

# Can the Land Use Master Plan Control Urban Expansion and Protect Farmland in China? A Case Study of Nanjing

ZINAN SHAO , TEJO SPIT, ZHIFENG JIN, MARTHA BAKKER, AND QUN WU

**ABSTRACT** Urbanization represents a challenge for plans aimed at controlling urban expansion and protecting farmland, such as the land use master plan (LUMP) instituted by the Chinese national government. This paper studies the effectiveness of such top-down plans under the authoritarian regime through the case study of Nanjing. In contrast to previous studies that compare actual and planned land-use maps, we compare actual and planned land-use patterns. We use land-use change data to examine spatio-temporal land-use change between the years 1997 and 2014. The results indicate that the actual amount of urban-rural built-up land exceeded planned regulatory amount by 50,185 ha and the total farmland was 70,541 ha less than the target outlined in the LUMP (1997–2010). Based on these results, and the fact that the allowed total urban-rural built-up land had already been surpassed in 2014, it is to be expected that the target of farmland protection outlined in the LUMP (2006–2020) will be broken, signaling the ineffectiveness of the plan to control urban expansion and protect farmland. Plan-led developments (e.g., new towns, development zones) and market forces (e.g., housing market, foreign direct investment) explain these developments. This study indicates that when cities embrace “growth-led” development and entrepreneurial governance, the ability of plans to control urban expansion and protect farmland is severely limited.

## Introduction

Since 1960, the amount of farmland per capita worldwide has decreased from 0.41 to 0.21 hectare (Linnér and Messing 2012). The world’s population has arrived at 7,550 million in 2017 and continues to grow, which is estimated to achieve 8,551 and 9,772 million in 2030 and 2050, respectively (United Nations 2017). Because of the large population and scarcity of farmland per capita, farmland resources are increasingly crucial for humankind to feed a growing population (Liu, Zhao, and Song 2017). However, urban expansion and the continued encroachment on agricultural

*Zinan Shao is a PhD candidate in the College of Public Administration, Nanjing Agricultural University, Nanjing 210095, China and a PhD candidate in the Land Use Planning Group, Wageningen University, Wageningen 6700AA, The Netherlands. His e-mail address is: shaozinan0511072@163.com. Tejo Spit is a professor in the Land Use Planning Group, Wageningen University, Wageningen 6700AA, The Netherlands and is a professor in the Department of Human Geography and Planning, Utrecht University, Utrecht 3508, The Netherlands. His e-mail address is: T.J.M.Spit@uu.nl. Zhifeng Jin is a researcher in Jiangsu Research Center of Land and Resources, Nanjing 210017, China. His e-mail address is: jinzhifeng118@163.com. Martha Bakker is an associate professor in the Land Use Planning Group, Wageningen University, Wageningen 6700AA, The Netherlands. Her e-mail address is: martha.bakker@wur.nl. Qun Wu is a professor in the College of Public Administration, Nanjing Agricultural University, Nanjing 210095, China. His e-mail address is: wuqun@njau.edu.cn. Qun Wu is the corresponding author. The authors would like to express their gratitude to the editor Dr. Barney Warf, and the anonymous reviewer(s) for their comments and suggestions, to Jinlong Gao, Feng Yuan, and Qingke Yang for the data collection. This paper is financially supported by the National Natural Science Foundation of China (Nos. 71233004, 71673140), the National Social Science Foundation of China (No. 17ZDA076), and the Graduate Student Training Project in Jiangsu Province (No. KYZZ15\_0163).*

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land is a worldwide phenomenon, not only in America (Ewing and Hamidi 2015), Europe (Hennig et al. 2015), Japan (Millward 2006), but also in most cities in developing countries, such as Ho Chi Minh (Huynh 2015) and Vientiane (Sharifi et al. 2014).

