in the developed countries, with its large population, Chengdu plain remains agricultural, and the occupational importance of its primary sector is still very high.

Table 7: Industry structures of the three economic circles in Chengdu
(Source: Zhang, Ren, Huang, 2009)

(%)	Primary Sector	Secondary Sector	Tertiary Sector
Total	7.69	42.5	49.81
First Circle	0.3	36.4	63.31
Second Circle	11.19	55.46	37.56
Third Circle	23.08	38.01	38.91

Thirdly, compared with developed countries, the proportion of the tertiary industry in Chengdu is relatively low, especially for the second and third circles (Figure 13). For developed countries such as the United States and in Europe, less than 5 percent of the work force is in the primary sector. There are several reasons for this. First of all, the overall agricultural productivity in Chengdu is not as high as that of developed countries. To ensure the food source for the city's large population, and the employment rate for a large number of agricultural populations in rural Chengdu, the government needs to encourage and preserve the primary industry. Also, because of Chengdu's landscape, with the surrounding mountains and hills, farm mechanization is hard to promote. Therefore, most of the agriculture activities need to be accomplished by laborers instead of machines. Owing to the large number of peasants, the education levels and the number of educated laborers in Chengdu are still relatively low. The government needs to bring about more preferential policies to attract elite to come and work in Chengdu. Because of the lower educated level of the employees, the income of Chengdu's urban population is not very high compared to the employee's' income in coastal cities. As the consumption level of the citizens in Chengdu is not as high as the citizens in China's coastal cities, the development pace of tertiary industries is relatively slow. Nevertheless, along with the 'Go West' program, the rapid economic structure changes has led to a great development of the service sector in Chengdu. Therefore, Chengdu's tertiary sector is going to have a lot of potential to develop in the near future.

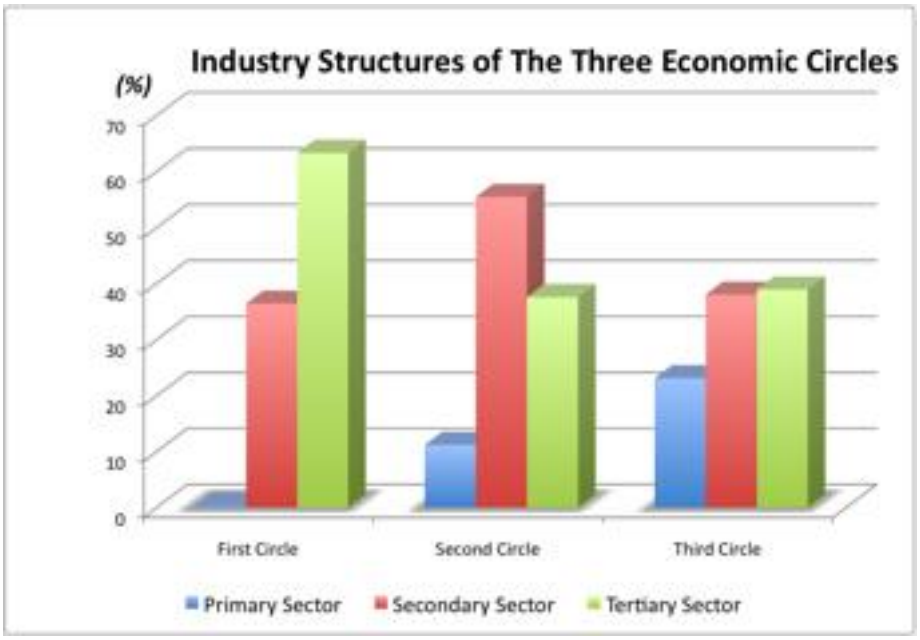


Figure 13: The industry structure order of the three circles in Chengdu
(Source: Zhang, Ren, Huang, 2009)

Employment Structure

Paralleling the structure and economic changes, the employment structure in different industries has had a similar trend—that shows dramatic increased population in the secondary and the tertiary sectors. In comparing the employment structures of Chengdu in 1978 and 2008, the primary sector took up 64 percent of employment in 1978 but decreased to only 25 percent in 2008 (Table 8). Contrarily, the tertiary sector had increased from only 20 percent in 1978 to 45 percent in 2008 (Figure 14). In addition, the employed population in Chengdu's three urban economic circles shows a similar characteristic as the industrial structure. However, compared with developed countries, the proportion of employed population in the primary sector is fairly high.

Table 8: The changing structure of labor force in the primary, secondary and tertiary sectors (Source: Chengdu 2009 Statistic Yearbook)

YEAR	Primary Sector	Secondary Sector	Tertiary Sector
1978	63.40%	16.20%	20.40%
2008	24.60%	30.50%	44.90%

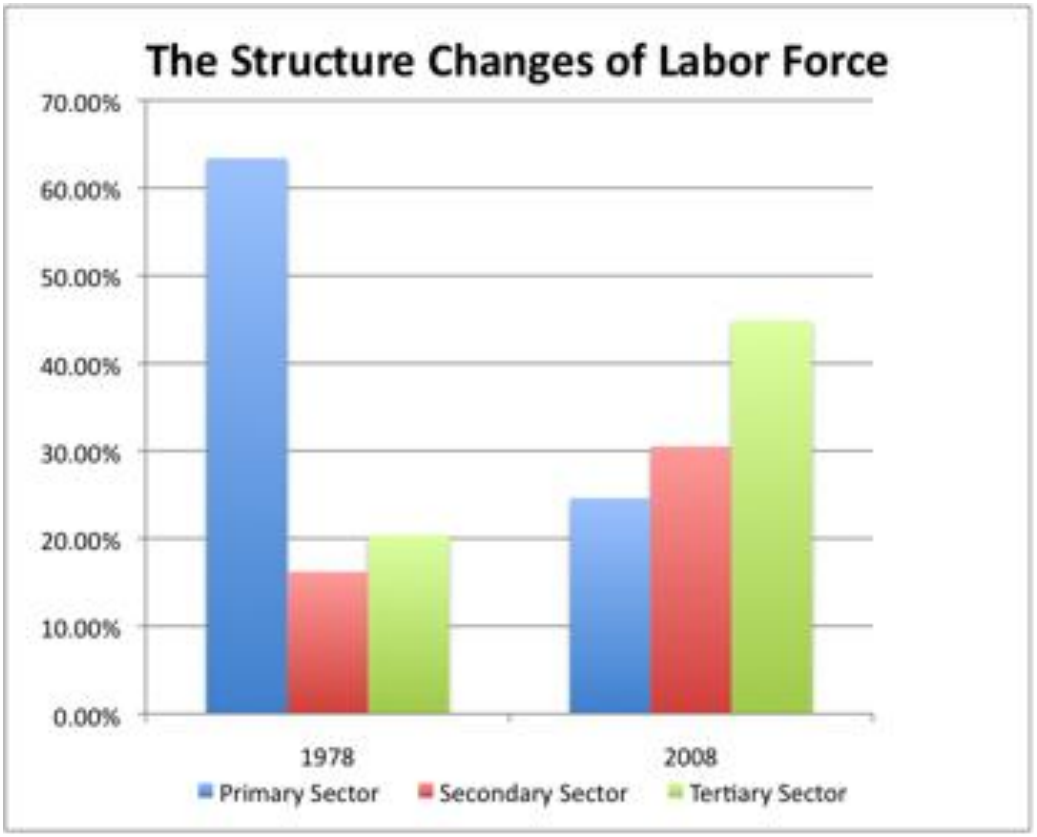


Figure 14: The employee structure changes between 1978 and 2008 in Chengdu (Source: Chengdu 2009 Yearbook)

Contrarily, the proportion of employed population in the service sector is still relatively low (Figure 15). For instance, in developed countries, especially in some of the largest metropolises around the world, the employed population in tertiary industry occupied more than 60 percent of its total labor forces, but in the case of Chengdu, there was only 34.1 percent by 2002 (Table 9). According to the prediction from the government report, by 2050, the percentage of employed population in the tertiary industry will reach about 60 percent (Study on the urban spatial development strategy of Chengdu city, 2003). However, compared to large international metropolises such as New York and Tokyo, this percentage is still low. In addition to the employed population structure, the education level and the number of educated employees among each economic circle are different (Figure 16). Chengdu, as the education and research center for many universities and institutions, has been attracting many highly educated college graduates to stay and find jobs each year due to its rapid urban development in the past decade. However, owing to the living quality, public infrastructure and the social benefits, most of the higher educated employees are concentrated in the first circle. As shown in table 10 below, the total employees with a degree higher than middle school, the number in the first circle is more than four times higher than the third circle.

Table 9: The employment structure among international metropolises in 2002
(Source: Study on the urban special development strategy of Chengdu, 2003)

Employment Structure	New York	London	Tokyo	Hongkong	Singapore	Chengdu
Primary (%)	0	0.06	0.09	1	0.44	40.9
Secondary (%)	15.32	22.76	25.04	32.1	35.26	25
Tertiary (%)	84.68	77.18	74.87	66.9	65.3	34.1

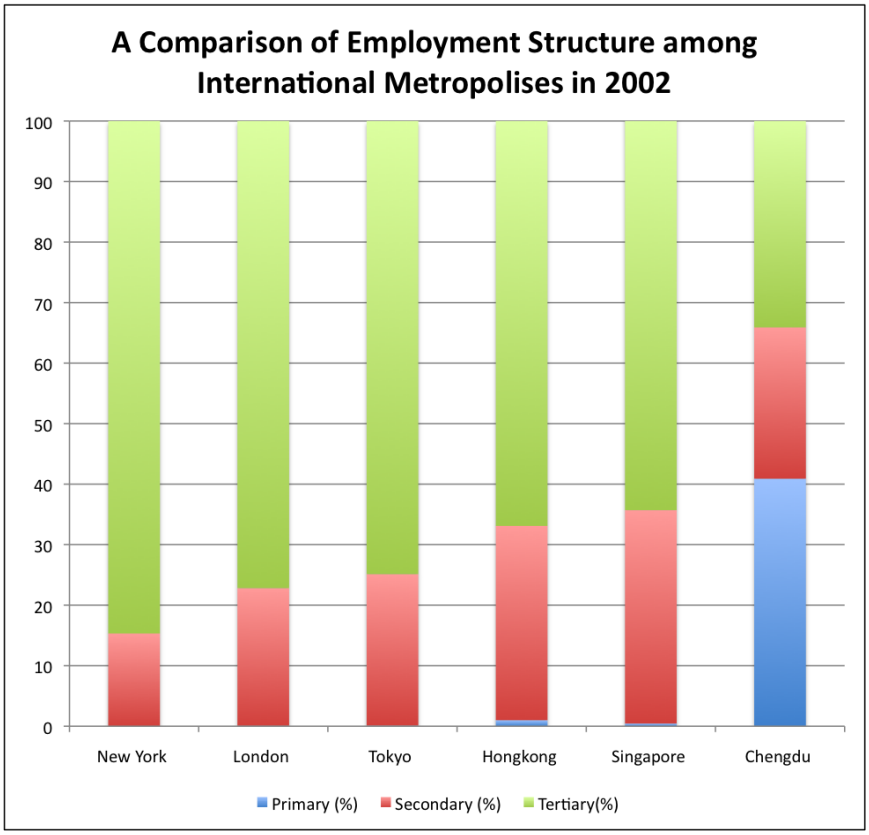


Figure 15: A comparison of employment structure among international metropolises in 2002
(Source: Study on the urban special development strategy of Chengdu, 2003)

Table 10: The differences of education level of employees in three circles in 2005
(Source: Chengdu Statistic Yearbook 2006)

	Master Degree and above	Bachelor Degree	Associate degree	High School	Middle School and below
First Circle	32,045	242,431	337,725	549,291	469,084
Second Circle	3,418	53,344	101,996	220,467	286,471
Third Circle	1,334	31,506	81,035	161,617	219,407

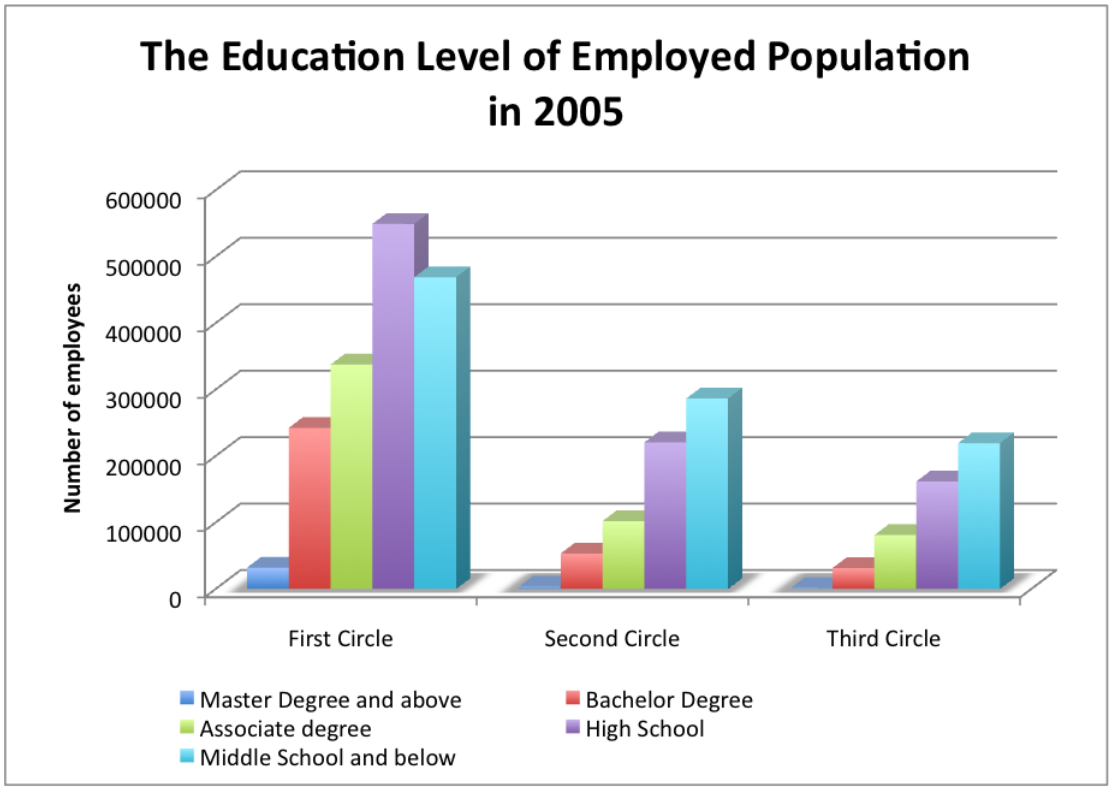


Figure 16: The education level of employed population in three circles
(Source: Chengdu Yearbook 2006)

Demographic Patterns

Population is always seen as one of the most important indicators to analyze the process of urbanization. To analyze the demographic patterns in China, one important aspect of China's population policy is the powerful population system in China, it is very unique and complicated— the Chinese hukou (household registration) system categorizes the entire population of the nation as agricultural and nonagricultural. It was a locality residence license that allowed the hukou holder to access social welfare that was geographically confined and to access local public goods and crops at subsidized prices. So hukou was using as one of the compensation when the government acquired land from peasants, the state offered job opportunities for farmers, housing compensation, compensation for the loss of crops, and the granting of urban residency licenses—the hukou. The government also controlled rural-urban migration through the hukou system, as it was very difficult to live in the city without it. So the farmers were very willing to give their land to the government (Chan, 1994). This hukou system is an institution that has affected many fundamental aspects of life for hundreds of millions of Chinese for half a century, and it is also close related to China's economic development over the past few decades.

At the end of 2008, according to the hukou system, there was a total population of 11, 239,606 in Chengdu, and the non-agricultural population was 6,120,756, totally about 54.46 percent of the total population. From 1953 to 2010, China's overall urban population increased from 78.26 million to 665.57 million; at present, the urban population makes up 49.68 percent of the total population. Since the economic reforms

initiated in 1978, China has been moving rapidly through its demographic transformation, as the economy shifts from farming to manufacturing and service activities and people increasingly shift their locations from farm to town and city. China now already has far more urbanites than any other country and perhaps as many as 200 million more people in cities and towns than the entire U.S. population. Especially after China's 'Open Door' policy, many Chinese started to taste the new freedom of mobility in the 1980s. The most notable result was the massive labor exodus from the countryside, called 'waves of rural labor' or 'minggong chao'. This emergence of the mass rural-urban migration in the 1980s caused a lot of issues almost in every big and mid-sized city in China. For instance, there was a lack of public services such as housing, infrastructure, health care and education etc.

In the case of Chengdu, the government started to shift its emphasis from specific city planning to broader urban planning that focused on the integration of urban and rural areas, in order to break the barriers of "hukou" system. This movement actually encouraged more peasants to become non-peasants, by applying this strategy to stimulate tertiary industries in rural areas. It also spread urbanization to stimulate the development of rural areas. For instance, owing to the daunting challenges of creating new jobs in the urban economy, the flow of rural migrants will be encouraged or channeled to places where there is a greater perceived likelihood of their being reasonably accommodated, such as in smaller cities and towns, and in this way avoiding the emergence of huge slum areas.

Since 1949, Chengdu's population has increased more than 6 million. The

population increase has been dramatic during the past three decades, especially within the non-agricultural sector. There are three main factors behind the population growth:

(1) The population growth from migration:

There are two types of migration, one is intra-province emigration and immigration, and another one is the emigration and immigration from other provinces.

There are several characteristics of Chengdu's migration: based on table 11 below, both the inner-province immigration and outer-province immigration population are larger than the inner-province and outer-province emigration population, respectively; secondly, the urban core area absorbs more of the migration population; thirdly, the inner-province immigration accounted for most of the immigration population; Lastly, the population growth from migration is higher than the natural growth rate, and thus, it is the main factor of population increasing in Chengdu (Figure 17).

Table 11: Population migration in 2005, 2008
(Source: Chengdu Statistic Yearbook 2009)

Year	Intra Province immigration	Intra Province Emigration	Immigration from other provinces	Emigration from other provinces
2005	282,438	116,542	72,554	32,892
2008	162,297	96,033	67,347	54,933

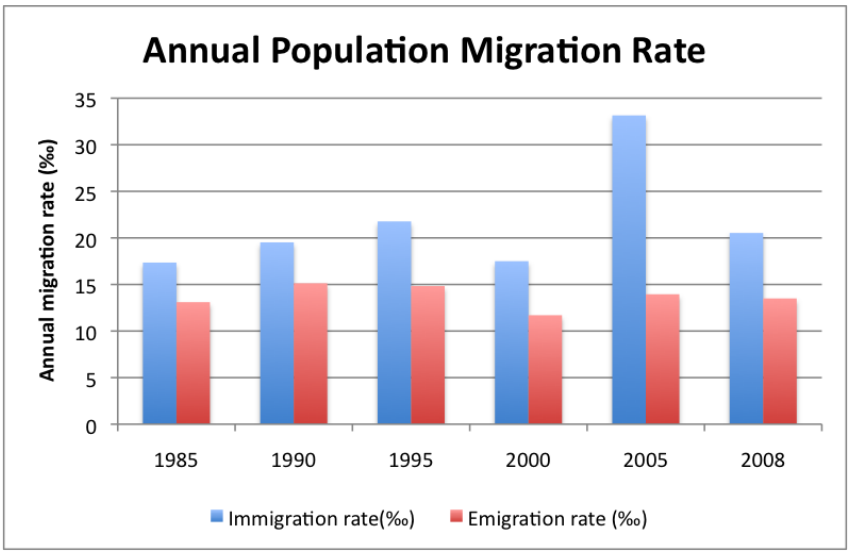


Figure 17: The population migration rate changes in Chengdu
(Source: Chengdu Statistic Yearbook 2009)

Because Sichuan Province has a large population, since the economic reforms the number of laborers migrating from Sichuan to eastern Chinese cities is always huge. However, as Chengdu's economic and urban development has been very effective during the past two decades, and also the government's 'Go West' program brought many new job opportunities to Chengdu, people from other parts of Sichuan province are gradually moving back from coastal cities to Chengdu to search for jobs. This migration includes not only the returning local people, but also the people from other provinces who come to Chengdu for better employment opportunities.