Although urbanization could provide job opportunities and reduce poverty among the agricultural population (Bai, Shi, and Liu 2014), the rapid pace of urbanization has severe consequences in land cover, freshwater resources, biodiversity, climate, and air quality. Urbanization has converted a large number of natural landscapes and open space for human needs at the expense of degrading biodiversity and overexploitation of water resources (Abrantes et al. 2016; Foley et al. 2005). Land taken by rapid urban expansion is often fertile and suitable for crop production, which proposes a challenge for food security (Bren d'Amour et al. 2017; Seto and Ramankutty 2016; van Vliet, Eitelberg, and Verburg 2017). Urbanization, which changes people's consumption and lifestyle, could increase greenhouse-gas emission and affect the carbon cycle (Marcotullio et al. 2014; Rosa and Dietz 2012; Seto and Shepherd 2009; Sharifi et al. 2014). Urban expansion is one of the primary drivers of habitat loss, and species extinction (Güneralp and Seto 2013; Seto et al. 2011). In many developing countries, wetlands and lakes have been reclaimed for urban land use (Bai, Shi, and Liu 2014). Furthermore, urban expansion has caused socioeconomic problems such as congestion, lack of housing, and increases in public service costs (Bloom, Canning, and Fink 2008; Woo and Guldmann 2011). The expansion of urban areas has been associated with the formation of growing slum populations in and around some major cities (Bloom, Canning, and Fink 2008).

Due to the massive negative effects of urban expansion, urban expansion regulation and efficient land use have been one of important urban policies toward achieving sustainability. Growth management measures, such as open space zoning, urban containment policies, and smart growth strategies, have been implemented not only in Western developed countries, but also in developing countries (Gosnell et al. 2011; Huynh 2015; Park, Park, and Lee 2010; Pául and Tonts 2005). The effectiveness of efforts to control urban expansion varies greatly according to environmental settings, economic drivers, political factors, and so on (Phillips 2015). Bengston and Youn (2006) and Siedentop, Fina, and Krehl (2016) found greenbelts useful for the protection of agricultural, forest, and recreational areas. Nelson (1999) found that growth management efforts were effective in preventing urban sprawl and preserving farmland. However, Padeiro (2016) and Sharifi et al. (2014) found that planning regulation cannot control urban expansion. These mixed conclusions about the effectiveness of growth management tools imply that further studies are needed. In China, evaluation of plan implementation has attracted many scholars' attention and they found the ineffectiveness of growth management based on a centrally planned system (Tian and Shen 2011; Zhao, Lü, and Woltjer 2009; Zhong, Mitchell, and Huang 2014; Zhou et al. 2017). The results seem to supply the explicit answer to the countries hesitating in applying the centrally planned system or a market-oriented management system in controlling urban expansion on one hand and on the other hand, can we regard the nonconformance as the evidence of plan failure? Our aim is, thus, to contribute to a better understanding of urban expansion management in the central planning system following the decentralization and marketization.

Scholars have been interested in understanding the process of land urbanization. Much research has linked urban expansion to population and economic growth (Li et al. 2015; Mu et al. 2016; Tan et al. 2005; Seto and Kaufmann 2003), and to the land market system (Yue, Liu, and Fan 2013; Zhang 2000). Also, scholars have identified that decentralization, globalization, and marketization can influence urban land use expansion (Chen, Gao, and Chen 2016; Huang et al. 2015). Recent studies have also augured that political and institutional forces are stimulating urban expansion, such as governmental intervention (Lin and Zhang 2015; Shu et al. 2017) or governmental administrative

conflicts (Huynh 2015; Sharifi et al. 2014). Research has also analyzed the role of local tax bases in urban expansion (Carruthers 2003; Carruthers and Ulfarsson 2002). However, the underlying factors of urban expansion in transitional cities have yet to be well studied. Seeking the driving forces and effective regulatory measures of urban expansion are necessary to achieve sustainable human development.