(2) The natural growth:

China's population growth has a close relationship with two important government policies. In the Fifth National People's Congress of the People's Republic of China held from February- March 1978, the Constitution of China was revised and the paragraph that 'the State advocates and encourages family planning' was written

into the Constitution. In his report to the Congress, Premier Hua Kuo-feng stated that: "Planned control of population growth is conducive to the planned development of the national economy and to the health of mother and child. It also benefits the people where production, work and study are concerned. We must continue to give it serious attention and strive to lower the annual rate of growth of China's population to less than one per cent within three years."

Besides the family planning, the government also brought out the birth control policy—'one child, one family' started at the end of 1970s; therefore, there has been a shift from a high to a low birth rate. The transition in birth rate has been accomplished, which has led to a steep decline in the rate of natural increase of the population and a sharp drop in the annual population added each year (Table 12). Along with the social and economic development in China, there has also been a significant decline in mortality and longer life expectancy during the past two and half decades.

In addition to the government policy, during the past half-century, along with Chengdu's industrialization in the 1950s and 1960s, also with the rapid economic development during the reform era, there was a significant decrease in the birth and death rate that led to a dramatic drop in the growth rate (Figure 18). Nevertheless, as Chengdu's urbanization and modernization process has developed during the past two decades, there is a continuous declining trend in the growth rate.

Table 12: The annual birth rate, death rate and growth rate changes in Chengdu (Source: Chengdu Statistic Yearbook 2010)

Year	Birth Rate (‰)	Death Rate (‰)	Growth Rate (‰)
1950	27.8	13.4	14.4
1978	10.3	6	4.3
1985	11.9	6	5.9
1990	13.07	6.37	6.7
1995	10.8	6.3	4.5
2000	9.6	6.6	3
2005	6.97	5.31	1.66
2008	9.03	4.73	4.30
2009	8.1	5.6	2.5

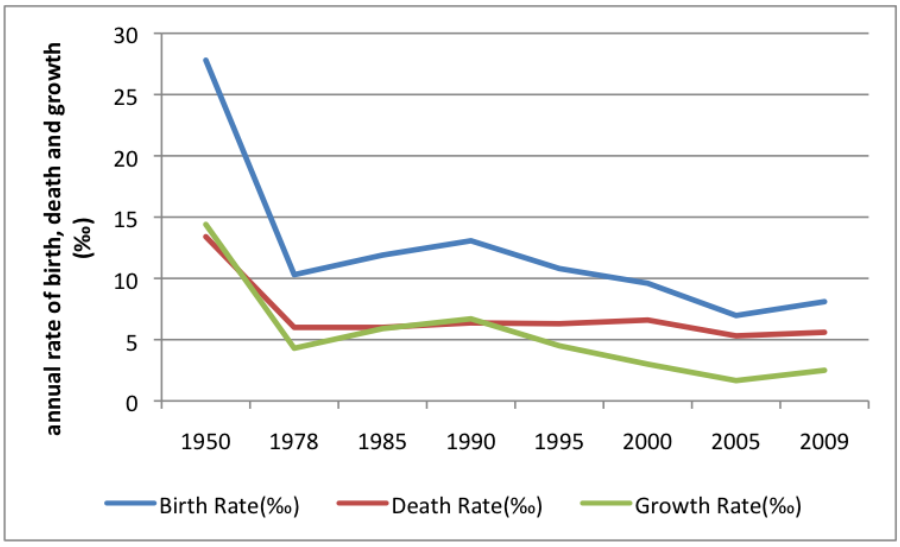


Figure 18: The natural growth of population in Chengdu (Source: Chengdu Statistic Yearbook 2006)

(3) Non-agricultural population:

This is one of the most important indicators representing the result of Chengdu's urbanization process during the past decades. During the past sixty years, Chengdu's non-agricultural population increased by almost five million from 1,006,900 in 1950 to 5,955,583 in 2007, and caused the unprecedented rise in urbanization levels (Table 13). At present, the urbanization level in Chengdu has reached more than 54 percent, showing that Chengdu now has become a metropolis with a relatively high urbanization level (Figure 19). In addition, through the dramatically increasing non-agricultural population, this urbanization process will surely continue during its future development.

Table 13: The urbanization level change of Chengdu since 1950
(Source: Chengdu Yearbook 2008)

Year	Total Population	Non-agricultural Population
1950	5,048,000	1,006,900
1978	8,060,600	1,794,600
1985	8,626,800	2,208,900
1990	9,195,000	2,509,900
1995	9,716,000	3,008,600
2000	10,133,475	3,458,970
2005	10,820,285	5,381,031
2007	11,122,841	5,955,583
2009	11,396,300	6,509,100

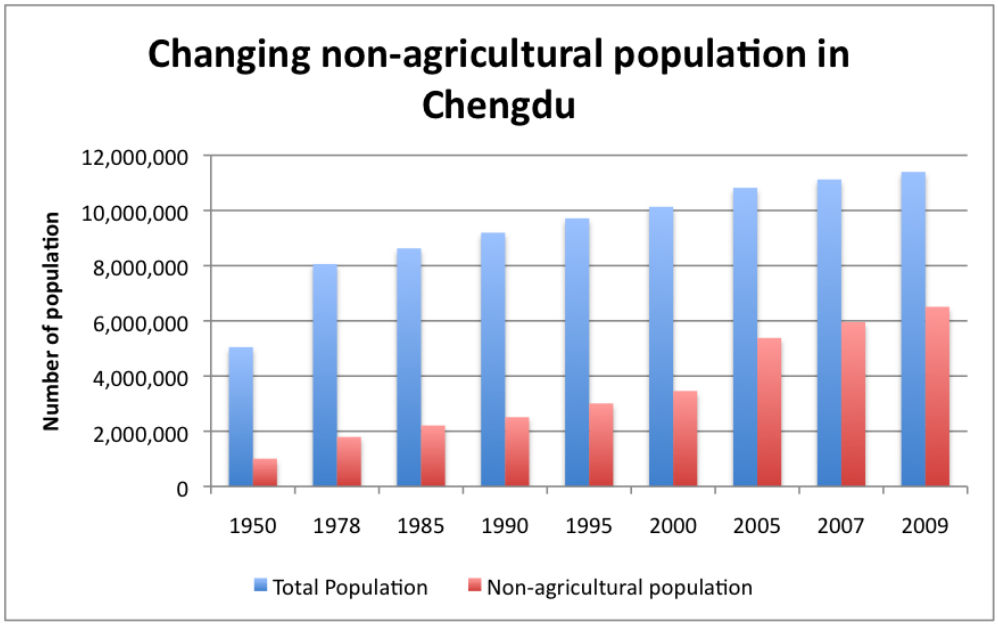


Figure 19: Changing non-agriculture population in Chengdu, 1950-2009
(Source: Chengdu Yearbook 2010)

Along with Chengdu's urban development, the population distribution has its own characteristic. The majority of Chengdu's population concentrated in urban areas. Shown in the density map below, the urban core area has the highest population density, followed by surrounding urban-rural adjacent districts, and the satellite cities and counties have much lower population density (Figure 20).

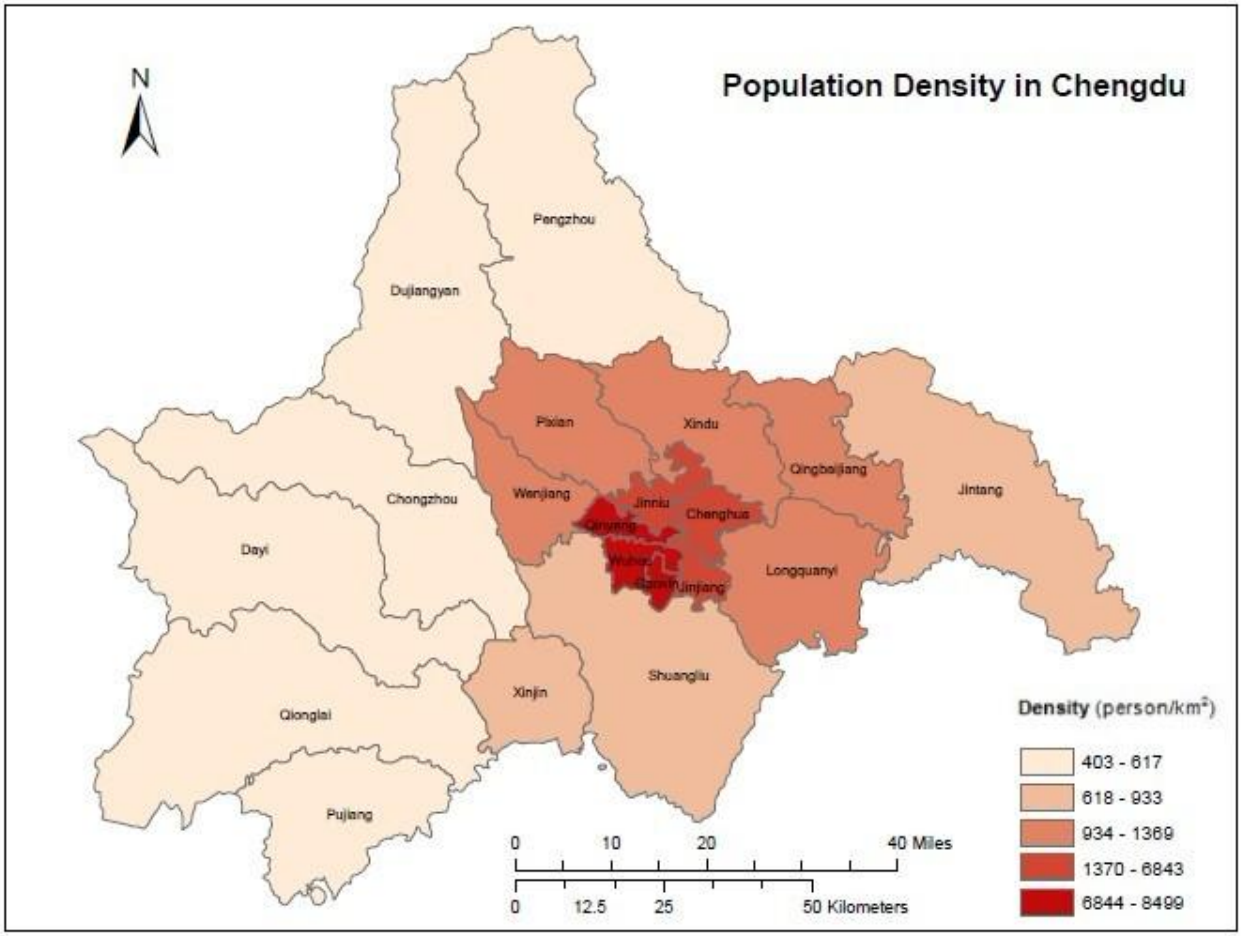


Figure 20: The population density in Chengdu in 2010
Note: Gaoxin district is included in Wuhou district
(Source: Chengdu Yearbook 2010)

CHAPTER 5

THE SPATIAL ANALYSIS OF CHENGDU'S URBAN DEVELOPMENT

China is in a transition period with a decentralized economy operated within a highly centralized government structure. To consider the land use and urban expansion process in Chengdu, it is very necessary to look at China's changing land use pattern. One of the challenges the Chinese government has faced in the period of economic reforms is the establishment of the land use system—how to ensure the ability to allocate land efficiently and to reduce the wasteful use of scarce farmland are the main concerns during the rapid economic and urban development. Historically, private ownership of land ended in China in 1956, since then the state has owned all land in urban areas, and state and collective ownership of land have co-existed in rural areas. Land in China is classified as agricultural land, construction land (land used for non-agricultural purposes) or unused land (wasteland, mostly state owned and located in western China). During the 1960s and the 1970s, China had no separate land administration agency at either the central or provincial level to co-ordinate and to supervise land use. Thus, the state and rural collectives made all land use decisions. In the urban-state sector, local governments at or above the county level acted on decisions of various state agencies, administratively allocating land to final users (Ho, Lin, 2003). In short, land use was managed by the central planning authorities before economic reforms.

However, after the 1980s, owing to the dramatic economic development and the open market, many problems emerged from the old land system in China. Firstly, the real

value of the land was unclear, because the users of the land had little or no incentive to use it efficiently. Secondly, administrative allocations could not catch up with rapid economic changes. Thirdly, there were conflicts between cities and rural collectives. (Ho, Lin, 2003). The emergence of the market economy in China after China's economic reform and the open door policy led to a growing demand for land-use reform. Especially the massive investment from foreign companies pushed the government to face the need for effective management of land use and related economic growth revenue generation (Zhang, 1997). Thus, changes have happened gradually after 1978. The government put forward land use rights, land taxation and use fees, land administration and regulations on land markets since then (Ding, 2003).

The most significant changes to land policy occurred in the late 1980s. The Bureau of Land Administration was established in 1986. The bureau was responsible for land policy reform, land allocation and acquisition, monitoring of land development, comprehensive land use plans, and implementation of land laws. The Land Administration Law passed in 1986 legalized private organizations and individuals to access state-owned land and attempt to develop the land market in China. During the period of economic reform, urban land uses has several breakthroughs. For instance, by separating the land use rights from ownership, the Chinese government had passed the commercialized land use rights in 1988, and it introduced a 'dual-track' system to assign land use rights in urban areas. Land use rights are assigned in two ways:

Allocation: it is used to dispense land use rights to state owned or non-profit users without time limits.

Conveyance: it is used to transfer land use rights to a commercial user for a fixed period, generally 40 years for commercial land, 50 years for industrial land and 70 years for residential land.

The ‘dual-track’ system revealed strong government controls in China’s land use system, and for the first time, it also signified the emergence of Chinese land use market under the market economy.

Land Use Changes in Chengdu

In the case of Chengdu, according to the government data, the city area of Chengdu was around 3,040 hectares in 1948, and the urban built up area was about 1,768 hectares. By 1953, the built up area had increased to 2,528 hectares. After the First Five-Year Plan, due to the relocation of many national factories, the urban construction areas had reached 2,395 hectares. The land use data from the 1960s to 1970s was hard to find because of the ten-year Cultural Revolution, but, in the survey of 1979, the build-up area in Chengdu was 58,200 hectares.

Land use and land management practices have gone through many significant changes during the past two decades in Chengdu. Because massive urban development has been based on the consumption of cultivated land, the government and the planners in China have confronted various issues during the dramatic urbanization process brought by the economic reform. Key challenges focus on managing land use more efficiently. With more than 21 percent of the world’s population living on cultivated land, which is less than 10 percent of the total area available on earth, China’s land resources are

extremely scarce in comparison to the world average. Chinese statistical authorities have reported that between 1978 and 1996, the total cultivated land shrank substantially from 99.39 to 94.97 million hectares, whereas the total population of China continued to rise from 962.59 million to 1.21 billion people (Lin, Ho, 2003). Since the Dujiangyan water project, Chengdu plain has become a prosperous agricultural region, and known as 'Tian Fu'—the heaven land. It is now still one of the most important agricultural bases for western China. Nevertheless, along with Chengdu's dramatic economic growth, urban development has brought many kinds of land use changes. The significant changes are the increasing of the built-up area, the rapid growth of the residential area, and more land that invested for the public facilities, and also the rise of the industrial area. As shown in table 14 below, the residential area has increased more than 10 times compared to 1953, similar to that, the area for public facilities has also risen more than 10 times. Through the process of economic development, the amount of industrial land construction was very impressive, too. Especially since the economic reform in the 1980s, the industrial area in Chengdu has grown from 1.72 km^2 to 84.9 km^2.

Illustrated by the table 15 of the changes in cultivated land, it is very easy to see the trend of the rapid decrease of cultivated land and the massive increase of built-up areas (Table 15). The increased cultivated area was always less than the decreased land, from 1978 to 2007, the cultivated area has already dropped about150 thousand hectares, the decreased cultivated land were converted into road and urban construction area. Chengdu's first land use plan was accomplished and submitted to the municipal government at the end of 1989, represented the government's intention to maintain the

agricultural land during the urbanization process. Chengdu as an important food producer for southwest China, the city government confirmed that the basic goal of land use planning was to balance the relationship between agricultural land and urban land. By the middle of the 1990's, the province approved Chengdu's first land use plan, and the planning period was from 1990 to 2000. This plan states that by 2000, the preserved cultivated land should be around 446,666 hectares (Chengdu Yearbook—the land, 2000).

Table 14: The land use changes of Chengdu from 1953 to 2007
(Source: Chengdu Statistic Yearbook 2008, Chengdu Yearbook—The Land, 2000)

Unit: km^2	1953	1979	1990	2000	2004	2007
City Area	--	--	1,382	1,418	2,177	2,182
Built-up Area	25.28	58.2	74.4	207.8	386	407.89
Residential Area	9.83	26.47	38.6	66.1	94	135.48
Public Facilities	5.25	1.71	--	29	50.5	54.97
Industrial Area	1.72	15	22.3	46.2	80.3	84.9
Transportation Area	4.08	1.72	3.0	8.6	7.4	5.21
Storage Area	--	--	3.4	5.4	6.4	7.42

Table 15: The changes of cultivated land
(Source: Chengdu Yearbook 1989, 2008)

(Unit: Hectare)	1980	1990	2000	2006	2007
The total cultivated area	493,385	466,538	432,914	352,315	346,662

Based on the actual data, by 2000, Chengdu's cultivated land was 432,914 hectares in 2000, which was less than the planned area. Thus, due to the population rise and the decreasing agricultural land, the revised plan was put forward in 1997, and the planning period was from 1997-2010. According to the revision plan, the area of cultivated land should be maintained around 422,987 hectares by 2010 (Chengdu Yearbook—The land, 2000). According to the land use plan for Chengdu municipality from 1997-2010, the main goal is the conservation of cultivated land, but at the same time, the plan also maintains the pace of urban development. Urban land construction focused on urban core areas and other districts along the highways and freeways.

Changing Land Use Policy in Chengdu

There have been significant shifts in Chengdu's land use planning policies. First, land use rights and land ownership were separable, which follows the example of the Special Economic Zones in China's coastal cities, especially the economic success in Shenzhen—one of the countries' most important SEZs (Special Economic Zones). Economic reforms ended the institution of free land use on 3 January 1988. New legislation—the Provisional Ordinances on Land Management of Shenzhen Special Economic Zone—was promulgated by the Guangdong Provincial People's Congress. It declared that state-owned land in the SSEZ should be recognized as a special commodity whose right of use could be leased. Moreover, it said that the right over the leased land could be transferred, assigned, bequeathed or mortgaged on the lessee's will within the validated term. Later, an amendment to the 1982 Constitution was proposed and approved by the National People's Congress on 12 April 1988, which reads: "the right of

land use can be transferred in accordance with the law." A milestone in China's land management history was the first transaction of land-use right occurring in the SSEZ on 9 September 1987, when the Shenzhen municipality sold the use right of a plot to a local public company for a lease term of 50 years (Zhang, 1997). The Land use right was gradually introduced to one-third of Chinese cities by mid-1980s. By then, the land-use right system allowed foreign investors to access land by leasing them land for a certain period of time. Investors paid up-front land-use rights fees and rents. This early reform in the land tenure system marked a new era of land policy in modern Chinese history. By the end of the 1980s, the Chinese government decided to include western China in these shifts in land use policies. Chengdu was approved as the demonstration city of land use rights reform by the provincial government in 1990 and more regulation of lease of land and rent of public land were put forward in 1992. Along with the implementation of the land use policy in Chengdu, more and more Chinese and also foreign capital and investment are attracted to Chengdu. Massive land use changes occurred after land use rights policy changed.