In 2030, 60 percent of world population (8.5 billion) is expected to live in cities, an increase of 5 percent since 2015 (Smith 2017). Nearly 75 percent of the new urban population will reside in Asia and Africa (Science 2016). This will surely be a challenge for policymakers and planners to control urban expansion. China experienced and is still facing the pressure of urbanization. The rate of urbanization in China increased from 27.5 percent in 1992 to 54.8 percent in 2014, with a rate of 1.2 percent per year and a total of 19 million people per year migrating to urban areas. According to the National New Urbanization Plan (2014–2020), the urbanization rate is expected to increase to 60 percent by 2020 with a rate of 0.9 percent per year. Fast urban growth and transformation are constantly shaping urban areas, resulting in a challenge for the management of those spaces (Wei 2005). The land use master plan (LUMP), instituted by the government at the national, provincial, and local levels, provides guidelines for the purpose of containing the outward expansion of built-up areas. Alongside rapid urbanization, China has witnessed the transition from a centrally planned economy toward a market-oriented economy. Chinese cities have been undergoing unprecedented growth and restructuring (Wei and Li 2002), creating a new institutional context for planning (Zhao 2015). The new economy and accompanying planning context highly contrasts with the planning practice and ideology that has been present since the Soviet socialist era (Gu, Wei, and Cook 2015). Institutional capacity-building aimed at promoting planning management has always been emphasized by the Chinese central government, yet, whether or not centrally planned management strategies and plans such as the LUMP can contain urban expansion and protect farmland, remains to be answered.

In this study, we focus on these issues by analyzing the spatio-temporal land-use change and comparing the physical reality with the guidelines provided by the LUMP. We used the case study of Nanjing in the years 1997–2014. Nanjing is representative of cities with rapid marketization, globalization, and economic development and transition (Chen, Gao, and Chen 2016; Qian 2013; Qian and Wong 2012; Wei 2010). A better understanding of urban growth and restructuring is necessary to improve city planning and management in the world's transitional countries (Wei and Li 2002). The primary aim of this study is to examine whether planning instruments under a top-down authoritative regime can regulate urban expansion and protect farmland. Further we aim to explore the underlying driving forces influencing urban expansion through a comparison with other studies so as to formulate effective urban planning and management policies in future.

The remainder of the study is organized as follows. In second section, we introduce China's land-use management framework. In third section, we introduce the methodology, study area, and data source. In fourth section, we analyze spatio-temporal land-use change and make a comparison the targets outlined in the LUMP. In fifth section, we explore the factors influencing plan implementation and then, we present our conclusions and discussions.

### **Land-Use Management Framework in China**

According to the Land Administrative Law, the LUMP is to be used by governments to regulate land use. Since the establishment of People's Republic of China, the LUMP has been written and revised for three separate time periods: the first for 1985–2000, the second for the years 1997–2010, and the current plan aimed at 2006–2020. The LUMP, which is often shaped by the national hierarchical structure, has five hierarchical levels: central, provincial, municipal, district/county, and township.

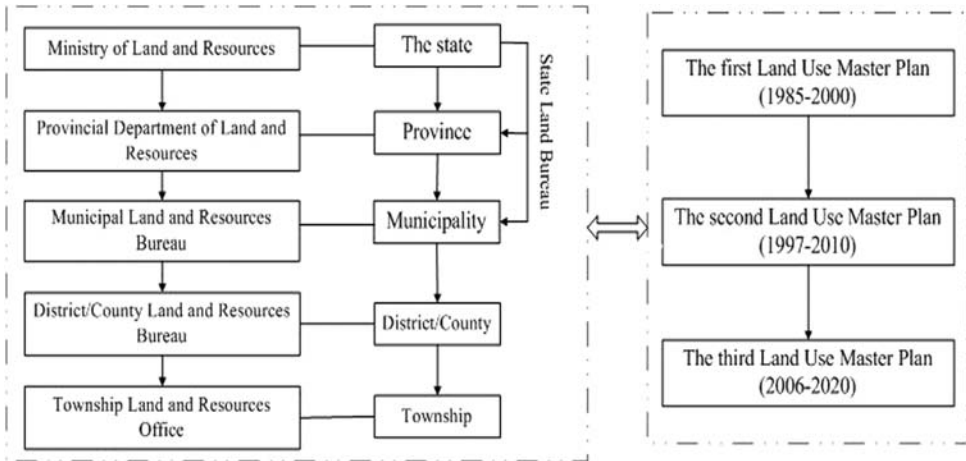


FIGURE 1. LAND-USE MANAGEMENT FRAMEWORK IN CHINA.