Urban Land Use Changes in the Central Area

The central area, as the core of the urban Chengdu, which contains six main districts of Chengdu, have witnessed powerful economic development and effective urban land use changes during the past two decades. The land use changes are going to be analyzed through two land use maps from 1994 (Figure 21), 2002 (Figure 22) and a predication map for 2010 (Figure 23). Through these three land use maps from different periods, land use changes can be analyzed.

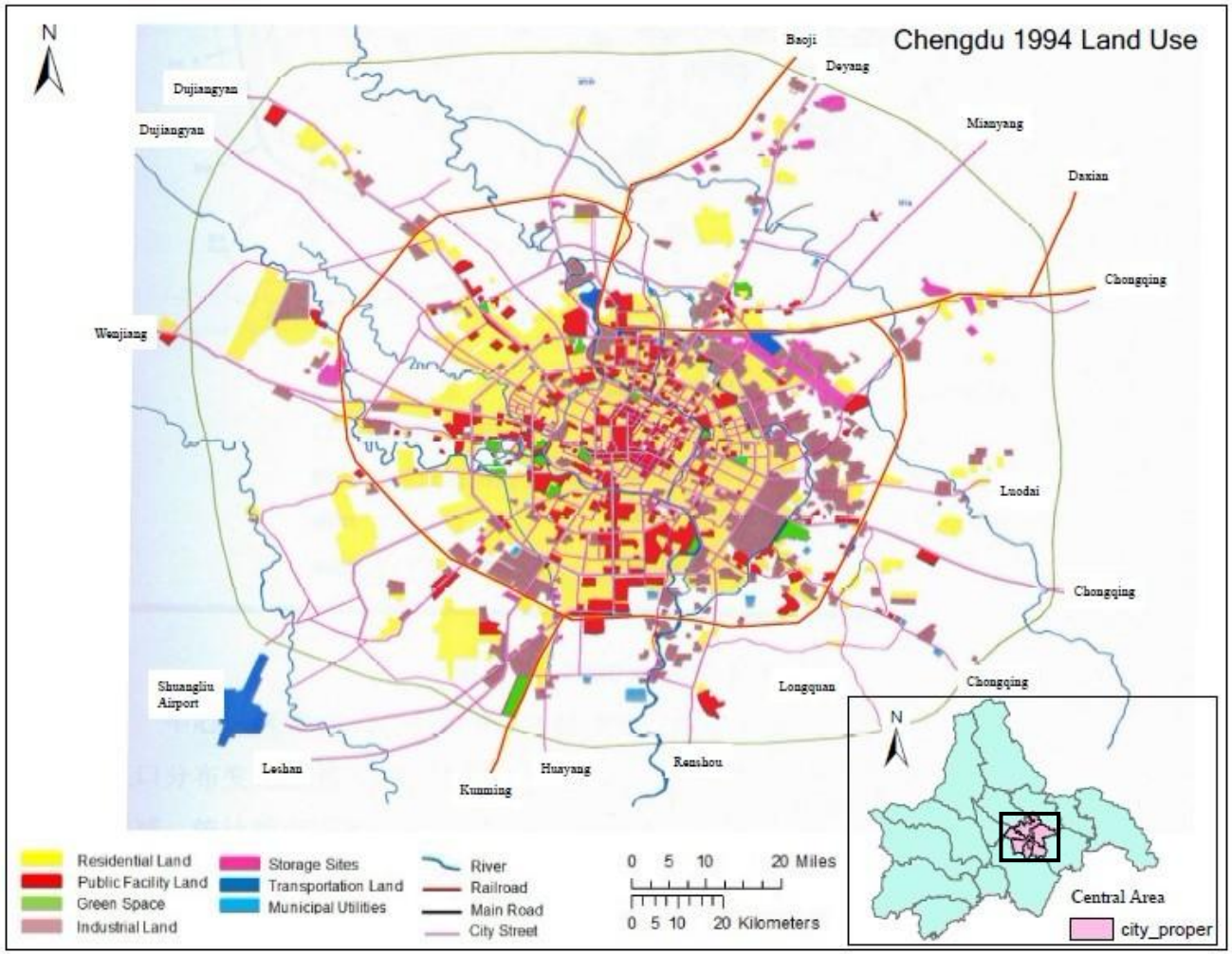


Figure 21: The land use map of central area in 1994,
(The insert map shows the location of Chengdu's central area)
(Source: Chengdu Urban Transportation Plan)

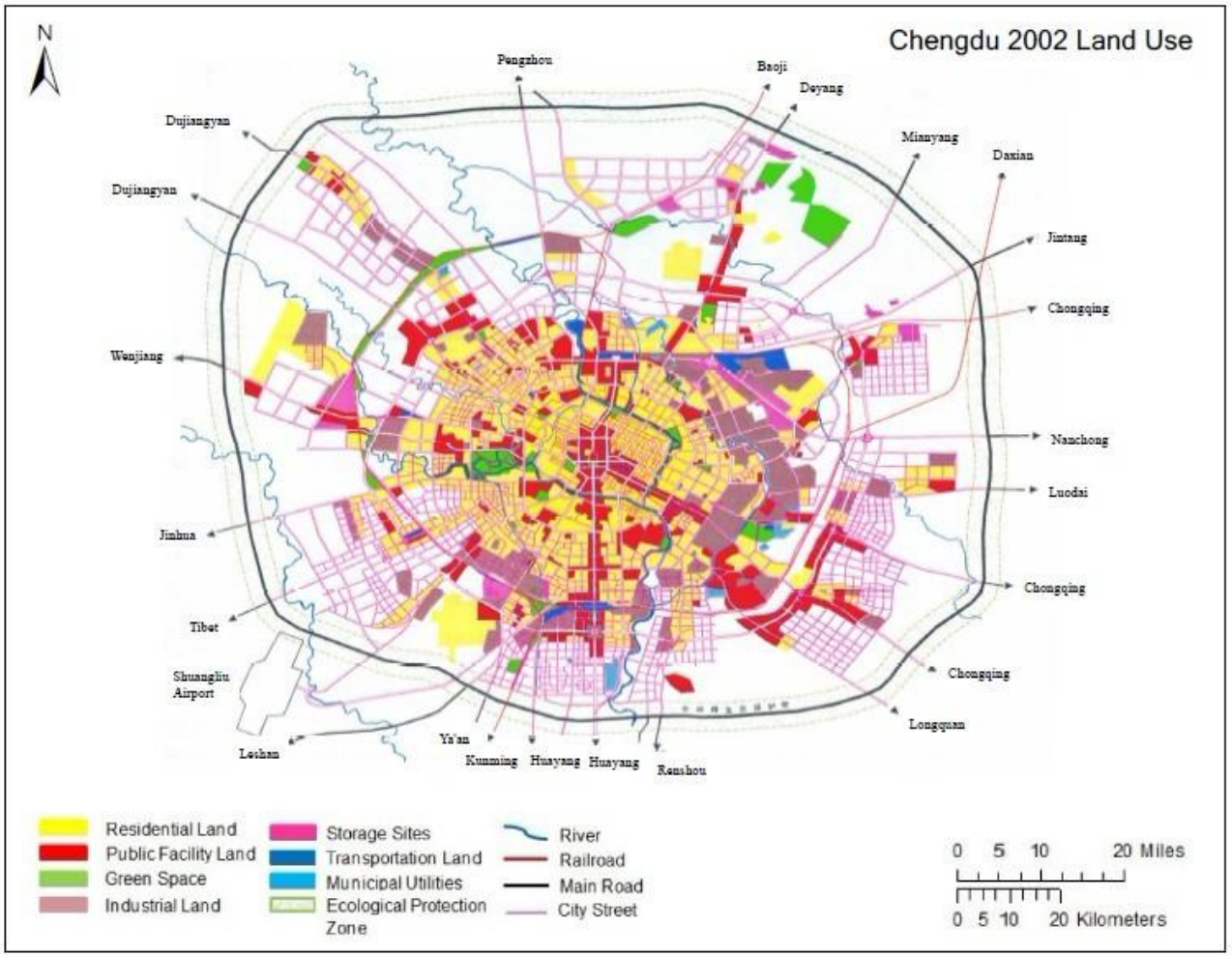


Figure 22: The land use map of central area in 2002
(Source: Chengdu Urban Transportation Plan)

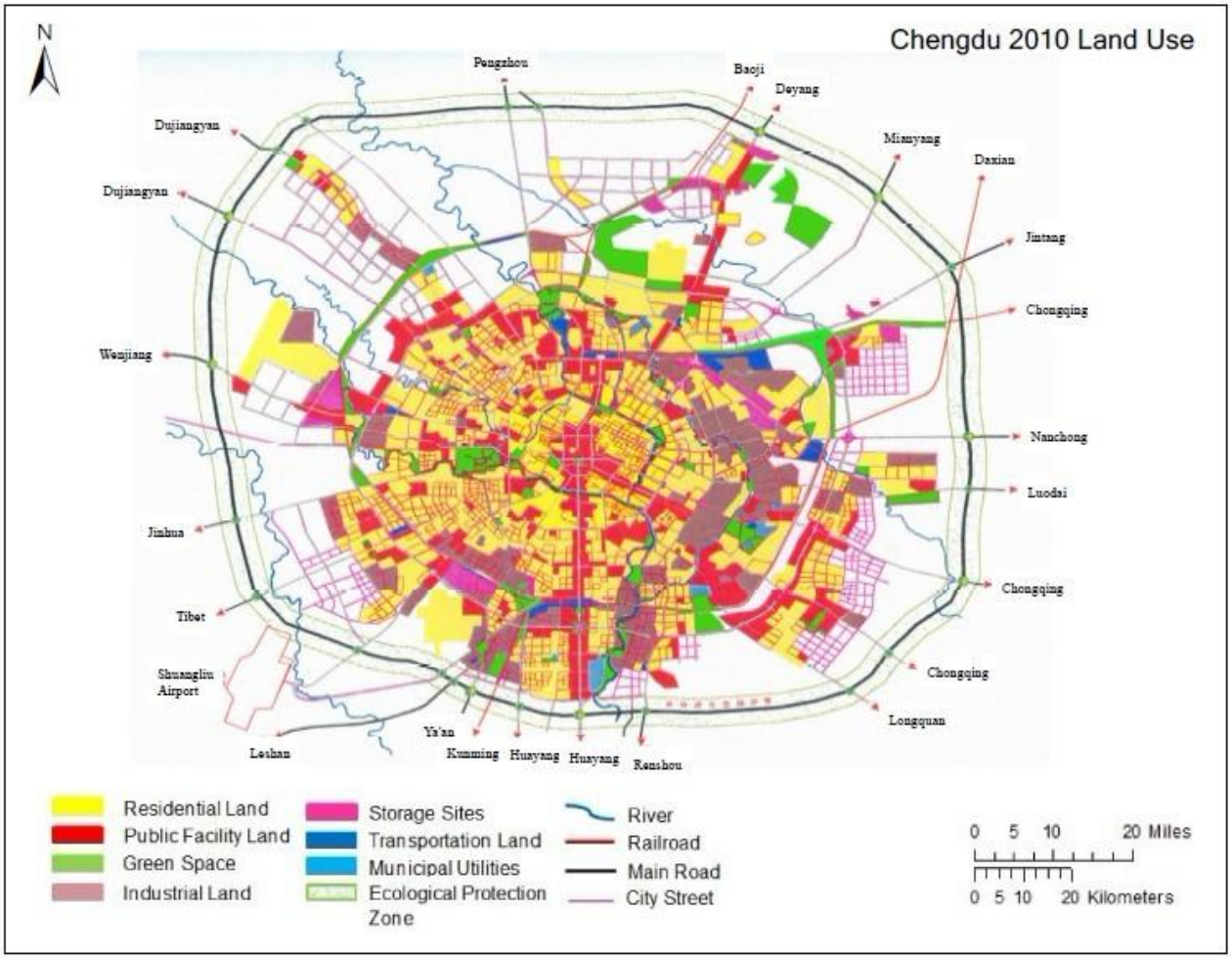


Figure 23: The land use prediction map of central area in 2010
(Source: Chengdu Urban Transportation Plan)

There are several patterns that can be illustrated from these three maps above:

First of all, residential communities have been moved out from the CBD and city center, and started spreading to the urban fringe areas. Because of raising urban land prices, the government earns more profits by leasing lands to businesses. Housing near the city center becomes unaffordable. Besides, due to the improvement of Chengdu's transportation system, and the increasing number of private-owned vehicles, accessibility is no longer the problem. More and more apartment buildings have been constructed along the second and third ring roads. Rural areas not only have lower house prices and more space, but they also have better environments. Therefore, more and more people moved to rural areas to search for higher quality of life.

Much like people pursuing higher living standards, the government has also paid more attention to the urban environment. Based on a sustainable development strategy, the green space in urban areas has increased dramatically. Because of the emphasis on urban sustainability and eco-friendly development, green space is becoming one of the important parts of city planning. Based on Chengdu's Master Plan from 2003-2020, Chengdu was designed as a 'world modern garden city'; therefore, to maintain the urban environment is very crucial.

Because of the importance of maintaining urban environments, various industries in urban areas have been moved to special designed rural areas. High-technology parks, and industrial zones have been built during the past two decades to absorb and attract various heavy industries and high technology industries. On one hand, the government designed well-planned industrial areas that offer better facilities such as power and

sewage systems for various factories. These designs also make it easier for the government to control the pollution. On the other hand, rural areas have lower land prices and more labor force; the factories and enterprises could also offer more job opportunities to rural employees; therefore, it helped to promote rural-urban integration.

To conclude, due to urban population growth, the area of residential land has increased dramatically during the past fifteen years. More and more urban infrastructure has been built to attract foreign investment to stimulate economic development. Green space such as city parks and green belt are increasing due to the city's sustainable planning, to make the city environmentally friendly. The distribution of industrial land is re-located around the urban and rural fringe area. Industries once located in the central area have been gradually moved out. Tertiary activities such as public services and high technology industries are becoming the main land use forces that occupied the city center.

Urban Expansion

In 1826, German economist Von Thunen created the model of agriculture land use with an isolated state morphology that is characterized by the concentric agriculture zones dominated by different crops, as dictated by simple cost-benefit relations. Even though the Von Thunen model was created in a time before factories, highways, and even railroads, it is still an important geographical model in a capitalist free market system. It is an excellent illustration of the balance between land use and transportation costs, as one gets closer to a city, the price of land increases. Nevertheless, his work could be seen as a foundation for the development of urban development theories, including the

concentric zone model from Burgess in 1925, the sector model from Hoyt in 1939 that allows for corridors or wedges of industrialization due to the influence of transportation networks, and the model-the multiple nuclei model from Harris and Ullmann in 1945 that emphasized multiple centers of specialized activities, resulting an asymmetric patch mosaic pattern. These models of urban forms were developed based on the studies of American cities, and thus, it may be less applicable to the cities in China. However, for the urban development in China, especially after the economic reforms in the 1980s, its land use patterns have spontaneously changed under the free market economy. Urban land use patterns in Chinese metropolises has become very similar compared to western land use models, therefore, those theories that mentioned above may be useful to some extent. In this research, a close relationship between transportation and urban expansion can be observed from the case study of Chengdu.

During the past thirty years, Chengdu urban planners have been confronted with unprecedented urban growth. As one of the most important metropolises in southwest China, Chengdu always plays a crucial role in the country's development strategy. In this paper, Chengdu is chosen as a study area that is representative of China's rapid growth cities. During the research, it is easily noticed that the expansion of Chengdu's urban edge has far exceeded the original 'urban core' definitive of the five districts of Jinniu, Chenghua, Jinjiang, Wuhou, and Qingyang. Rather, the majority of new development has occurred in the counties and districts adjacent to these urban core districts, such as Xindu, Longquanyi, Shuangliu, Wenjiang, and Pixian. The government applied the "Shi dai Xian" strategy by using the central city to lead the development of adjacent counties and

villages, which advanced the integration of urban and rural areas. This is also the future urban development plan for most Chinese cities. After the initiating of economic reforms, especially after Chengdu was named as one of the open cities in inland China by the national government in 1992, Chengdu's urban expansion accelerated. From 1980 to 1994, Chengdu's urban built-up areas had increased from 60 km^2 to 106 km^2, almost doubling in fourteen years. But 1994 to 2010, its built-up area rose dramatically from 106 km^2 to 515 km^2 (Figure 24).

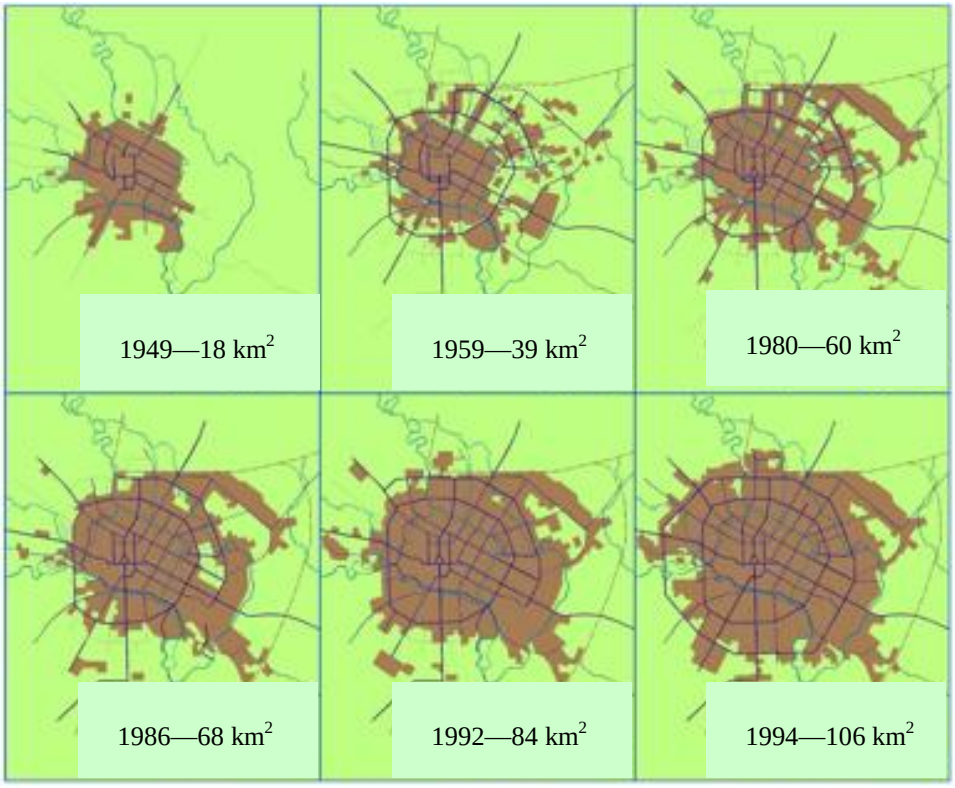


Figure 24: The changes of built-up area in Chengdu from 1949-1994
(Source: Government Report)

Table 16: The population and built-up area changes between 1949-2010
(Source: Chengdu Statistic Yearbook, 1995, 2005, 2011)

Year	1949	1959	1980	1994	2004	2010
Built-up areas (km^2)	18	39	60	106	386	515
Urban population of Municipality (million)	1,125	1,804	2,383	3,015	4,645	7,020
Total population of Municipality (million)	5,013	5,958	8,225	9,604	10,597	11,100

Table 16 shows that during the past sixty years, the built-up area in the central city increased almost 30 times, from 18 km^2 at 1949 to 515 km^2 at 2010. Meanwhile, the urban population has grown significantly from 1,125 million to 7,020 million, and the urbanization level also almost tripled, from 22.4 percent in 1949 to 63.2 percent in 2010. Illustrated by figure 25, the pattern of Chengdu's urban development shows the city was oriented around the old urban core, and gradually extended to the surrounding areas. Urban core area is located within the First ring road; and between the First and Third ring road is the main urbanized area. Chengdu's urban growth mainly concentrated within the Third ring road from 1978-1991, and then after 1991, urban development gradually expanded outside the Third ring road. Relying on the development of Chengdu's transportation road network, urban growth can be seen along the freeways during the past two decades. The directions of urban growth changed from the single center to south-north axis, and formed a unique development direction, and illustrated an urbanization process, which is developing from urban outward towards nearly rural regions. According to the 1996 Chengdu Master Plan, the development north and west of central

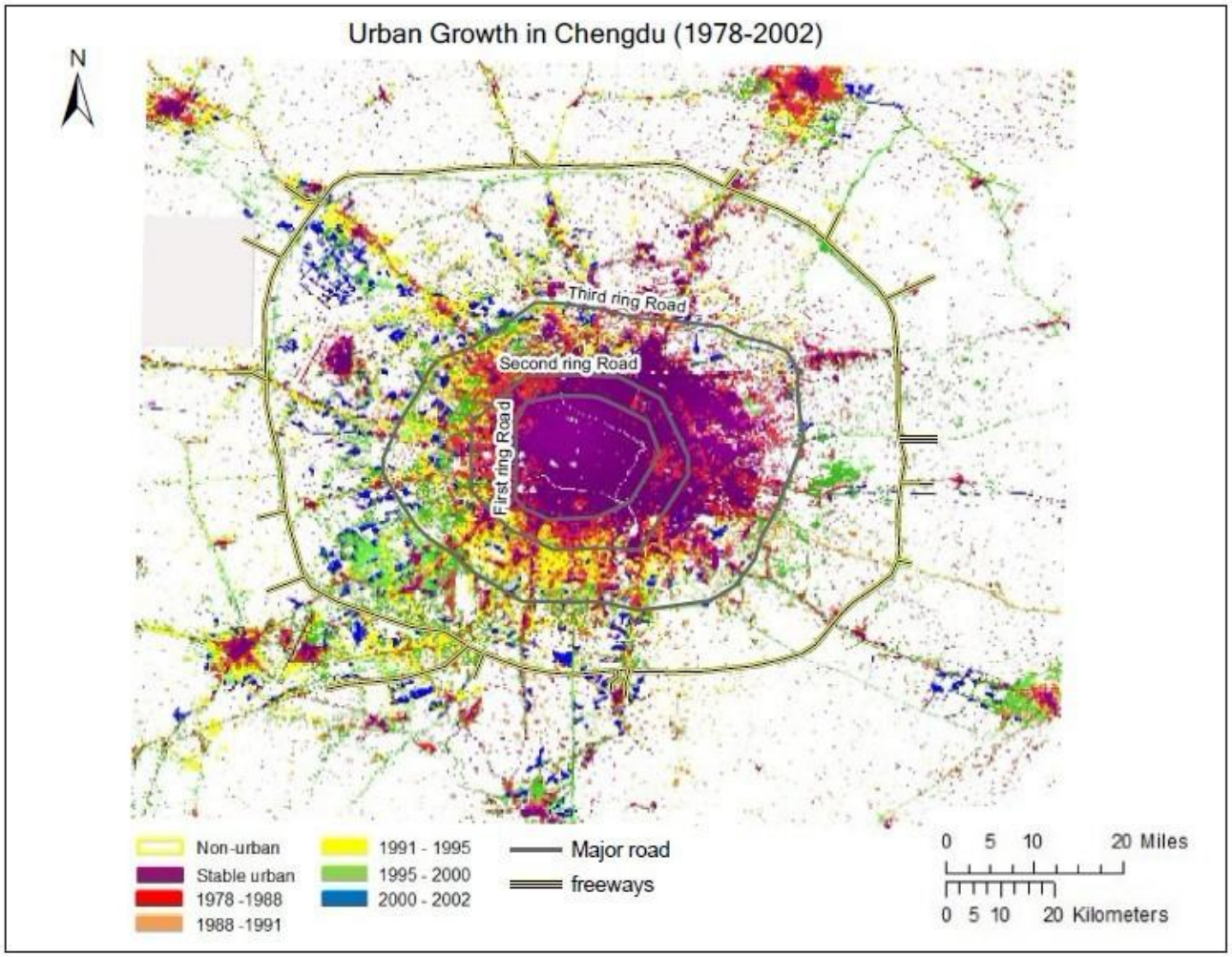


Figure 25: Urban growth in Chengdu from 1978 to 2000
(Source: Karen C. Seto, 2003)

city should be restricted due to the mountainous landscape, and the city should be guided to develop eastward and southward. Thus, the main direction of Chengdu's urban expansion has been converted successfully by implementing this planning strategy. Nevertheless, due to the significant economic and urban development of Chengdu in the past two decades, Chengdu's Master Plan needs to be modified. Therefore, in the Master Plan of Chengdu 2003-2020, the urban development is focused on stimulating the process of urbanization through all four directions from south, north, east and west to approach the mountain foothills.

Table 17: Estimated population and built-up area of Chengdu in 2020
(Source: Chengdu Urban Transport System Plan)

Range		Population (Thousand)	Built-up Area (km^2)	Per capita land (m^2)
Municipality		10,350-10,660	1,029.6	96-99
Metropolis		7,600	673.09	89
Urban-core		4,800	400	83
Six peri-urban clusters		2,800	273.05	98
	Huayang	310	28.5	92
	Xindu-Qingbaijiang	790	70.79	90
	Shungliu	390	40.73	104
	Longquan	520	51.55	99
	Wenjiang	280	32.52	116
	Pixian	510	49	96

According to government plans, by 2020 the total population of Chengdu municipality will reach between 10.3 and 10.6 million; and the built-up area will be around 1,029.6 km^2. Compared to 2010, total population of Chengdu will be slowly decreased and built-up areas will be increased almost double. The population of the metropolis area will be around 7.6 million, including 4.8 million in urban core area and 2.8 million in peri-urban area; the total built-up area in metropolis is 673 km^2, with 400 km^2 in urban core area and 270 km^2 in peri-urban area, respectively (Table 17).

Urban Expansion through Six Corridors

With the substantial increase of urbanization level of Chengdu, urban sprawl has become obvious during the past ten years. After economic reforms were initiated, rather than just physical planning, the great value of urban planning in the process of urban and economic development has been gradually recognized. Currently, planners provide decision-support for the local government to control and lead rapid urban expansion. Based on Chengdu's latest Master Plan (2003-2020), the integration of urban and rural areas is emphasized in the city plan, the land use and urban construction will be based on the city center, and expanded through not only north and west, but also east and south, to approach the mountain foothills. To achieve this goal of urban and rural integration, the strategy of 'three convergences' is applied—population converge into the city and town; land converges into the minor family; industry converges into development zone, which accelerate the fundamental changes of urban and rural spatial structure and ways of production and living (Wang, Gao, 2008). The Master Plan is supported by the development of districts and counties—Xindu, Qingbaijiang, Pixian and Wenjiang,

Shuangliu and Longquanqi. To achieve this goal, the government designed different function areas through the six corridors: the ChengWenQiong Corridor, the ChengXin Corridor, the Southern Corridor, the ChengLong Corridor, the ChengQing Corridor, and the ChengGuan Corridor (Figure 26). According to the comprehensive plan, each corridor is assigned as a functional region with its own prioritized economic type of development, and the districts and counties will be utilized as a sub-core region for the city's future economic and urban development (Comprehensive Plan of Chengdu 2003-2020).

ChengWenQiong Corridor: The ChengWenQiong highway opened in October 2004. This 65.1 km highway passes through Qingyang and Wenjiang districts, Chongzhou, Dayi and Qionglai counties. New developments include a mix of residential buildings typical of peri-urban areas in China, such as new villas for farmers, a number of new suburban-style housing complexes, and small industries such as garment and shoe factories, and printing firms. In this corridor, Wenjiang is one of the newest developing districts in Chengdu and is focused on printing, food processing, and high technology industries. In the meantime, it is going to focus on tertiary industry such as college education, scientific research institutions and tourism.

ChengXin Corridor: This region, located southwest of Chengdu, contains part of the Shungliu County, and all of Xinjin and Pujiang counties. Depending on the ChengRen freeway, and ChengYa and ChengLe highways, Shungliu County is undergoing an effective transition from rural to urban in the past decade, and it is also

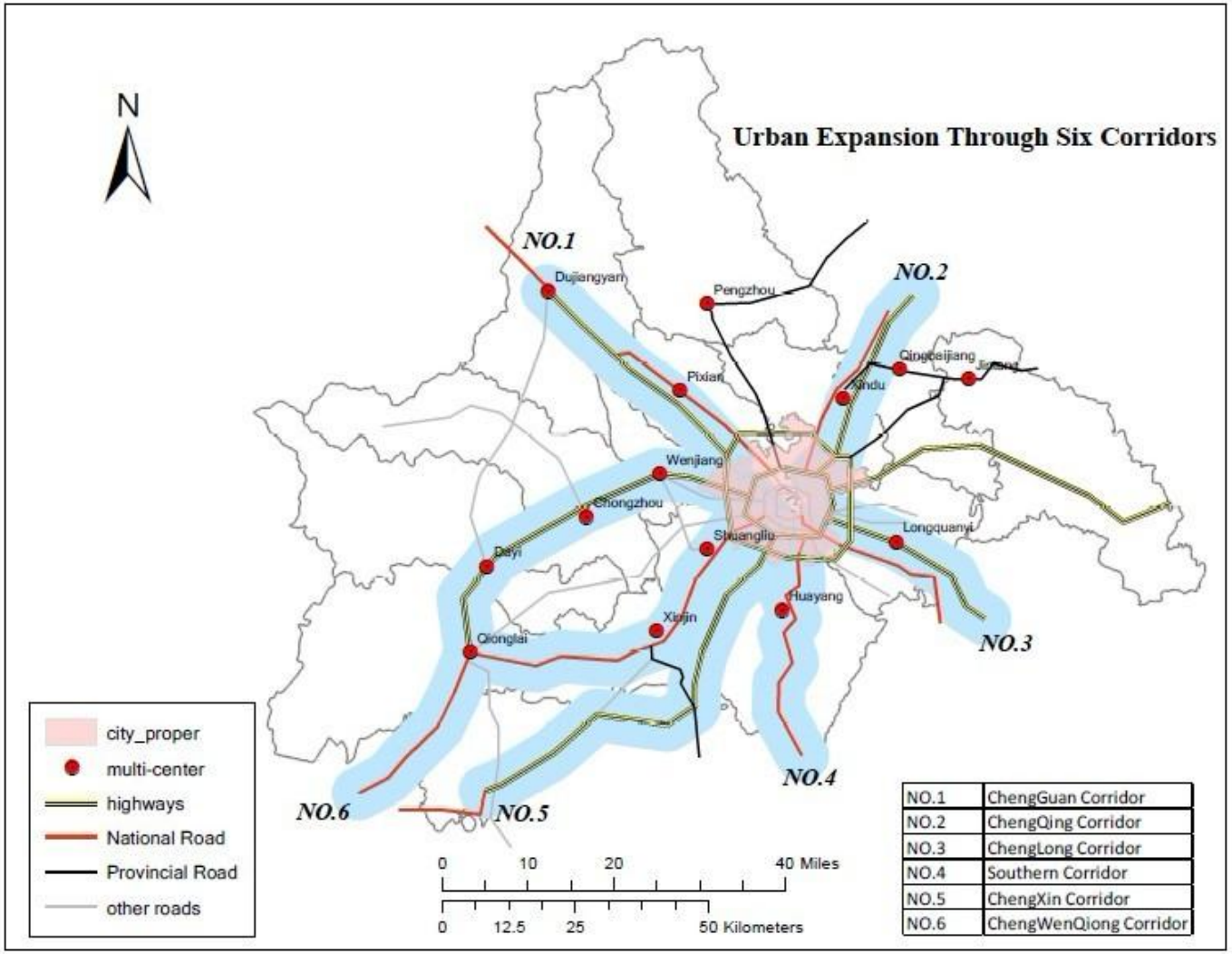


Figure 26: Six corridors during Chengdu's urban expansion (By author)

functioning as a powerful development force for the southern part of Chengdu. Shuangliu County is located in the south and adjacent to the central district of Chengdu city, where there is the Chengdu international airport and Southwest Airport Economic Development Zone. Dongshen town in Shuangliu County is an important adjacent suburban area to Chengdu. This development zone concentrates on the electrical machinery and medical equipment industries. Xinjin has been designed to develop the building material, food processing, and chemical industries. Pujiang, similar to Xinjin, has also been designed as an industrial town with pharmaceuticals and food industry.

Southern Corridor: Depending on the ChengRen freeway and ChengYa highway, Shungliu County is undergoing an effective transition from rural to urban in the past decade, and it is also functioning as a powerful development force for the southern part of Chengdu. Shuangliu County is located in the south and adjacent to the central district of Chengdu city, where there is a county seat, Chengdu international airport and the Southwest Airport Economic Development Zone. Due to its great location, Shuangliu County, especially the adjacent suburban area named Huayang, has been assigned as an important development zone. Currently, Huayang town functions as the convention center, focused on business services.

ChengQing Corridor: This region is located at northeast of Chengdu, and contains two sub-centers, Xindu and Qingbaijiang. The ChengMian highway, ChuanShan road and also the BeiXin freeway that finished in July 2007, has greatly shortened the travel time between Xindu and Chengdu. Due to Xindu's close distance from Chengdu and also

the proximity of the BeiXin freeway (North Train Station to Xindu), Xindu is designed as the logistics center for northern Chengdu, the furniture industry, and the mechanical and electrical equipment industries and will attract investment for economic development. It is also one of the sub-core regions for Chengdu's rapid urban expansion to the north. Besides, depending on ChengQing freeway and ChengMian highway, Qingbaijiang is another important area for Chengdu's economic and urban development for its northern part. Qingbaijiang is designed as the industry zone for the heavy-duty equipment manufacturing, the building material industry, and the chemical and metallurgical industries (Wang, Gao, 2008).

ChengLong Corridor: Chenglong Corridor relies on the ChengYu (Chengdu to Chongqing) highway and ChengLong freeway. Longquanyi County is becoming a crucial suburban district as a metropolis fringe area of Chengdu. Along with the urban sprawl and the rapid pace of suburbanization, Longquanyi is playing a more and more important role in Chengdu's urban development. Based on its geographic location, Longquanyi is the base for agricultural products, especially for fruits and vegetables. In addition, due to the improvement of the transportation conditions, it has been designed not only as a national economic and technological development zone, but also as a modern manufacturing zone, as well as the logistics center for eastern Chengdu. In addition, the leisure vacation industry such as the agritainment (agricultural for entertainment) has been promoted during the past several years.

ChengGuan Corridor: ChengGuan highway connects Chengdu and Dujiangyan

city. The city of Dujiangyan was heavily damaged by the 2008 Sichuan earthquake (7.9 magnitude); supported by the national and the city government in the past few years, the area recovering from the earthquake. As part of Dujiangyan, Pixian county has become a zone of high technology industry, and also a scientific research and education base for many colleges and universities. Dujiangyan, as one of the most famous tourism attractions of Chengdu, is now recovering from the earthquake, and attracting many tourists from all over the world.

According to the master plan, depending on the six corridors, and through the new development in fringe clusters of counties and towns such as Xindu, Qingbaijiang, Wenjiang, Pixian and Shuangliu, Longquan, Chengdu's urban expansion is experiencing a rapid transition. It is changing from the circle structure to 'fan vane' layout. In other words, by carrying out the urban and rural integrated development strategy and the "three convergences" policy, Chengdu's development model is now changing from one single-center model to a multi-center model. Different centers have their very own characteristics, such as logistic center, high-technique industry, and heavy-duty industry and manufacture industry etc.

The Factors behind the Land Use Changes and Urban Expansion in Chengdu

The urban build up has moved out of the core of the city along roadways, which radiate out from the city like spokes on a wheel. With rapid urbanization processes at work, urban expansion grows like a weed, so it is necessary to carry out land use planning and city planning to control the disorder and expansion. To conclude the driving

forces of urban expansion in Chengdu, there are several aspects that need to be considered.

The Physical Geographical Element

Backed up against the Qionglai Mountains in the Sichuan Province of Central China, topography could limit Chengdu's urban expansion. In the case of Chengdu, it has a total land area of about 12,390 km^2; with three geographical unites including the west plain, hills inside Sichuan basin, west edge mountainous of Sichuan basin. Even though the plain area occupies 40.1 percent of the whole municipal total area, the foothills and mountainous areas still accounted for more than half of the total area (Peng, Zhao etc, 2008). Chengdu's urban expansion has mostly undergone on the four directions of western, eastern, southern, and northern side of the city, approaching the mountain foothills. Most of the cultivated land and new urban construction are concentrated in western plain. Forestry land and natural grassland is located along the west edge of the mountainous regions in Chengdu.

The Driving Forces behind Economic Development

Economic development requires a long period of structural transformation in materials inputs through relocating natural resources. Land could be seen as a crucial element and a key factor of production, and it is always the best witness to record key economic transformations. Therefore, land use changes reflect economic development. Along with the economic growth, land resources are used for urban development. Agricultural land and habitats like forest and grassland are transformed into land for

housing, roads, and industry etc. Economic development also leads to changes in industrial structure form. The transition from primary, secondary and tertiary activities produced changes in land use types (Wu, Su, Zhang, 2006). In addition, to attract investment to stimulate economic development, the government has allocated urban or rural land for companies and factories. The Economic development zones and high technology parks are built by the infusion of foreign and domestic capital. As the second largest city in southwest China, Chengdu is now influenced by globalization. On one hand, with the investment from foreign and domestic companies, it helped Chengdu's economic and urban development and promoted Chengdu's urban competitiveness in global market. At present, Chengdu is one of the most popular investment destinations in China. On the other hand, the massive foreign and domestic capital brought high technology industries and attracted more high educated elites to Chengdu, which stimulated Chengdu's economic structure transition, raised Chengdu's urbanization level through the increasing of the tertiary industry. Various business services, high-grade housing market and malls occurred in urban Chengdu, stimulated Chengdu's economic development. After the reform of the urban land market, the price of the land varies according to the distance to the urban center: the further the land is from the city center, the cheaper its price will be. Hence, the urban expansion focuses on the suburban district for its low-priced land, which in turn leads to effectively uncontrolled and disordered expansion of the boundary of the city (Zhou, He, 2007). Recently, suburbanization is occurring in Chengdu, as the lower land value and land price in suburb area has caused

the shift of land use from industrial and administrative to commercial and other tertiary uses.