Public participation is often absent in plan making and implementation under this top-down planning system. The first plan was established in the central level and just pilot in some provinces and municipalities. The second and third plans are implemented according to a hierarchical structure, namely, the Ministry of Land and Resources, the Provincial Department of Land and Resources, the Municipal Land and Resources Bureau, the District/County Land and Resources Bureau, and the Township Land and the Resources Office. As the agent of the central government, the Ministry of Land and Resources is responsible for making and implementing the national plan (Figure 1). Provinces are supposed to oversee municipal land use; however, they often cooperate with municipalities in many cases in order to encourage provincial development. As a result, the central government set up State Land Supervision Bureau in 2006 in order to strengthen local land-use management.

In the LUMP, land is classified into three broad patterns: agricultural land, built-up land and other land. “Agricultural land” includes farmland, orchards, forest, pastures, and other agricultural land (e.g., rural roads), while “built-up land” includes settlements, industrial/mining sites, transportation, water facilities, and other built-up land (e.g., military land). “Other land” refers to lakes, rivers, beaches, and other natural land such as marshland and desert (Guidelines for the LUMP issued by the Ministry of Land and Resources).

The LUMP gives strict regulations concerning land-use conversion. The LUMP at the national level provides guidelines for subordinate-level government’s LUMP, stimulating a regulatory amount for each land-use pattern. For example, the national LUMP (2006–2020) sets the regulatory amount of farmland for Jiangsu province at 4.75 million ha in 2020. The LUMP written by the Jiangsu Province distributes this amount to 13 municipalities. These municipalities then distribute the amount to districts and counties (Figure 2).

## Research Methods and Area

**Research methods.** Local comprehensive plans are often regarded as a blueprint or guide for future development (Berke and Godschalk 2009; Brody and Highfield 2005; Cullingworth 1997). The LUMP for Nanjing provides a blueprint for future land use in the city. This coercive plan designates land-use patterns permitted in specific areas within each local jurisdiction. In this study, we compared practical land use with spatio-temporal land-use configuration in the plan (Abrantes et al. 2016; Laurian et al. 2004; Loh 2011; Padeiro 2016). Facing socioeconomic uncertainties, the



FIGURE 2. FARMLAND PLANNED MANAGEMENT.

constant adjusting of land-use patterns and spatial reconfiguration among jurisdictions is inevitable. Therefore, comparing the actual with future land-use maps in order to study plans’ effectiveness makes little sense. The total regulatory quotas in the plan cannot however, be changed and adjusted in the LUMP (Figure 2). In contrast with the application of future land-use maps by some studies (e.g., Abrantes et al. 2016), this study uses land-use change data to compare actual quantities with planned regulatory quantities.

We categorize land-use patterns into five metrics deriving from regulatory-quotas indicators in the official LUMP. We then investigate the composition and configuration of land-use patterns, which reveal comprehensive and detailed spatio-temporal land-use patterns and highlight discrepancies. Here, we also pay special attention to the factors that influence the plan implementation.

The lack of longitudinal accurate and reliable data presents particular analytical challenges for examining plan regulation over longer periods (Brody and Highfield 2005; Tian and Shen 2011). In our study, the first data set includes information on regulatory quotas in the provincial LUMP. The second data set includes planning documents from the Nanjing municipal government, research reports, and official municipal statistics. The third data set, which was crucial to the success of this study, includes results from a land-use change survey from the Department of Land and Resources of Jiangsu Province. When data from China’s First Land Resources Investigation was available in 1996 (Lin and Ho 2003; Liu, Zhao, and Song 2017), the annual land-use change survey was conducted since 1997. This official data from remote sensing interpretation is more authoritative and credible, so that we can do a comprehensive and detailed analysis and comparison between outcomes and the plan.