The Motivation of the Population

Clearly, the urban expansion has a close connection with the urban population. The size of the urban population is closely related to the urban built-up area. The increasing urban population is very significant for the past ten years in Chengdu. Due to the preference policy from the national government after the 'Go West' program, the economy has been growing rapidly because of huge global demand for Chinese products. By 2010, a total of 902 million dollars of FDI has been attracted to Chengdu (Chengdu Statistic Yearbook, 2011), foreign companies; various high-tech industries have chosen Chengdu as their investment destination. In the meantime, more and more job opportunities are created to appeal to elites and high-educated labors that graduated from the universities in or near Chengdu each year, and also the elites from other big cities come to Chengdu to compete with locals for a better career. Also, with better living conditions, and lower daily expenses compared to other big cities in China, Chengdu is now attracting many laborers back from coastal cities such as Guangzhou, Shenzhen and Shanghai to their hometown to find a similar job, even with lower pay. In addition, because of the loss of control of the hukou system, the flow of rural migration that searches for a better life in urban areas has kept rising during the past two decades. These in-migrations have boosted Chengdu's urban population and overall urban sprawl. To control migration, the government has put forward the strategy as the urban-rural integration. The industrial zones are moving out from the urban area, which helps

relocate the large number of urban migrants to adjacent suburban areas, and also improves the economic development in the rural counties.

The Development of the Transportation System

The urban growth always depends on the development of the transportation system, and Chengdu is no exception. By 2007, the total length of road in Chengdu was more than 18,982 km, highway was 438 km, the primary and secondary, and also the third and fourth level of paved road occupied 647, 1,697, 1,843 and 11,369 km, respectively. In addition, the substandard road was 2,986.355 km. Thus, the distribution of road network of Chengdu is mainly based on the national and province highways, and then combined with the road of villages and towns to form the network of traffic (Figure 27). Between 2009 and 2011, there are several transportation projects concentrated on the construction of provincial highways, city freeways and primary road, such as ChengXin primary road (Chengdu to Xinjin), Qiongming highway (Qionglai to Mingshan), ChengDe freeway (Chengdu to Deyang), and ChengGuan freeway (Chengdu to Guanxian) (Chengdu transport annual report, 2009). Chengdu's urban development through six corridors is the best example of urban expansion along major highway arteries. Counting on the construction of its highway system, the urbanization level of Chengdu has raised dramatically during the past two decades. Furthermore, started in 2005, Chengdu completed the construction of its first subway line by 2010. The first phase will link Honghuayan to Fuhuayuan via the city's North and South Train Station. The line will be extended at both ends, running for 26.7 km from Dafeng to Guangdu with 23 stations. The second line is planned to open around 2012, which runs from the Sichuan Institute of

Economic Management in the west to Chengguan bus station in the east, serving the University of Traditional Medicine and the Niushikou shopping district. Chengdu Metro hopes to complete both lines by 2014, bringing the total length of its network to 82km (City News, 2006). After the first two main Metro Lines are finished, another five lines will be constructed in the next twenty-five years to establish a great metro network in Chengdu—with a total length at 274.15 km, and 146 stations. This project of Chengdu Metro will cover more than 80 percent of the urban area (Figure 28). The accomplishment of this project will be remarkable; it is not only going to help relieve the stress for the present ground traffic, but also depend on the network, it will support Chengdu's multi-center development strategy. In addition, by connecting the adjacent suburban districts to the urban center, the metro system is going to extend the travel distance, and meanwhile, to shorten the travel time for urban employees. This mode of transportation will encourage people to move away from the city center, which would help to slow down the quickly rising housing price in urban area, and also relieved the pressure of housing issue in the city. The airline service to Chengdu is improving, too. The second terminal for Chengdu airport is now under construction, and will be finished in the near future. By then, the new airport will be able to accept more than twice the number of passengers and to land larger airplanes than the old one. In short, the development of Chengdu's highway system, the new metro system, the latest high-speed railways that connect Chengdu to other big cities in China, and also the airline system all lead Chengdu to become one of the most crucial transportation hubs not only in west China, but also in Asia.

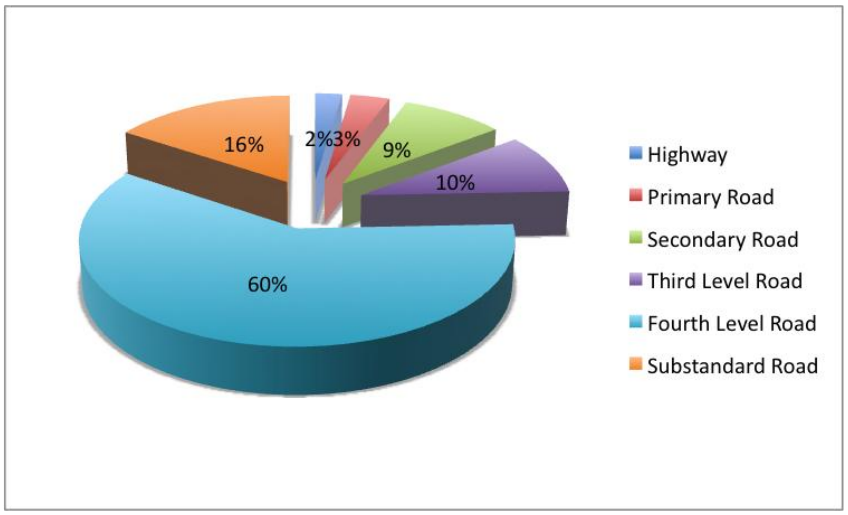


Figure 27: The road network of Chengdu
(Source: Chengdu Urban Transportation Plan, 2005)

Figure 28: Chengdu Metro System
(Sources: www.cdmetro.cn)

The Urban Development Patterns and Trends in Chengdu

Overall, the past 25 years reveal several key patterns in Chengdu's urban development. First, a great deal of land conversion has occurred outside the city proper in small towns and satellite cities. Secondly, the city has functionally reorganized around sub centers and targeted development zones. These kinds of changes can be seen in many Chinese cities. To conclude, Chengdu's urban development pattern could be summarized as layers development combined with new multi-center development. The final goal for the government is to slowly transition from its single-center model to multi-center model. At present, Chengdu's urban growth and economic development expanded by infilling along the three ring roads. The distribution of the economic structure as the first, the secondary and the tertiary industry is followed by three layers as the central urban area, the region between the metropolitan district and the central urban, and the region between administrative region and metropolitan district. The tertiary sector occupied the first layer, the secondary sector dominated the second layer, and the primary sector located mostly in the third layer. Because of the rapid construction of Chengdu's highway and freeway system, also the latest metro system, and the improvement of the public facilities and infrastructures in rural Chengdu, the urban growth patterns have had some significant changes during the past decade. Relying on its transportation system, Chengdu's urban expansion is now growing along its six corridors; districts and counties with diverse functions are designed for each corridor to stimulate the process of urban-rural integration and the rural economy.

CHAPTER 6

THE EVALUATION OF URBAN PLANNING IN CHENGDU

The Changing Policy of Urban Planning in Chengdu

Following the instructions given from the State Government, the policies of urban planning in Chengdu overlapped with the process of the nation's economic and urban development. There are several important periods that connected with Chengdu's urban planning.

1952-1957: After three years of recovery from the end of civil war and the establishment of PRC in 1949, by 1952, Chengdu was chosen as one of eight main construction cities. Urban planning became an important government function in managing urban areas with the establishment of a planned economy. The first modern urban planning of Chengdu began in 1953. Chengdu's first comprehensive plan was approved and implemented by the state government in 1955. In this city plan, urban layout, land use planning and function zoning were included. Industrial areas were focused in northern and eastern suburbs, educational and scientific research areas were located in the southern part of Chengdu, and residential areas were constructed between the industrial areas and the old city center.

1958-1977: During this period, urban planning in Chengdu changed due to different government strategies. As a consequence of the Great Leap Forward, several new industrial regions were established and many city construction projects were developed to meet the unrealistic goal of industrialization from the national government.

Those massive urban construction projects resulted in rapid urban expansion and caused great changes on the urban landscape. While the government concentrated on construction, basic economic and social conditions were ignored; which led to urban planning apart from the construction. After the Great Leap Forward, the ten years of the Cultural Revolution brought chaos to the whole nation. Throughout the decade, urban planning was totally abandoned, planners were forced to receive reeducation by workers and peasants, while planning institutions and activities were eliminated, too. Nevertheless, to proclaim the power of Chairman Mao, many historical sites were destroyed replaced with Mao's exhibition halls and Mao's sculpture built along with fortification.

1978-1989: After the end of the Cultural Revolution, the urban planning bureau was reestablished in 1979, and planners gained more power. More studies were completed, more public participation was encouraged, and experts and scholars were invited to join the planning process. In 1982, Chengdu was named as one of the famous historical and cultural cities, and historical preservation was added into the urban planning process. The State Council also approved and developed the revised master plan. After a few years, six district plans were applied, followed by detailed plans for their improvement. Especially after the enactment of the 1989 City Planning Act, Chengdu saw a great promotion of its urban planning and the city gradually emerged as a metropolis in western China.

1990-present: Chengdu has undergone dramatic urban growth since the initiation of economic reforms. To better guides and anticipate future urban development, the

administrative area of Chengdu was enlarged. In 1990, Chengdu divided the five old districts into seven districts; then by 2002, with approval by State Council, Wenjiang and Xindu were changed from counties to districts. Currently, Chengdu has nine districts—Jingjiang, Qingyang, Jinniu, Wuhou, Chenghua, Qingbaijiang, Longquanyi, Xindu, Wenjiang, four county-level cities—Dujiangyan, Pengzhou, Qionglai, Congzhou; and six counties—Jintang, Shuangliu, Pixian, Dayi, Pujiang, Xinjin. The adjustment of the administrative boundaries and the rise of counties to district level helped improve the process of urban development. Besides, it makes the resource management more efficient due to better government control. It also supported urban planning strategies, and guided the direction of urban growth (Zhou, 2007). During the process of urban expansion over the past two decades, the urban planning strategy has changed in the process of urban development and economic development. To reflect the economic reform era, and to adapt to the tremendous economic and urban development, the goal of Chengdu's urban planning has become oriented toward sustainable development, and the integration of urban and rural areas. To achieve the goal of sustainable development, the policies made by the municipal government have had a great influence during the process of urban land use changes and urban expansion. Also, the government policy is able to help control the loss of cultivated land, especially the rapid degradation of agricultural land in peri-urban area. Other policies such as land use rights, farmland protection, and other regulations related to land use also assisted the government in conserving agricultural land, and improve the land values and control land prices. Table 18 below presents some of the important examples of land use policies in Chengdu.

Table 18: The government policies during the land use reforms in Chengdu (Source: Chengdu Yearbook—the Urban Planning, 1998)

Type of Policy	Title	Function
General Policy:	The Resolution about legally strengthening land management from the committee of Chengdu city people's congress (1989) The notice of legally strengthening land resource and the asset management (1994)	-- To improve the land use management by following the national land use regulation. Improving the publicity of land use laws and regulations. --To establish the standard land market; to control the use of cultivated land during the process of urban development
Land of Construction	The resolution of compensation and resettlement of land requisition for state and city construction (1994)	-- To solve the conflicts during the process of land requisition for state construction

Table 18: The government policies during the land use reforms in Chengdu (Continued)

Paid use of Land	The approach of land use management for foreign investment enterprises (1990) The management of state owned town land usage right remise and transfer (1992)	-- Ensured the regulation and land use rights, also the preference policies for foreign companies -- Confirmed the detailed regulations of transfer, remise, rent, time limited and so on.
Cadastral land	The provision of determine ownership of state-owned land (1989) The provision of registration of certificate of state-owned land (1990)	-- These two provisions demonstrated the land use rights and land use regulation in details, which provided the legislation support along the process of land use.
Cultivated land protection	The implement of farmland protection planning (1995)	-- Confirmed the goal of the farmland protection plan, and clearly the range and area of cultivated land

Chengdu's Urban Planning: Some Important Examples

Funan River Project: Environmental Protection

Fu River and Nan River are the two main waterways that cross the city proper. They are the branches of the Minjiang River, which also play an important part in the Dujiang dam since a thousand years ago. These two streams create a unique urban landscape in Chengdu, and made it a unique historical city—a city that never moved its location and never changed its name. However, during Chengdu's rapid industrialization period before the 1970s, and also after the initiation of economic reforms, these two rivers became focal points of urban problems. Issues like summer flooding, industrial pollution and lack of infrastructure limited the urbanization process. Also, old apartment buildings along the rivers, and the unplanned wastelands nearby affected the urban landscape (Figure 29). Therefore, in 1993, city official initiated a comprehensive improvement project for Funan River, as one of the most important decisions for Chengdu's future sustainable development. Because of the rivers' historical influences, and its important role during the city's economic and urban development, it is also a project that has a close relationship with Chengdu's Master Plan. There were five important parts in this project:

Flood control: in this part, the construction focused on reinforcing 23 kilometers of river levees, widening the river channels from 30-80 meters to 20-120 meters, and building and remodeling 17 bridges that cross the river. The capacity for flood control had been dramatically raised after the improvements.

Water quality: owing to lack of government regulation of sewage disposal before

the 1990s, the water was greatly polluted in Funan River through industrial and municipal sewage. In the Funan River project, sewage pipes were built to connect factories and sanitary wastewater to the city's sewage treatment plants. In addition, heavily polluted industries were moved to rural areas.

Urban greening: for Funan River's landscaping, urban greening and historical reservations were planned in the project. Firstly, green belts along the river were planted; small parks and recreation areas were built near the river to provide people better places for their leisure time. Secondly, historical sites near the river were reserved, and promoted as tourist attractions and offered as locations to present folk culture and local artists.

Road and pipe network construction: infrastructure always has a close connection with urban development. Along with the Funan River project, basic facilities such as transportation construction, as well as sewage, electricity, natural gas and water supply networks needed to be considered. Through the improvement of the road systems and pipe networks, the infrastructure along the Funan River facilitated the city's economic and urban development.

Affordable housing: during the project, more than 100,000 people were moved out, and then moved back to the area. Because older mixed land uses along the river restricted urban development, the Funan River project provided an opportunity for urban planners to redesign the area. Industries were relocated, old apartment complexes were removed, and business and residential areas were rebuilt along the river to offer people a better place to live.

Figure 29: Funan River in the 1980s, before the project
(Source: forum.xitek.com)

Figure 30: The results of the Funan River Project (By author)

During this project, the total reconstruction region reached 2,000 square kilometers, and the total cost was about 2.7 billion RMB. This project was completed in 1997. The Funan River Project marked a crucial example of urban planning in Chengdu and was the beginning of Chengdu's urban reconstruction. It also illustrated the concept of historical reservation and environment protection that was brought about in Chengdu's 1982 Master Plan. During the past two decades, this project has become a national model of successful urban design, which supports the sustainable development of Chinese cities (Figure 30).

In November 2001, Chengdu started the Sha River Project. Sha River is the branch of Fu River and is located in the eastern part of the city, and crosses the city from north to south. It provides the source water for industrial and residential use, and also plays an important role in flood control and irrigation. Along with economic and urban development, the pollution in Sha River affected the urban environment of Chengdu. The project was mainly focused on environmental protection and infrastructure construction. It used the Funan River project as its basic model, with a more comprehensive and clearer plan. For the first stage, city government invested 3.25 billion RMB, with 1.31 billion RMB used for environmental and ecological protection. Therefore, Sha River project can be seen as another example of Chengdu's urban planning to maintain and improve the urban environment for sustainable development (Figure 31).

Figure 31: Sha River in 2008
(Source: http://scnews.newssc.org)

As the great influence of river system in Chengdu plains, water resources are always crucial, not only to provide irrigation for farmland, but also to provide water sources for industries and people's daily life. Therefore, how to improve the river system and how to maintain water quality is now one of the most important parts of urban planning in Chengdu. What is more, rivers are an important urban landscape in Chengdu; there is a close relationship between the river system and urban development. Through some of the river projects in past few decades, the infrastructure, transportation and environment along the rivers have been improved greatly. On one hand, it offers people a better living condition; on the other hand, it potentially raises urban land values, and offers huge returns on the government's investment through releasing the lands for real estate and business use.

Five Roads and One Bridge Project:
Improvement of Transportation Infrastructure

As the hub of transportation for southwest China, transportation was always very crucial during Chengdu's urban development process. This project started in 1998 and was accomplished by 2002; it is seen as the milestone for Chengdu's infrastructure construction. It is also the government of Chengdu's biggest investment since 1949 on the urban basic facilities construction project. It included the Third Ring Road, South Renming Road, Chengyu Road, Chenglong Road, Chengluo Road and the overhead viaduct in front of Chengdu's South Train Station. This 'Five Roads and One Bridge' project was put forward during government modification of Chengdu's comprehensive plan from 1995-2010. This project was closely tied to Chengdu's new urban development plan—to lead the city's development from its eastern and southern directions rather than just from the circular routes. The contributions of this project are very significant:

First of all, this project improved the city's transportation infrastructure. Along with Chengdu's dramatic economic and urban development, the old transportation network in Chengdu could not accommodate the increasing number of privately owned vehicles. In addition, more roads needed to be built to support the process of urban expansion since Chengdu's economic reform.

Also, owing to the close relationship between urban growth and transportation, the construction of the road network coordinated with Chengdu's comprehensive plan from 1995-2010. This project offered the basic infrastructure for the city's urban planning strategy and focused development to the east and south.

Along with urban and economic development, improvement of infrastructures and

public facilities is becoming very important. Thus, the basic facilities of these areas that conjoin five roads and one bridge were greatly improved; consequently, it stimulated the economic potential of those areas; and it also raised the land price along those roads and attracted investment to establish new economic zones in the eastern and southern parts of Chengdu.

Old-city Renewal: Historical Preservation

Tracing back to the 1980s, Chengdu was named as one of the famous historical cultural cities by the national administration, and from then on historical preservation has always played an integral role in Chengdu's urban planning. In Chengdu's Comprehensive Plan 2005-2020, the urban planning is applied as a useful decision-support tool for historical preservation. During the urban planning process, historical preservation needs to be considered along with the urban development strategy. For instance, the urban development transitioned from the circular expansion to mainly grow to the east and south. This strategy helped control the development through the west and north, and to protect more historical and cultural heritage in those two areas.

In addition, in terms of the changing urban development model from concentric to multi-center development, the plan encouraged large migrations from the old city center to peripheral zones. This plan helped preserve Chengdu's unique historical city center landscape. Several historical parks, streets and zones were also established to ensure the protection of historical architecture. One of the successful cases is the Kuan Zhai Alley (Figure 32). The Kuan Zhai Alley is located in the urban center and preserves the historical architectures of these two alleys. This area was designed as a historical site

with great restaurants, unique stores, local galleries, and traditional folk culture. At present, Kuan Zhai Alley is one of the most popular tourist attractions in Chengdu. It not only brings tourists from all over the world, but is also enjoyed by local people. In addition, historical preservation was always part of urban planning since the 1980s. For instance, historical preservation is an important part in Funan River Project; some historical parks were built along the river to keep the old architecture. Besides, historical streets were built to attract tourists, and also provide locations to promote folk culture and local art during the modern urban development process (Figure 33).

Figure 32: A historical street-- Kuan and Zai Alley in the center of Chengdu (Source: www.163.com)

Figure 33: Traditional folk culture: Sugar Painting—Jinli, a historical street.
(Source: www.hc263.net)

Agritainment: The Integrations of Urban and Rural Areas, A Unique Tourism Planning

Tourism is becoming one of the most important incomes for the Chinese government in the past decade, owing to the rise of domestic income and more leisure time in each year, especially for the urban population. Nevertheless, compared with Western developed countries, the amount of money Chinese spend on vacations and tourism is still relatively low. Agritainment is a kind of tourism that can now be found in China and which most Chinese can afford. Agritainment is a very unique farm-based

tourism that started in 1992 in Chengdu. Various family style activities and many traditional and organic foods are provided in ranches and small farms that offer agritianment activities. People go to villages and small towns during the weekend, just to get away from modern urban life. Because of improved public transportation system and more privately owned cars, many Chinese can visit these sites. Also, due to the low cost and advantages of short travel time, this kind of suburban tourism was invented by Chengdu, and now has already spread to many cities in China.