**Research area.** *The Nanjing metropolitan area.* The Nanjing metropolitan area is an important city in the Yangtze River Delta (Figure 3). In 2014, it covered 6,587 km<sup>2</sup> with 1,607 km<sup>2</sup> of built-up land. The urbanization rate increased from 51 percent in 1997 to 81 percent in 2014, with a rate of 1.8 percent per year, representative for other Chinese metropolises undergoing rapid economic transition and spatial restructure. The metropolitan area was composed of 13 districts until 2013: urban core districts (Xuanwu, Baixia, Qinhuai, Jianye, Gulou, and Xiaguan), suburb districts (Pukou, Qixia, Yuhuatai, Jiangning, and Liuhe), and exurban districts (Gaochun and Lishui), which were categorized as counties in 2013. Nanjing has been challenged by Shanghai, Hangzhou and even by the neighboring Suzhou in attracting external capital and resources in the Yangtze River Delta Region (Wei 2010). This competitive factor has exerted influence on the city’s plans, making

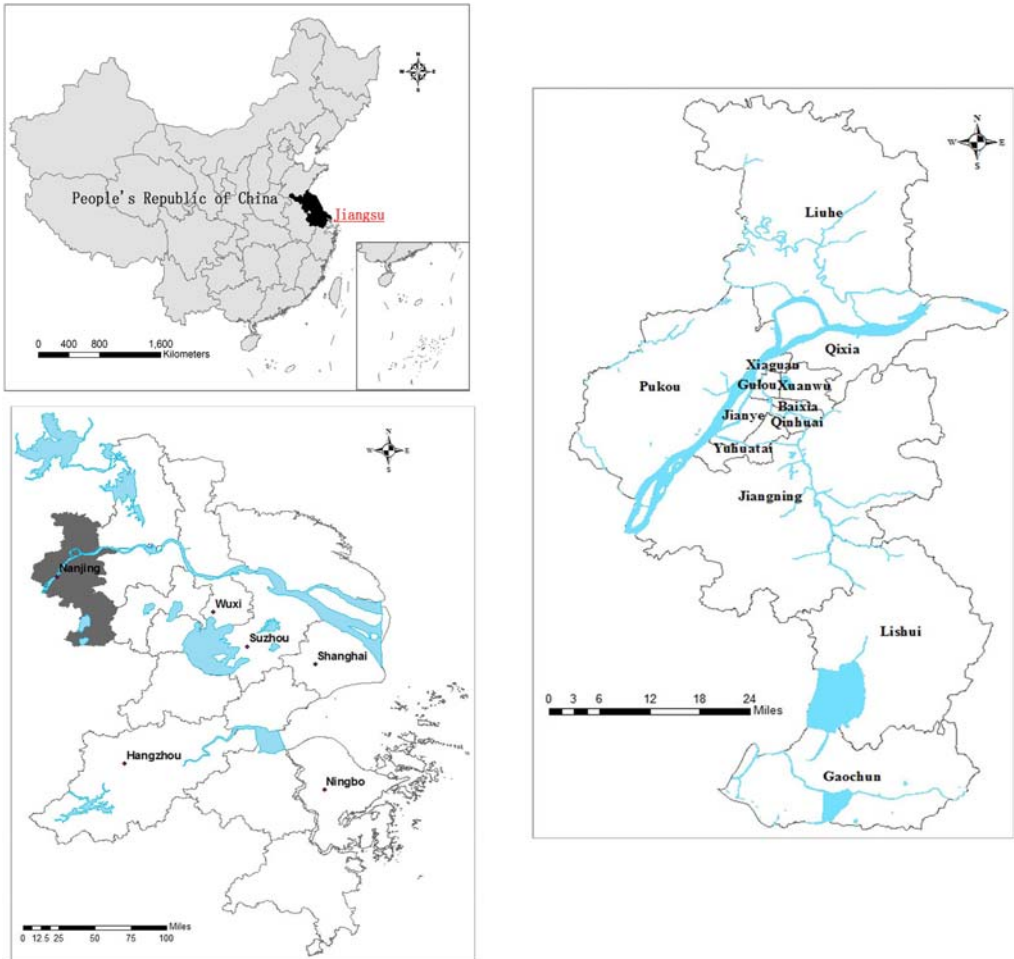


FIGURE 3. THE LOCATION OF NANJING.

Nanjing an interesting case for this study. Furthermore, the city has taken an active position in adjusting its urban development strategy in order to meet the challenges presented by the LUMP.

*Land use master plan in Nanjing.* Under the top-down and rather hierarchical planning system, the Nanjing municipal LUMP reflects the LUMP of Jiangsu Province, which in turn follows the guidelines of the national LUMP.

In 1997, the State Council enacted the policy of strengthening land-use management and protecting farmland, which required local governments to revise and update the LUMP. Under this background, Nanjing prepared to compile the LUMP (1997–2010) in 1997, and was approved in 1999. However, the fast urbanization and economic growth brought much pressure on land-use management and the plan became quickly out of date. The Nanjing municipal government began to compile the new plan “LUMP (2006–2020)” in 2006. The main principles and objectives of both plans are to protect farmland and regulate built-up land expansion so as to achieve sustainable development. Plans stipulate areas designated for growth to guide future development, optimize spatial land-use configuration, and have strictly quantitative regulation for land-use patterns in the respective period.

TABLE 1. THE COMPARISON BETWEEN ACTUALITY AND THE PLAN (1997–2010) UNIT: HA.

	2000			2010		
	Planning	Actuality	±	Planning	Actuality	±
Farmland	309,731	301,020	8,711	310,453	239,912	70,541
Urban-rural built-up land	87,248	92,736	−5,488	85,510	135,695	−50,185
Urban settlement and industry/mining site	42,683	42,796	−113	50,954	77,992	−27,038
Rural settlement	44,565	49,940	−5,375	34,556	57,703	−23,147
Transportation	13,687	14,472	−785	15,681	25,239	−9,558

### Spatio-Temporal Land-Use Change

*Results for land use master plan (1997–2010).* According to the second plan (1997–2010), the regulated amount of farmland was 309,731 ha in 2000 and 310,453 ha in 2010. The plan however, surpassed the targeted amount. The actual amount was 301,020 ha and 239,912 ha, which was 8,711 ha and 70,541 ha less than the target, respectively (Table 1). It also failed to meet the regulated target for built-up land. The goals of urban-rural built-up land were 87,248 ha in 2000 and 85,510 ha in 2010. However, they expanded very fast due to urbanization and industrialization. Built-up land reached 92,736 ha in 2000 and 135,695 ha in 2010, respectively, which were 5,488 ha and 50,185 ha larger than the target. The urban settlement and industry/mining site, rural settlement and transportation land<sup>1</sup> had similar results (Table 1).

In terms of spatial land-use change, the urban core districts were the center of economy, politics, and culture, which were designated as developable areas. Therefore, the plan distributed more farmland out of core districts. Table 2 shows that the greatest amount of transgressive conversion occurred in suburb and exurban districts. However, the spatial configuration deviated from the plan. For example, Jiangning district was to keep 79,206 ha of farmland in 2010, which meant the addition

TABLE 2. THE SPATIAL FARMLAND CONFIGURATION IN 1996 AND 2010 UNIT: HA.

	1996		2010		
	Actuality	±	Planning	Actuality	±
Urban core districts	2,024	−1,347	677	598	79
Suburb districts					
Pukou	40,879	376	41,255	28,091	13,164
Qixia	13,208	−40	13,168	8,072	5,096
Yuhuatai	5,326	−303	5,023	1,454	3,569
Jiangning	78,082	1,124	79,206	55,845	23,361
Liuhe	75,286	429	75,715	62,381	13,334
Exurban districts					
Lishui	51,837	253	52,090	42,405	9,685
Gaochun	42,725	593	43,318	41,066	2,252

TABLE 3. THE SPATIAL URBAN-RURAL BUILT-UP LAND IN 1996 AND 2010 UNIT: HA.

	1996		2010		
	Actuality	±	Planning	Actuality	±
Urban core districts	15,175	1,598	16,773	19,041	-2,268
Suburb districts					
Pukou	11,993	-598	11,395	19,183	-7,788
Qixia	8,054	556	8,610	12,951	-4,341
Yuhuatai	5,218	765	5,983	6,791	-808
Jiangning	20,013	-677	19,336	33,652	-14,316
Liuhe	21,569	-2,890	18,679	26,902	-8,223
Exurban districts					
Lishui	8,726	-1,375	7,351	13,179	-5,828
Gaochun	6,544	-385	6,159	9,346	-3,187

of another 1124 ha farmland. The district however ignored the addition of farmland and actually decreased the amount to 55,845 ha in 2010, 23,361 ha less than the target outlined in the plan.