Chengdu is known as a tourism city and the leisure capital of western China, and also, it is one of the biggest agricultural bases in western China. Along with Chengdu's economic development, the quality of people's daily life is rising. Tourist attractions and vacation destinations with services such as hotels, restaurants, stores and so on are one type of tourism with high cost. However, owing to the limited income and leisure time for most of the urban population, a cheaper type of tourism is demanded. Famers in Chengdu invented agritainment by showing their yard and garden to urban tourists, and they offered people from the city a chance to experience rural life (Figure 34). This type of tourism is family based and focused on a one-day tour. There are three types of agritainment: First, based on the farmlands, visitors can harvest their own organic vegetables and enjoy local food (Figure 35). Secondly, due to Chengdu's monsoon climate and its hilly landscape, Chengdu is famous for its orchards, such as pear, peach, cherry, loquat, and kiwi etc. In spring, people visit rural ranches to enjoy the sight of peach and pear blossoms (Figure 36); in autumn, people go to orchards to harvest fresh fruits. On one hand, farmers can get profit through tourists; on the other hand, urban

people can relax and enjoy beautiful rural orchards, and also can get fresh fruits for cheaper prices there. The third type is based on historical value of the tourist destinations. Due to the improvement of transportation systems in the past decade, historical towns near urban Chengdu have attracted more and more tourists to come and visit. Historical architecture, local folk culture and local food are provided in town, and this stimulates economic development and helps historical preservation in rural Chengdu (Figure 37).

Owing to the profits agritainment brought to farmers, the Chengdu municipal government has heavily promoted agritainment tourism since 1992. Through urban planning, this so-called agritainment is now becoming one of the most important incomes of the tourism industry in Chengdu. According to a government report and the statistical data, by 2003, there were at least 5000 agritainment places around Chengdu, and the resulting tourism attracted more than 20 million tourists from all over China. In addition, this type of tourism not only helps the economic development in rural Chengdu, but also improves the conservation of cultivated land near the city. What is more, in order to attract people to come to rural and suburb areas to enjoy a better air and water quality, the agritainment also contribute to the environmental protection of the rural-urban fringe areas. In short, it can be seen as a very good example of sustainable development in the urban planning strategy

Figure 34: A modern Agricultural Park near Chengdu named ‘City home’ as an agritainment location (By author)

Figure 35: Various types of organic vegetables are provided for people to harvest in ‘City home’ (By author)

Figure 36: The agritainment in Longquanyi district, tourists enjoyed the peach blossom (Source: http://scaround.lotour.com)

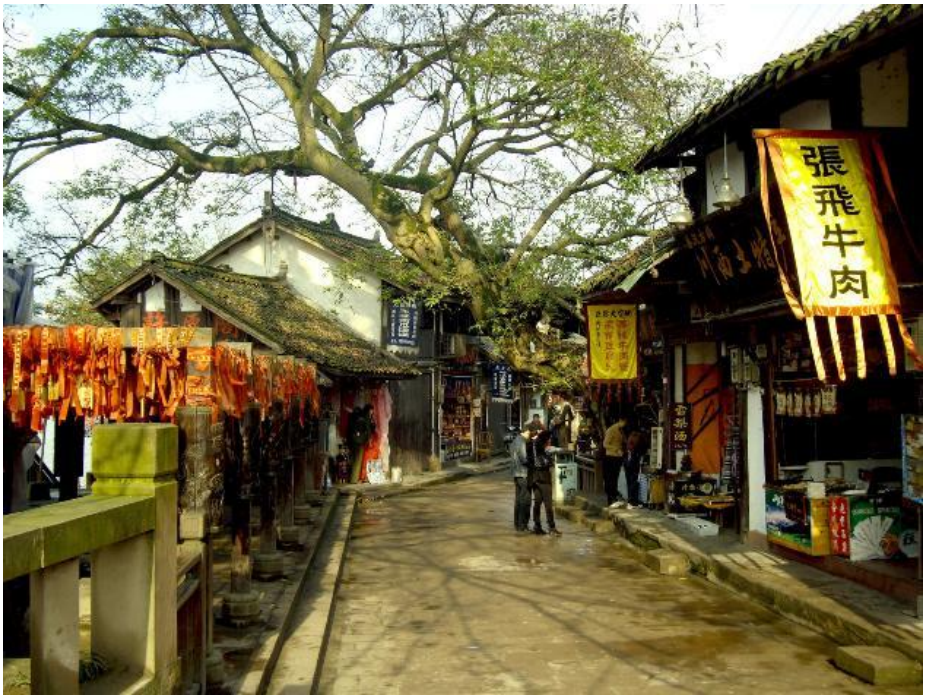


Figure 37: Pingle ancient town in Qionglai County
(Source: http://scaround.lotour.com)

In short, Chengdu's urban planning projects such as transportation infrastructure construction, river projects, old city renewal, and agritainment all show the power of city planning in the process of urban development. The improvement of transportation infrastructure attracted more and more investment to Chengdu, and also helped Chengdu to become the transportation hub and logistics center in southwest China. The Funan River project and Sha River project not only shaped the urban landscape and improved the environment, but also brought more profits to the government through increasing land values along the rivers. Old city renewal and preservation represented government's attention to Chengdu's historical remains during its dramatic urbanization process, and also, it offered historical parks and streets to present folk culture and local arts. Nevertheless, agritainment revealed Chengdu's urban planning in a very creative way; it stimulated economic development in rural areas, and also provided new opportunities for the urban population. In addition, as mentioned in Chengdu's master plan, Chengdu is identified as a famous tourism city in China, and therefore, along with the spread of agritainment to other cities in China, it is also becoming a good advertisement for Chengdu's tourism industry.

Urban Planning of Chengdu for the 21st Century

Based on Chengdu's current economic and urban development, the latest Chengdu Master Plan was enacted in 2003 by the municipal government and the planning period stretches from 2003 to 2020. Resulting from the national government's 'Go West' policy and the increasing input of national funds into Chengdu and Chongqiong

municipalities, the regions consisting of the two cities is becoming a more and more important economic power in western China. The two urban areas create a huge region that is over 206,100 km^2, and house more than 98.4 million population, produced a total GDP was more than 1.58 trillion RMB in 2003 (Master Plan of Chengdu 2003). As the urban agglomeration increases, the economic and technical development zones within these two metropolises are seen as crucial driving forces not only in western region, but also for China's overall future economic and urban development.

In the past ten years, Chengdu's urban planning has had its most important transition during its rapid urbanization process. Firstly, due to the 'Go West' Program being brought about by Chinese government at the end of the 1990s, the designated function of Chengdu changed, from just the capital city of Sichuan Province to the important 'Three Centers, Two Hubs' in southwest China. Therefore, the latest urban planning goal is to develop Chengdu as a technical center, business center, and financial center, as well as the hub of communications and transportation for the southwest China region. Nevertheless, Chengdu is also one of the most important cities for tourism and one of the most famous historical and cultural cities. Secondly, the urban growth model is gradually changing from a single-center model to a multiple-center model.

Currently, due to the tremendous urban expansion, the single-center model is not appropriate for Chengdu's future development. As Chengdu is becoming a metropolis in western China, many issues occur during the urbanization process. Thus, the revised master plan presents a new multiple-center model that combines with the old single-center model. The integrated development of urban and rural areas was the main

development strategy. Additionally, over the next decade, the urban structure will develop the main urban area as the central zone, and several urban districts as sub center areas. To conclude, Chengdu's current urban development structure could be divided into two types:

(1) According to the government report, six areas are divided in the urban development region, they are:
   a. CBD: inside the First Ring Road, area: 5.56 km^2
   b. Urban core: between First Ring Road and Second Ring Road, area: 61.3 km^2
   c. Central urban area: inside the Outer Ring Road, area: 541.0 km^2
   d. Main urban zone: the urban built-up area, including central urban area and six built-up districts, area: 660 km^2
   e. Metropolitan district: planning region, area: 3681 km^2
   f. Administrative region of a city: overlapped with the administrative area of Chengdu, area: 12390 km^2 (Chengdu transport annual report 2009).

(2) According to the division of the administrative areas and the development conditions of each area, three big circles for Chengdu's urban growth can be recognized:
   a. First Circle—Central urban area: inside the Outer Ring Road, area 541 km^2
   b. Second Circle—between the metropolitan district and central urban area, area: 3140 km^2
   c. Third Circle—between administrative region and metropolitan district, area: 8709 km^2 (Chengdu Comprehensive Plan 2003-2020).

In this latest Master Plan, Chengdu was also designed to be a world recognized modern gardening city (Shijie Xiandai Tianyuan Chengshi). Therefore, future land use patterns and the direction of the urban growth are trying to achieve this purpose. A metropolis with the integration of urban and rural areas will be emphasized in Chengdu's future urban development as the nation's strategy. The metropolitan area should contain the development zones, satellite cities, surrounding tourist areas and also exurban towns and villages, and highways and light-rail transportation are applied to connect the surroundings and central urban zone together as a whole. Land uses are going to be decided by four different development types: the ecological tourism zone in the surrounding mountainous areas, the enhanced development zone for modern agriculture in the plains, the advanced development zone in urban centers by promoting the tertiary industry and high-technique economic zones, and the expanded development zone in hilly suburban districts for advanced manufacturing industry combined with modern agricultural and tertiary industry. Relying on the classification of various development zones, Chengdu's future urban development will focus on the rural-urban integration, the construction of multiple centers in adjacent suburban districts, and sustainable development.

CHAPTER 7

SUSTAINABLE DEVELOPMENT: NEW CHALLENGES AND TRENDS

The Sustainable Development in China

The term ‘sustainable development’ came out in the 1970s and started to be known by people during the next two decades. The definition of sustainable development is “improving the quality of human life while living within the carrying capacity of supporting ecosystems” and sustainability is “a characteristic of a process or status that can be maintained indefinitely” (Cheng, Zhang, 1999). Having the largest population, China has confronted more pressures and challenges in its economic and urban development than any other country in the world. Owing especially to the performance of the economic reform and the ‘Open Door’ policy, China has faced rapid economic development and urban growth. Thus, the old development pattern known as “development first, then clean up” is no longer suitable. However, because the central authority had been more concerned with investing in quantity than quality in Mao’s period, the issues of environmental pollution and wasted resources that occurred during the process of industrialization and economic development were inevitable. Owing to the diverse conditions of China’s various regions, the government has to simultaneously deal with the environmental consequences of development and underdevelopment. In general, the environmental problems in China have two sides: (1) modern industrial growth has given rise to pollution, and (2) economic stagnation or slow development in large remote areas has resulted in ecological destruction to some extent (Breslin, 1996). Chinese

leaders have realized the challenges of sustainable development during China's unprecedented economic and urban growth. Turning to the 21st century, one of the goals that the Chinese government is trying to achieve is the so-called sustainable development. Chinese leaders hold the view that the essence of sustainable development is that which must be based on the rational use of resources and protection of the environment. They believe that the relationship between population, resources and the environment must be handled well; they have to promote economic growth in the Central and Western regions and reduce the regional disparities in China in the intermediate and long-term future (Cheng, Zhang, 1999). Since 1978, an estimated 150-200 million people have moved from the countryside into cities. It is also estimated that 70 percent of the Chinese population will live in urban areas by 2050. Therefore, for the future of urban development, the country has realized that the new cities should be as sustainable as possible to accommodate the huge influx of workers without destroying the environment in the process. In the meantime, according to the urban planning strategy, the new cities should be eco-friendly and the old cities should become more eco-friendly along with its urban growth (Cheng, Hu, 2010). However, to achieve the goal of sustainable development, just relying on the government is not enough; public involvement is also necessary. Therefore, another challenge of China's sustainable development is to help people to realize the importance of sustainability and also to encourage them to participate.

The Challenges of Sustainable Development in Chengdu

Sustainable development has close relationships with various factors, such as environmental, resource, cultural, social and also political agendas. Thus, it is one of the most essential components when making the urban development strategy, because part of sustainable urban planning represents consideration of the city's future development. The growing urban population, land usage and availability, huge resource consumption, as well as environmental pollution during Chengdu's urban evolution have become challenges for Chengdu's future sustainable development. Historically, in Mao's era, the policy dispersed both heavy and other national strategic industries in western and central China for national security reasons and in order to minimize regional wage inequalities. Under Deng Xiaoping's era, the policy shifted to the increasingly economically liberalized program of the reformist regime, and focused on coastal cities (Simon, 2008). Chengdu, as one of the largest metropolises in western China, was a very important heavy industrial base before the 1980s. Affected by industrialization, the contamination of local rivers, soils, air and groundwater was pronounced. Starting its economic reform at the end of the 1980s, Chengdu has witnessed a dramatic urbanization process, which caused other problems such as loss of cultivated land, deforestation, and a large amount of energy consumption. Currently, Chengdu is now playing a crucial role in the national government's 'Go West' program to lessen the differences between western and eastern China. Because of the preference policy from the government, Chengdu has experienced a even more powerful economic development and rapid urban growth during the past ten years. Being a metropolis in southwest China, and emerging as an attractive investment

destination for foreign capital, globalization during Chengdu's urbanization accelerated the transformation of society and the environment, resulting in economic exchanges and new communications technologies, but also in poverty and environmental degradation (Francoise, Gardiol, 2008). To summarize, there are many issues and challenges that cannot be ignored and need to be discussed in Chengdu's urban development.

Environmental Protection

As one of the most well-known tourist cities in China, Chengdu's tourism has a close relationship with its environment and is based on four aspects: its favorable ecological environment for giant pandas (Figure 38); the World Cultural Heritage--Dujian Weir and QingChen Mountain; the JinSha Relic that displays the ancient Shu history and civilization more than 5000 years ago; lastly, the new type of tourism is agritainment, which has already been introduced to many other cities in China.

Figure 38: Chengdu Research Base of Giant Panda Breeding (By author)

Recovering from the 2008 Sichuan 7.9 magnitude earthquakes, Chengdu still identified itself as a famous tourist destination in China in accordance with its Master Plan. In 2009, Chengdu's total tourism income was 48.5 billion RMB, and Chengdu's revenue from foreign tourists was about 290 million dollars, accounting for 82.8 percent of the province's total foreign tourism income (Chengdu Statistic Yearbook, 2010). With its beautiful natural landscape in its rural areas, and its rich historical heritage in the urban areas, environmental sustainability is becoming the main challenge for Chengdu's urban planners. Environmental issues caused by human activities such as deforestation, the water loss and soil erosion could be seen through the massive landslide and rock falls during the earthquake. The consequence was huge economic loss and casualties. Hence, environmental planning is playing a very necessary part in Chengdu's urban planning, according to the government's report; environmental protection includes three aspects:

a) Environmental Quality: water, air and noise control.
b) Pollution Prevention: Prevention of water pollution from industrial wastewater and urban sewage; as well as the pollution of atmosphere and solid waste pollution.
c) Ecological Conservation: To improve the ecological system through the construction of natural reserves, landscapes and famous scenery and also forests and parks, also the design of eco-demonstration communities.

Even with a growing awareness of environmental issues, there are still many challenges:

a) Firstly, due to the industrialization process in many rural regions in Chengdu, water and air pollution from secondary industries such as

chemicals, medicine, building materials, metallurgy and minerals are hard to control.

b) Secondly, unexpected urban growth has resulted in increasing urban population, the expansion of built-up areas, and the massive process of urban expansion all leading to additional municipal solid waste and water sewage. Nevertheless, the increasing number of automobiles is another source of air pollution, according to the 2009 Statistic Yearbook of Chengdu, the number of automobiles in Chengdu increased from 282,954 in 2000 to 1,018,999 in 2008. Private cars increased from 200,912 in 2000 to 826,119 in 2008.

c) Thirdly, the pollution in rural areas is also increasing. Along with the integration of urban-rural strategy, various secondary industries have been relocated to rural regions to achieve rapid development for the rural economy. On one hand, the rural industrialization has stimulated the economic development in rural Chengdu, and speeded up the process of urban growth; on the other hand, this process has also brought the pollution of water, soil and the degradation of eco-systems in rural areas. Besides, chemicals fertilizers and pesticides are used to pursue more agricultural products due to the population pressure, which also caused the risk of food safety (Jie Chen, 2007).

d) Fourthly, with the establishment of more and more high-tech industrial zones in Chengdu, this kind of industry also has become a potential

pollution source. Radioactive contamination, electromagnetic radiation, and electronic waste need to be considered and controlled in the process of urban planning (The Eleventh Environmental Protection Plan of Chengdu, 2006).

Resource Management

During the process of economic and urban development, the consumption of resources is massive. How to manage these limited resources more efficiently is another challenge in urban planning. There are several types of crises in regard to resource management that the city planners are confronting at present:

a) Loss of agricultural land: working on 7 percent of the world's arable land and 20 percent of the world's irrigated land, Chinese farmers provide food for 21 percent of the world's population (Henry Rempel, 1997). Chengdu, as one of the agricultural bases in China, is facing the pressure of lacking food resources. But under the market reform era, the governors favored short-term gain rather than preserving the environment; thus, profits were made through renting out the land rights. The investors considered the lower price of land between rural and urban fringe areas; therefore, there is an inevitable trend to convert the agricultural and forested land to urban uses. Housing, industrial parks, commercial, recreational facilities and public infrastructure as roads, power stations, airports and so on have been built on agricultural land. In the case of Chengdu, the loss of cultivated land is continuing along with its urban expansion.

b) Massive energy consumption: within the process of urbanization and modernization, energy consumption is tremendous. Along with industrial restructuring, the growth of secondary and tertiary industries in Chengdu required continuous natural resources. Based on the statistical data, energy consumption has increased during the past three decades. At present, the main source of energy is still coal. Compared with the entire world's 34.8 percent coal consumption, the coal consumption in China is 68.6 percent, and the developed countries are only 20 to 30 percent (Zhang, 2011). The coal-based energy production and consumption energy system has already faced many problems such as shortages of resources, low energy efficiency, high emissions, and environmental damage (Byrne, 1994).

c) The issue of using hydropower: in the case of Chengdu, the main local energy budget also contains a large amount of hydropower. Although Chengdu has abundant water resources, with the urban population expansion in the past two decades, the demand of power is difficult to satisfy. More and more hydropower stations were built to provide more power supply. However, the hydropower stations have had a large influence on the river's ecosystem and also affected the landscape to some extent. Besides, urban construction has caused pollution of Chengdu's water resources, and has greatly damaged the circulation of the underground water system (Huang, Xu, 2007). Therefore, the rapid economic growth is supported by huge energy consumption. Even the

> government passed China's Energy Conservation Law in 1998—which aims to promote energy conservation activities throughout society, to improve energy efficiency and increase economic benefit thereof, to protect the environment, to ensure economic and social development, and to meet the needs of people's livehood (Yao, Li, 2005). The law has not yet found its way to grow the economy rapidly without rapid endangering the supply of energy for consumers.

From the beginning of economic reform in the 1980s, Chengdu is still on its way to urbanization and modernization. Table 19 below shows the dramatic increase in energy consumption in Chengdu in the past thirty years. Especially for electrical power, figure bellowed illustrated that from 1978 to 2008, it increased more than thirteen times (Figure 39). Besides, both the water supply and natural gas supply increased more than seven times (Figure 40 and 41). Within the next few decades, energy consumption will be still increasing. Faced with the dropping rations of reserved primary energy, the use of renewable energies such as solar, wind, and nuclear power etc. are very necessary. More detailed guidelines from the city government as how to use the natural resources more efficiently, how to maintain the geological condition such as the soil or underwater system during urban construction, and how to break the barriers for renewable energy development in Chengdu need to be considered by future urban planning.