During the second planning period (1997–2010), large investments in the real estate market, the construction of new towns and development of infrastructure made significant changes to the built-up area of Nanjing. The plan aimed to guide development in the urban core districts and decrease the amount of urban-rural built-up land in peripheral districts. However, suburb districts expanded faster than expected (Table 3). For example, the urban-rural built-up land in Jiangning district was to be decreased to 19,336 ha in 2010, 676 ha less than the amount in 1996. The amount increased instead to 33,652 ha, totaling to 14,316 ha more than the amount outlined by the LUMP.

**Results for land use master plan (2006–2020).** Compared with urban land-use patterns, farmland has a lower priority for local governments when allocating land. In Nanjing, the amount of preserved farmland often did not meet the target (Table 4). According to the plan, the quantitative farmland protection was set at 242,215 ha in 2010. The total amount of farmland was 239,912 ha in 2010, 2,303 ha less than the target. According to this tendency (Figure 4), it may be expected that the target will be again be exceeded in 2020.

TABLE 4. THE COMPARISON BETWEEN ACTUALITY AND THE PLAN (2006–2020) UNIT: HA.

	2010			2014	2020	
	Planning	Actuality	±	Actuality	Planning	±
Farmland	242,215	239,912	2,303	237,010	236,035	-975
Urban-rural built-up land	124,665	135,695	-11,030	142,287	132,988	-9,299
Urban settlement and industry/mining site	71,662	77,992	-6,330	85,456	80,694	-4,762
Rural settlement	53,003	57,703	-4,700	56,831	52,294	-4,537
Transportation	13,694	17,369	-3,675	20,239	18,203	-2,036



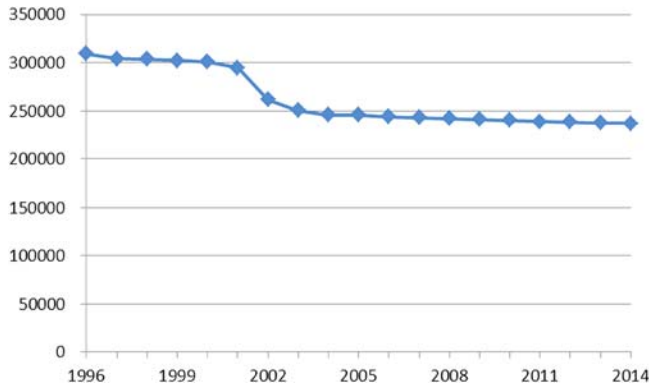


FIGURE 4. FARMLAND CHANGE BETWEEN 1996 AND 2014.

The growth pattern of built-up land during the third planning period shows similar results with the second planning period. The amount of built-up land was significantly higher than the planned target. The total area of urban-rural built-up land was 135,695 ha in 2010, with 11,030 ha more than the regulatory amount in 2010. As shown in Table 4, the regulatory amount of built-up land was surpassed in 2010. The regulatory amount of urban settlement and industry/mining site was surpassed in 2014 (4,762 ha). Although the plan continues until the end of 2020, the plan has already proved incapable at controlling the expansion of built-up land.

In terms of spatial land-use change, we find that the targeted goals do not match with the spatial reality (Table 5). During the planning period, Jiangning and Lishui districts are planned to keep 56,241 ha and 43,738 ha, respectively. Yet the amount in 2014 was 53,586 ha and 42,072 ha, a total of 2655 ha and 1666 ha less than the target. According to the plan, the smallest decline in the amount should have taken place in the Lishui district (98 ha), yet in reality, there was a 1666 ha decrease, which is far more than what was lost in the Qixia district (2 ha).

The plan aimed to guide new built-up land to the south of the city and other suburb districts (Table 6). In reality, there exists a clear geographical concentration in the Jiangning district, which

TABLE 5. THE SPATIAL FARMLAND CONFIGURATION UNIT: HA.