Table 19: The energy consumption change from 1978 to 2008
(Source: Chengdu 2009 Statistic Yearbook)

Energy Type (Unit)	1978	1980	1990	2000	2008
Electrical Power (100 million KWh)	19.7	23.68	35.61	82.1	261.08
Tap Water Supply (100 million ton)	0.82	0.97	4.1	4.68	5.95
Natural Gas Supply (100 million cu.m)	4.42	4.56	10.4	15.18	30.94

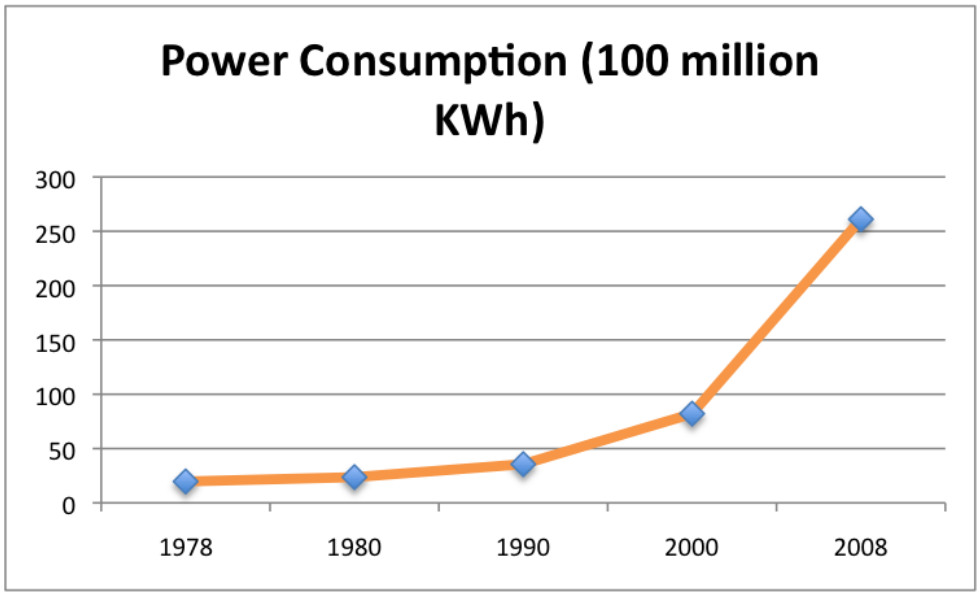


Figure 39: The electronic power consumption change
(Source: Chengdu 2009 Statistic Yearbook)

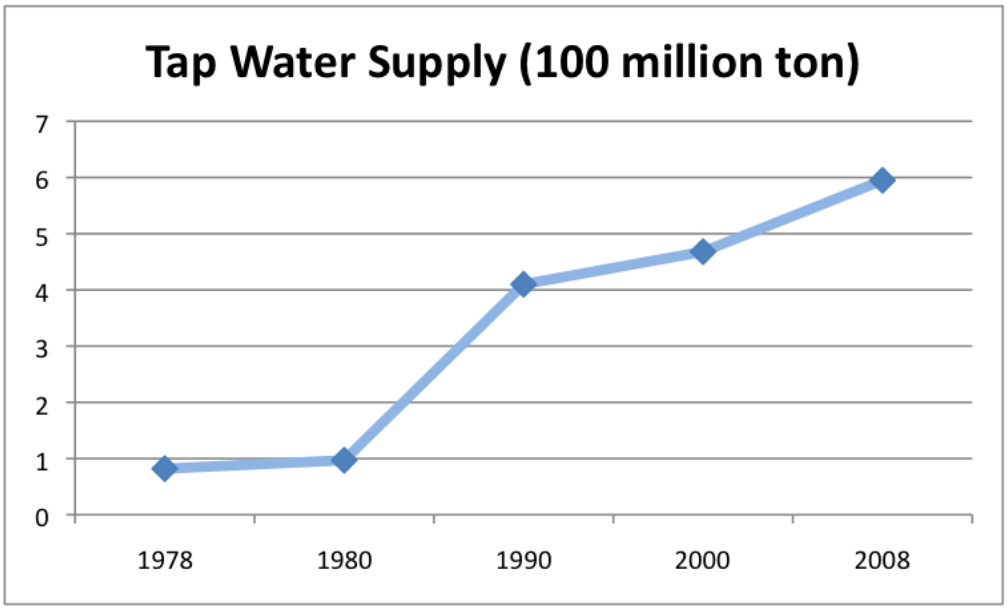


Figure 40: The tap water supply change
(Source: Chengdu 2009 Statistic Yearbook)

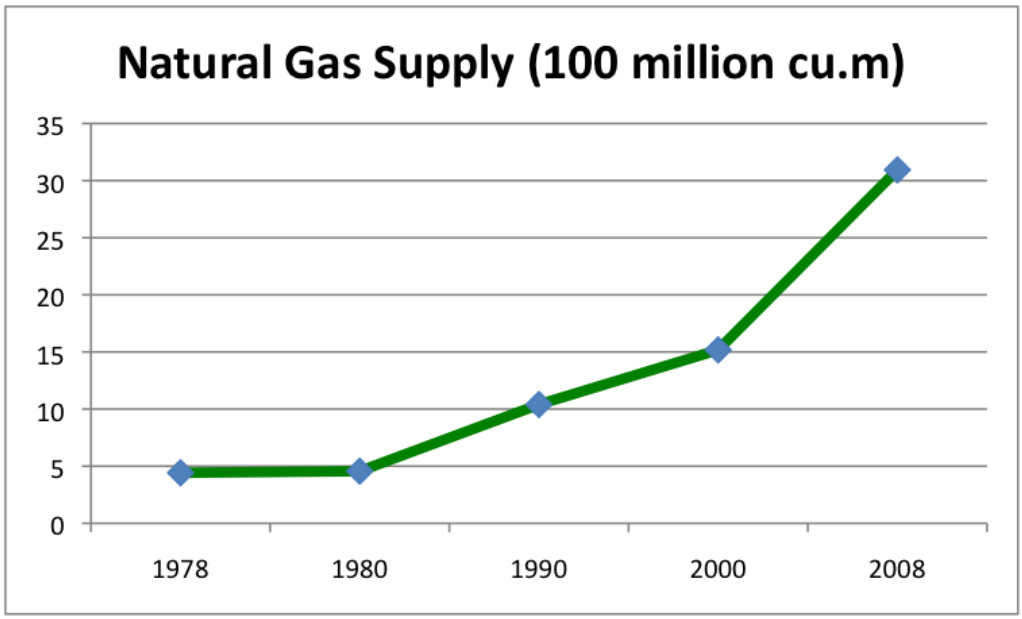


Figure 41: The natural gas supply change
(Source: Chengdu 2009 Statistic Yearbook)

Population Migration

The migration from the countryside to the city is the main drive of urbanization. Massive population migration has emerged as a huge issue in managing sustainable development. Population growth always has a close relationship with the urban environment, economic development and also social stability. Along with the relaxed urban population controls under the era of economic reform, more and more of the rural population has broken through the restrictions—the hukou system—and migrated to urban areas to search for better job opportunities. Especially for the metropolises such as Chengdu, with its rapid urban and economic growth during the past decade, rural-urban migration has increased dramatically. During the last decade, many challenges related to rural-urban migration have occurred and need to be considered for sustainable urban development.

Urban Poverty: at present, urban poverty is one of the issues in urbanization process. There are two types of urban migration: low-income groups, which represents an unskilled and low-income social group and high-income groups that represents a high skill and high-income social group, which consists of businessmen and employees who work in foreign or joint-venture corporations (Wang, 2002). The migrants, especially from low-income groups, and also the recently displaced workers in traditional manufacturing sectors were faced with many urban social problems such as unemployment insurance, pensions, medical care and public housing and so on. Based on the statistical data, in 2008, the unemployment rate was around 3 percent, and the rate of low-income urban population was around 5 percent. Government has not paid enough

attention and fund to the low-income and unemployed groups, thus, many problems have occurred in urban development process. Slums have appeared due to the unaffordable urban housing prices; many low-income migrants' children cannot go to local schools or cannot afford to because of the restriction of the 'hukou' system. Last but not the least, public safety is another issue caused by floating population. Crimes such as robbery, theft and fraud in those slums and the areas nearby are much higher than other urban areas (Nielen, Smyth, 2008).

Rural migrants who work in cities lack many rights. As peasants, they live in the urban areas without the 'hukou'; they do the same work with lower payment but without employment rights, education rights and healthcare; public services such as medical care, labor market information services and living places are not provided to them, either (Gu, Zheng, 2007). Different policies need to be applied by the government to control the growth of urban poverty and slums, and social welfare and housing allowances need to be offered to those low-income populations.

The Urban-Rural Income Gap: to look at the chart below, it is clear that the gap between the urban and rural household incomes in Chengdu has increased over time (Figure 42). The mean per capita income in urban Chengdu is more than double that of rural areas. Part of the reason is that the 'hukou' system controls population movements, such as poor access to public service, social welfare and medical care and so on (Sicular, 2007). Another reason is that rapid economic development in urban areas attracted many high-technology industries, and also stimulated the development of the service industry; therefore, more high-income job opportunities have been created due to the economic

growth. This urban-rural income gap has led to more rural to urban migrants to search for better job opportunities and better living qualities. Meanwhile, it could also cause shortages of farm labor in the countryside.

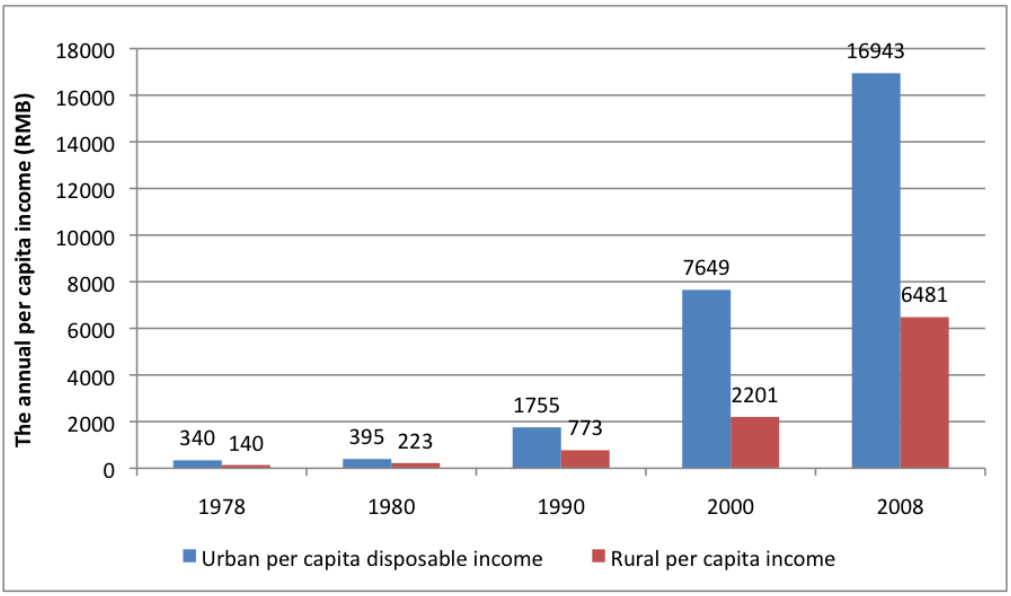


Figure 42: The comparison of the rural-urban income changes
(Source: Chengdu Statistic Yearbook 2009)

Township and Village Enterprises (TVEs): TVEs were established as not only one of the most important driving forces in China's economic development, but also the most efficient way to absorb surplus workers. Being part of the urban master plan, the TVEs could be seen as a useful tool during the process of integration of cities and countryside. Although it raised taxes and produced new commodities for urban markets and export, they also caused great environmental degradation. In addition, TVEs help to enhance the influence of the newly functioning districts, but lack of urban planning and government control, and the short distance between new planned multi-centers to the original urban

center, the designed new rural districts still have less attraction to absorb surplus rural migrants. Thus, more detailed plans need to be made in the future to confirm the function of those newly designed urban centers, and more government investment needs to be put into the TVEs, and more public services need to be provided to attract migrants from the central city to rural areas.

Urban Infrastructure: Rapid economic growth not only brings rapid urbanization, but also creates a shortage of urban infrastructure. Especially after the economic reform era began, the provision of public facilities and urban infrastructure is critical to attract foreign investment, and it is also considered to be a good form of government investment because the land equipped with infrastructure can increase revenue from land lease (Wu, 1999). Also, rural-urban migration leads to the continuance of the growth of urban population, and contributes to urban expansion in urban fringe areas. Besides, the strategy of urban-rural integration that moves many secondary industries to countryside and rural districts, all these urban developments result in increasing demands for public facilities and infrastructure. Therefore, how to meet the requirement of public infrastructure during urbanization is one of the main aspects to achieve sustainable urban development. Due to the high costs, urban planning is able to provide decision support for the city government to wisely invest in urban infrastructure.

Urban infrastructure in China has the following components:

a) Transport infrastructure: roads and bridges;

b) Energy infrastructure: electrical power and natural gas supply;

c) Water management infrastructure: drinking water supply, sewage and drainage systems and flood control;

d) Communication infrastructure: telephone and TV networks;

e) Waste management facilities: garbage collection and disposal;

f) Greening facilities: road trees and public parks;

g) Basic public amenities: Department of General Finance, Ministry of Construction (Wang, Zhang, 2011).

As Chengdu is becoming an important economic and business center for southwest China, the construction pace of infrastructure determines Chengdu's urban competitiveness compared to other cities in western China, even the whole of China.

Table 20 below shows that the infrastructure construction has already increased greatly during the past 60 years. Various kinds of public facilities and urban infrastructure are provided by government funds. Energy supplies are increased to meet the demands of industrialization and urban growth, transportation service and construction are increased to support the urban population growth and urban expansion, green space and parks are built to improve the urban environment (Figure 49).

Although the improvement is significant, compared with the remarkable urban development and the rapid urban population growth in Chengdu, the current infrastructure is inadequate (Chen, Jia, 2008). Especially for the urban fringe areas and rural areas, the infrastructure is not sufficient to handle demands (Figure 43). Therefore, more accessibility to public transportation services, more inputs of energy and resource supplies, the availability of public facilities such as power stations, sewage and drainage

systems, and also the requirement of better waste management facilities etc. need to be considered for Chengdu's future urban development (Figure 44).

Table 20: The infrastructure construction changes in Chengdu
(Source: Chengdu Statistic Yearbook 2010)

Infrastructure Type	1978	1980	1990	2000	2008
Power Consumption (100 million KWh)	19.7	23.68	35.61	82.1	261.08
Tap Water Supply (100 million ton)	0.82	0.97	4.1	4.68	5.95
Natural Gas Supply (100 million cu.m)	4.42	4.56	10.4	15.18	30.94
The Number of Public Transportation Vehicles	361	476	942	2118	6825
The Number of Taxi in Chengdu	--	32	1585	7852	12732
The Length of Paved Road (Kilometer)	319	324	423	1058	2418
The Area of Green Space (hectare)	160	277	1896	4013	15446

The improvement of infrastructure in rural Chengdu could help it to achieve the goal of rural-urban integration, and to attract more investment and migrating populations from the central city to its surrounding areas. Besides, along with Chengdu's Master Plan to slowly shift the urban development model from single-center to multi-centers, the districts and counties that aimed as new city centers need the government to put more efforts to build the infrastructure to meet their designed function in the urban plan. Infrastructure issues deficiencies in cost recovery and inadequate maintenance issues are still in existence; thus, the provision should be priced to reflect resource scarcity and

investment costs. User charges are necessary to ensure efficient use of infrastructure and to discourage wasteful consumption.

Figure 43: The transportation situation in urban fringe area (By author)

Figure 44: Cars and people were stuck on an overpass in central Chengdu after one rainstorm at July 2010 (Source: china.com.cn)

To conclude, Chengdu is undergoing its dramatic urbanization process, and the government and urban planners have already realized the importance of the goal of sustainable urban development. However, the process of sustainable development is no doubt full of challenges. The goal mentioned in Chengdu's Master Plan is not only becoming a globalized metropolis, but also a garden city that has a better environment for people to live, and an eco-city that keeps its natural environment for people to travel. Sustainable urban planning is now providing decision-support for the government behind the unprecedented urban growth and the economic development. In addition, the municipal government needs to foresee the potential advantages of sustainable development for the future generations versus just pursuing short-term projects through blind urban expansion and in the process destroying the environment, and depleting natural resources.

CHAPTER 8

CONCLUSION

In this study, the changing urban development and urban planning in China have been analyzed through the case study of Chengdu—the capital of Sichuan Province, and also one of the strongest economic powers in southwest China. Due to changes initiated under China's economic reforms, the country has undergone a transition from a centrally planned economy to a market economy. The economic transformation has led to unprecedented economic development and a dramatic urbanization process for China in the past three decades. Through this study, a better understanding of the urban growth patterns and the driving forces behind China's urban development has been provided, especially for the cities in western China. It also assessed the important effects of urban planning and the influences of government policies on the process of urban development.

Driving Forces behind Chengdu's Urban Development

Cities in western China share many common characteristics in the process of economic and urban development under the influences of the 'Go West program, which offered preferential policies for western Chinese cities to attract FDI and to reduce regional poverty. Therefore, from Chengdu's case, the driving forces behind the urban development in western China's metropolises could be analyzed. Government policies, economic growth and structure changes, as well as population migration are several important factors that could be found behind Chinese cities urbanization process.

Government Policy

Chengdu's designation as an open city by the national government in 1992 gave the city the same preferential policies as coastal cities in eastern China. Becoming an open city helped Chengdu's economic development in the 1990s, but there was still a huge gap between western Chinese cities and the coastal cities due to the location and the fall behind urban construction. To enhance its urban competitiveness, Chengdu benefited a lot from preferential policies such as lower tax rates and relaxed regulation after the national government put forward the 'Go West' program. Since then, Foreign Direct Investment (FDI) has been attracted to Chengdu. Because of Chengdu's important role in reducing the differences between western and eastern China, the national government and the municipal government have put a large amount of funds into the construction of infrastructure such as highways, the metro system, airports and train stations. Becoming the transportation hub to connect western China to the rest of China provided Chengdu many opportunities for its economic and urban development. In addition, Chengdu is also now contributing to the global market. By 2007, 124 of the Fortune 500 companies had chosen Chengdu as their home in China. Nevertheless, as the Chengdu Plain is one of the important agricultural bases in China, as well as one of the famous tourist cities in China, land use policies have also developed to maintain Chengdu's arable land, protect its environmental quality, and to preserve historical sites in urban areas. Those policies make sure Chengdu will still keep its own historical and cultural characteristics during the process of urbanization.

Economic Development

Chengdu began experiencing a booming economic development in the 1990s, which led to rapid urbanization. Economic development brought many great chances for urban construction of Chengdu. Chengdu is now the largest railway hub in southwest China, with nine cargo railway routes to major Chinese cities such as Guangzhou, Shanghai, and Beijing. It also has one of the largest freeway networks with the various classes of expressway and highway spanning over 30,000 km. With its close relations between the business sector and academic community, highly educated laborers often prefer to stay in Chengdu to search for better job opportunities versus migrating to coastal cities. As one of the most important cities in western China, Chengdu now is now becoming a center for science and technology, high-level services, commerce, trade, and finance, as well as a leading hub of transportation and communication in southwest China. By 2008, Chengdu's total GDP was 390.1 billion RMB, including 27.01 billion from primary industries, 181.67 billion from secondary industries and 181.42 billion from tertiary industries. Chengdu ranked number seven among fifteen sub-provincial cities--metropolises with population of more than 1000 thousand and has a higher political level compared to other cities (Table 21). Chengdu's economic development is contributing significantly to its urban development. More and more foreign companies have been attracted to come and invest in Chengdu. Special economic zones, high-technology parks, and convention centers were built in the urban areas, and the income of Chengdu's tertiary industry has increased more than 23 times that from 7.64 billion in 1990 to 181.42 billion in 2008 (Chengdu Yearbook 2009).

Table 21: The comparison of economic development in sub-provincial cities in 2008 (Source: Chengdu Yearbook 2009)

	GDP	First Industry	Secondary Industry	Tertiary Industry
Chengdu	3901	270.1	1816.7	1814.2
Shengyang	3860.5	183.7	1934.1	1742.7
Changchun	2588	244	1311.8	1032.2
Ha'erbing	2868.2	390.2	1077.6	1400.4
Qingdao	4436.2	223.4	2255.5	1957.3
Wuhan	3960.1	144.7	1827.7	1987.7
Xi'an	2190	103.5	987.7	1098.9
Nanjing	3775	93	1795	1887
Jinan	3017.4	175	1330.7	1151.7
Guangzhou	8215.8	167.7	3199	4849.1
Xiamen	1560	21.5	818	720.5
Shenzhen	7806.5	6.7	3815.8	3984.1
Dalian	3858.2	289.1	1993.9	1575.2
Hangzhou	4781.2	178.6	2389.4	2213.1
Ningbo	3964.1	167.4	2196.7	1600
Rank of Chengdu	7	3	9	7

As table 21 shows, Chengdu's GDP is higher than Xi'an, and also higher than some inland cities such as Changchun and Nanjing. However, the eastern coastal cities

such as Guangzhou and Shenzhen are still leading the country's economic development. It is also easy to see that the more advanced the economy is, the proportion of its tertiary industry is much bigger than the first industry. Hence, along with its rapid economic development, Chengdu is confronting a rapid restructuring of its economy. Urban expansion is now emphasizing urban-rural integration to support rapid urban expansion. Adjacent suburban districts are planned to be absorbed into the secondary industry and preserve some primary industries such as agricultural and mining. Public facilities and infrastructure are improved in rural Chengdu, assisting economic development and optimizing urban expansion.

Population Migration

Population is the most important indicator in assessing urbanization. In this study, massive population migration is a crucial element behind Chengdu's remarkable urban growth. The rapid economic development during the past two decades has led to a massive rural-urban migration. People from rural areas came to the city to look for more job opportunities and a better quality of life. Despite issues brought by the huge floating population, the large rural labor force does provide Chengdu with a powerful stimulation for its urban expansion. Compared with other coastal cities, Chengdu has advantages such as less competitive in its labor market, lower living expenses, and more affordable housing prices, which attracted native people to move back from coastal cities. Elites have also migrated to Chengdu to pursue a better quality of life. Increasing urban populations have caused urban expansion, because more living space is necessary. In the past ten years, rural Chengdu started to have some very significant development within

its tertiary sector, resulting in more construction of housing, public facilities, infrastructure and so on in the suburbs, which accelerated urban growth. Because of the dramatically increasing number of privately owned automobiles, and also thanks to the government's great investment in Chengdu's transportation network, not only rural employees but also urban employees now can afford to live in rural areas and work in urban areas. In addition, following the government's rural-urban integration strategy, Township and village enterprises (TVEs) are built in rural regions to attract urban laborers and migrants. These new zones are designed in the surrounding areas of Chengdu to stimulate rural economic development, and finally promote Chengdu's urban plan—to transit from a single-center model to a multi-center model.

The Assessment of Urban Growth and Urban Planning in Chengdu

Through the spatial analysis of this study, there are several results can be found in Chengdu's urbanization process. Currently, Chengdu's urban growth model is an incorporation of expansion along its three ring roads and several highways. Based on the government strategy of rural-urban integration, the adjacent districts and counties near urban core areas have benefited greatly from Chengdu's development of its transportation system. These districts and counties have been assigned as sub-centers for Chengdu's future urban and economic development. Chengdu's urban expansion through six corridors become the new trend of its urban development, the regions along these six corridors have been designed as different function zones to attract FDI and domestic

investments, including manufacture, high technology industries, convention center, logistic center, and education and scientific research base.

Meanwhile, Chengdu's urban growth brings changes to Chengdu's urban land use. Industries have been relocated to designed development and industrial zones in urban-rural fringe areas for better infrastructure management and pollution control. Residential communities have gradually spread to rural Chengdu due to the construction of road networks, the increase of private-owned cars and lower housing prices. Under the concept of 'sustainable development', urban environment and landscape have been improved through more green spaces such as city parks and gardens, as well as historical preservation by building historical street and parks.

In this research, the importance of urban planning and its changing policies during a city's development has been explained. Economically, provincial and national governments have targeted Chengdu as a center for science and technology, high-level services, commerce, trade, and finance, which helped Chengdu to attract more and more foreign capital investment to promote economic development. As a leading hub of transportation and communication in southwest China, Chengdu is now significantly influenced by globalization during its urbanization process and many high-technology foreign companies now choose Chengdu as their main investment destination. Politically, Chengdu is playing an important role in the government's 'Go West' program to shorten the disparity between western and eastern China. Also, it is the most important gateway to reach Tibet, and thus, it plays a crucial role for the Tibetan region from both in economic and ethnic strategy.

Urban planning in Chengdu has been increasingly focused upon historical preservation and infrastructure construction. Nevertheless, the changing economic structure and the dramatic urbanization process have produced many challenges. The large number of rural-urban migrants has caused social, housing, and environmental issues. The loss of agricultural lands during the urban expansion caused the risk in food resources. The demand for more urban infrastructure has been increasing during the recent era of economic development and urban growth. All these issues need to be solved urgently in the next few decades, in order to improve Chengdu's sustainable development. There are several results that can be concluded from this study:

(1) The expansion of urban growth through the corridors along different directions of Chengdu's extended urban region shows the dynamic economic development trajectory and reveals how Chengdu's Master Plan changed future urban development from a single center to a multi-center model. This trend has been documented in several metropolises in China such as Beijing, Shenzhen, Guangzhou, and Shanghai. Industry restructuring accompanied urban expansion. The proportion of tertiary services has increased greatly in Chengdu during the past ten years, which helped modernization and urbanization of the city.

(2) The development of metropolitan fringe areas illustrates process of suburbanization: Chengdu has had a tremendous expansion during the past two decades, and Chengdu has become more dispersed. People need to travel longer distances to access employment, housing and social services. This has

resulted in peri-urban development. Because the municipal government is intent on emphasizing multiple centers for Chengdu's future development, the government has put a large amount of funding into infrastructure construction in rural Chengdu. Development zones with diverse functions are distributed in adjacent suburban districts, attracting domestic and foreign investors, who prefer newer industrial settings on the rural fringe, not only for their cheaper land prices and lower taxes, but because of the availability of infrastructure, wider roads, and increased green space.

(3) As a famous tourist city, tourism is more important in Chengdu than in any other modern cities of China. By applying urban planning, Chengdu has maintained its own characteristics of urban development that retain its historical and cultural background. Historical and cultural preservation have merged into plans for urban construction. Historical streets and business communities are built on urban land. Those historical sites provide a place to keep and to present folk culture such as the Sichuan Opera, traditional food, local arts, and also add a unique tourist experiences in Chengdu.

(4) Additionally, this study illuminates the many challenges for sustainable urban development that urban planners in Chengdu need to face. The high rate of rural-urban migration during recent years has caused a lack of housing, and the house prices are increasing year after year due to rapid economic development, which in fact makes houses unaffordable for many urban employees. Besides, large population clusters also lead to the shortage of

> public utilities, and problems such as healthcare and public education. Due to the principle of sustainable development, efficiency now is over the equality in the process of urban planning. Natural resources need to be used more wisely, environmental protection is part of urban planning, and cultural and historical preservation is one of the important components during the process of planning. Public facilities and urban infrastructure also need to be considered by planners.

In short, as Chengdu's urban development process and urban planning share many similar characteristics with other mid-size metropolises in China, the importance of this study is significant. At present, western China is playing a more and more important role in the nation's economic development, and will continue as a strong driving force for China's future development. Cities like Chengdu in western China is going to become crucial to carry forward the 'Go West' program in the next decade. Its economic growth will stimulate the urbanization process, and promote the rural-urban integration. Along with western cities urban development, the differences between western and eastern China will be lessening.

Challenges for China's Urban Planning System

Under the transition from central-planned economy to global market economy, the original planning system in the pre-reform period is no longer appropriate for current Chinese cities. Urban planning in China is always a government function; however,

China's political system has limited the power of its urban planning system. There are several main challenges.

The Hierarchy of the Government

One challenge within the urban planning system is the hierarchy of the government at different levels. In a city like Chengdu, the master plan may take a couple of years before it can go through the national government and then be put into effect. Considering the pace of economic development and urban growth, the approval process for urban planning is not effective. Taking Chengdu as an example, the Master Plan had to go through several different government levels. Illustrated by the flow chart below, the process to make a master plan needs to be examined by different departments, and gets approved by not only the Municipal People Congress, but also by the State Council (Figure 45). Therefore, this process may take several years before it finally can be carried out. This also happens when the municipal government needs to revise the urban plan. As the city is undergoing such an unprecedented economic development and urban growth, this kind of long process to get approved for urban planning is questionable and cannot be served appropriately by the government's decision-support in the process of urbanization. Furthermore, because of the limitation of the political boundary, regional development has been considered less during the process of making the urban plan. However, under the market economy, cooperation among cities that are near each other is becoming more and more important. Thus, when the urban planners are making the urban plan, the range should not just be limited in municipal levels, but also the whole region. Enhancing Chengdu's cooperation with other cities in Sichuan province and also

Chongqing municipality could help Chengdu to better share natural resources, to have better connections with other cities in central China, and to play a better role in the national's regional development.

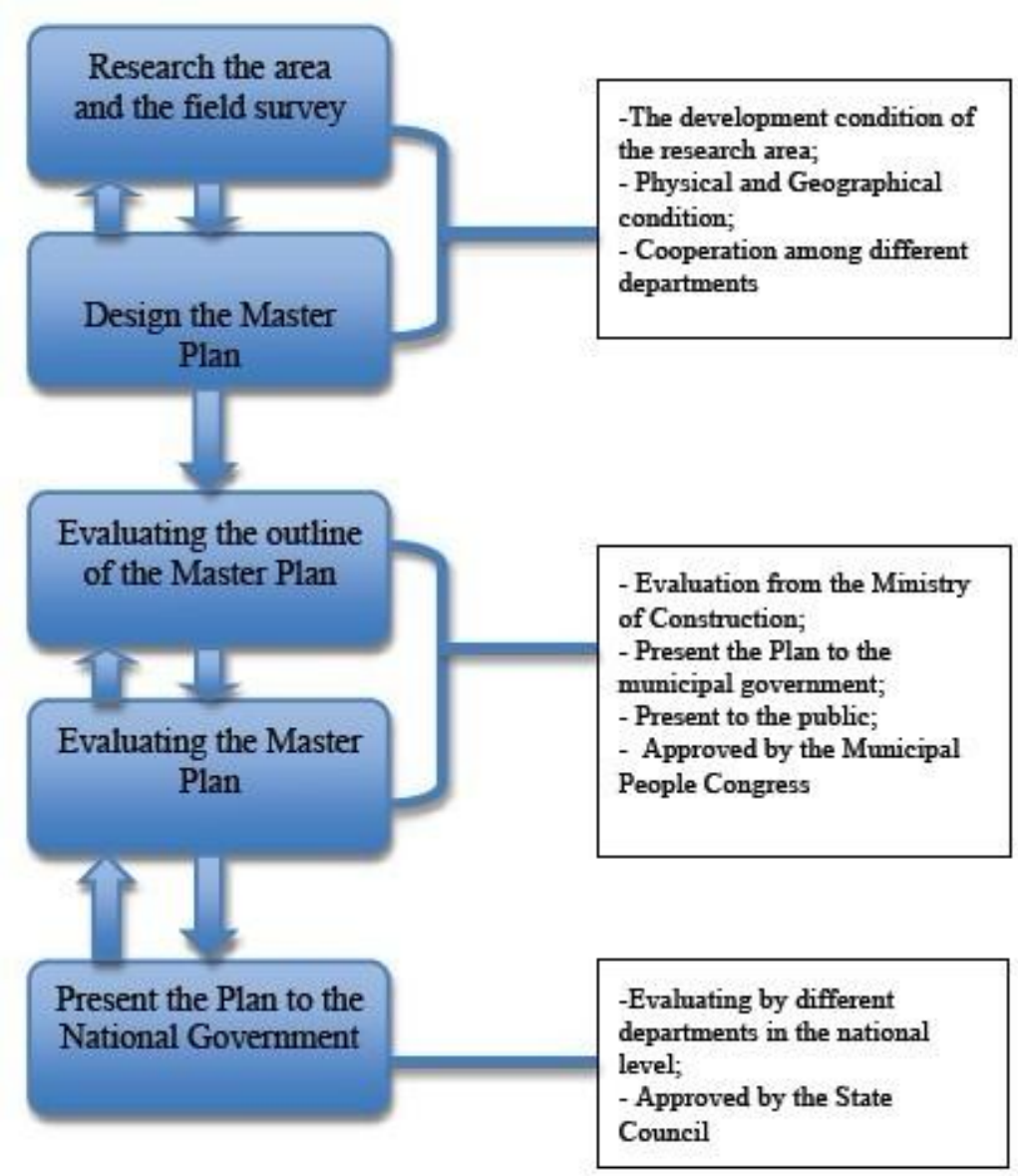


Figure 45: The flow chart of the process of making Chengdu's Master Plan (By author)

Land Use System

In China, land ownership is still retained by the state and is regulated under a highly centralized government structure. Although China is becoming more decentralized, the legislative framework and institutional structure are still highly centralized, with rigid hierarchical connections and controls between different government levels. This framework leads to an effective control at regional and municipal levels, but not on local individual actions. This has caused many problems in controlling land uses in rural areas. In addition, the framework also carries out a dual price system in the land-tenure market, in which a user of administratively allocated land use can legally rent the land out for a lower than market price (Zhang, Pearlman, 2009). At present, this dual-price system is causing a lot of problems such as overdevelopment, loss of agricultural land, and corruption in the land markets. Local communes in rural China have sold arable lands to produce instant economic returns. Officers in planning and construction developments have gotten benefits from investors or companies by issuing illegal land use and building permits. In recent years, city planners have confronted the high risks of involvement in corruption (Zhang, 2002).

Cooperation and Public Participation

Under the heavily concentrated decision power within the central government, cooperation among different departments and public participation are absent from the process of making urban plans. Key public officials are still appointed rather than elected. In urban development, main decisions are usually made by mayors rather than by people's representatives or by professionals. Planners' roles are about implementing what

has been decided to do rather than what should be done. This results in problems such as a lack of persistence of the urban plan due to term limitation of each key official, and lack of professional skills for making urban plans. Facing this transitional period, the planning process needs to be decentralized from the central government to the district government level. More detailed plans should be made through the county level based on their own development situation. Also, higher level planning supervision and public participation should be included during the process of urban planning, for the ultimate aim of the urban planning is to offer people a better place to live.

Future Trends in Chinese Urban Development

For future Chinese cities, sustainable development will be a main goal. Urban planners need to consider how to maintain natural resources, efficiently use energy, and preserve cultural heritage, while keeping up the rapid pace of economic development and urban expansion. Under the globalization trend, regional cooperation is becoming more important than individual development. Better regional development strategies could help China to lessen the differences between different regions, and improve future growth. China's fast-growing economy and its stronger position in the global community provide opportunities for industries to support agriculture and for cities to support the countryside. Therefore, rural development now is a significant part in urbanization. Rural development and urbanization are closely inter-related aspects of migration, employment, and land use. With the process of urbanization, the rural population is increasingly marginalized and natural environments are increasingly threatened. The rural-urban

integration strategy has helped control the massive rural-urban migration, promoted the rural economy, and also advanced the urban expansion pattern. Through Chengdu's case, the transition of single-center model to multi-center model could be applied to many other metropolises and mid-size cities in China, to improve the rural-urban integration through stimulating rural economic development.

Because of China's powerful economic development, the urbanization process of all Chinese cities will continue, no matter what are their sizes. Regional development and regional cooperation may create mega-city networks to help decreasing future poverty in China. Urban planning will continue to be one of the most important tools to provide the government decision-support in its urban and economic development. Facing various challenges such as environment degradation, natural resource consumptions, historical and cultural loss, and better urban plans could ensure the sustainable growth for rural and urban China. Furthermore, confronting many challenges in urban planning, the reform of planning system itself is necessary in the near future. Professional assistance, public participation, longer planning period and consistence of the master plan need to be considered for the future planning system.

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APPENDIX A

GIS DATA AND ATTRIBUTES

DEFINITION OF GIS ATTRIBUTES LABELS

LABEL	DEFINITION
FID	Field identification
CODE	Zip code
AREA_	Geographical extent
PERIMETER	Geographical extent
NAME	District name
Type	Administration level of district
density	Population density
FID	Field identification
road-id	Provincial road identification number
connect-to	Destination of provincial roads
FID	Field identification
Name	Name of the highways
FID	Field identification
road-id	National road identification number
connect-to	Destination of national roads

GIS ATTRIBUTES

FID	CODE	AREA_	PREIMETER	NAME	Type	density
0	510182	1419	2.13094	Pengzhou	County-level city	564
1	510181	1208	2.03449	Dujiangyan	County-level city	505
2	510114	481	1.62247	Xindu	District of central city	1369
3	510124	437	1.16038	Pixian	County	1159
4	510121	1156	2.56475	Jintang	County	765
5	510113	393	1.35215	Qingbaijiang	District of central city	1081
6	510115	277	.995790	Wenjiang	District of central city	1331
7	510184	1090	2.19079	Chongzhou	County-level city	617
8	510129	1327	2.42799	Dayi	County	403
9	510106	107	.975829	Jinniu	District of central city	6618
10	510108	109	.759510	Chenghua	District of central city	5905
11	510112	559	1.33371	Longquanyi	District of central city	1061
12	510105	66	.617445	Qinyang	District of central city	8499
13	510104	60	.516832	Jinjiang	District of central city	6843
14	510122	1068	1.81865	Shuangliu	County	883
15	510107	124	.574016	Wuhou	District of central city	7401
16	510109	124	.304000	Gaoxin	District of central city	7401
17	510183	1384	2.39586	Qionglai	County-level city	479
18	510132	330	.874345	Xinjin	County	933
19	510131	579	2.56475	Pujiang	County	433

GIS ATTRIBUTES CONTINUED

FID	road_id	connect_to
0	S103/S104	Meigu/Leshan
1	S105	Qingchuan
2	S101	Nanjiang
3	S101	Nanjiang

FID	Name
0	Second Ring Expressway
1	Chengya Highway
2	ChengWenqQiong Highway
3	ChengGuan Highway
4	ChengMian Highway
5	ChengNan Highway
6	ChengYu Highway
7	Chengdu Loop Expressway

FID	road_id	connect_to
0	G213/G317	Lanzhou/Naqu
1	G108	Beijing
2	G318/G319/G321	Shanghai/Xiamen/Guangzhou
3	G213	Mohan
4	G318	Nielamu
5	G108	Lanzhou