	2005		2020		2014	
	Actuality	±	Planning	Actuality	±	
Urban core districts	1,291	-1,246	45	490	-445	
Suburb districts						
Pukou	28,754	-905	27,849	27,804	45	
Qixia	9,606	-1,427	8,179	8,177	2	
Yuhuatai	2,381	-1,317	1,064	1,340	-276	
Jiangning	59,283	-3,042	56,241	53,586	2,655	
Liuhe	63,386	-1,137	62,249	62,733	-484	
Exurban districts						
Lishui	43,836	-98	43,738	42,072	1,666	
Gaochun	37,057	-387	36,670	40,807	-4,137	

TABLE 6. THE SPATIAL URBAN-RURAL BUILT-UP LAND CONFIGURATION UNIT: HA.

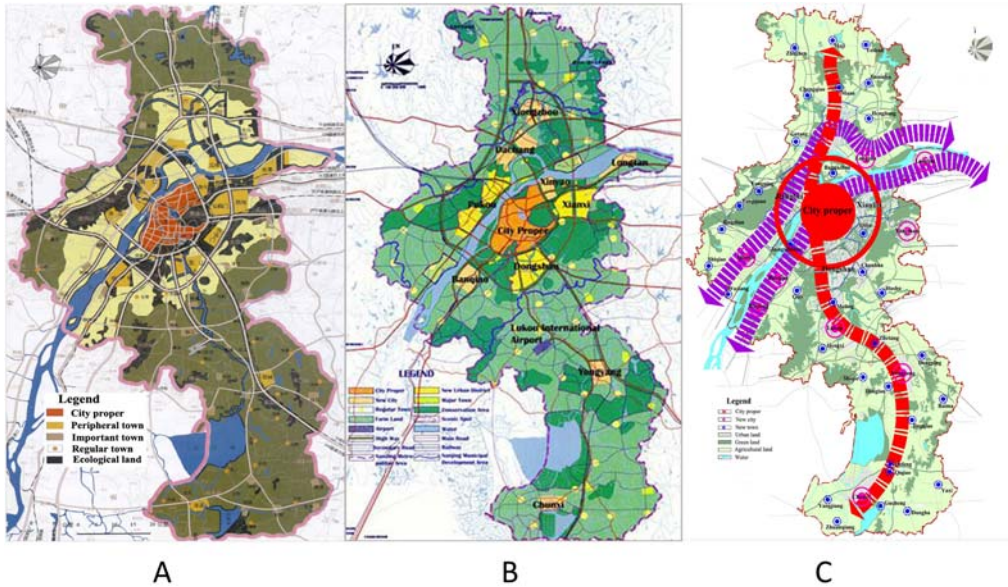
	2005		2020	2014	
	Actuality	±	Planning	Actuality	±
Urban core districts	16,889	1,667	18,556	19,614	2,726
Suburb districts					
Pukou	15,889	1,550	17,439	20,150	4,261
Qixia	11,043	1,901	12,944	14,149	3,105
Yuhuatai	5,304	1,421	6,725	7,005	1,701
Jiangning	26,551	3,596	30,147	35,479	8,928
Liuhe	24,334	1,330	25,664	27,481	3,147
Exurban districts					
Lishui	11,082	976	12,059	13,963	2,881
Gaochun	8,616	840	9,456	9,832	1,216

was originally allotted 3,596 ha of new built-up land. Because central areas were already developed and new development in these areas is rare, most new built-up land was concentrated in the suburb districts. Furthermore, land prices in suburban areas were cheaper and developers were able to obtain more profits, moving built-up activities further out of the center. This indicates a spatial conformance with the plan, yet the total amount of new built-up land shows the spatial deviation from the planned configuration. For example, the LUMP capped additional built-up land in the Pukou District at 1,550 ha from 2005 to 2020. However, from 2005 to 2014 alone, an additional 4,261 ha were realized, which is 2,711 ha more than the target.

From the above analysis, it can be concluded that the LUMP failed to control urban expansion and protect farmland effectively during the two planning periods. In the following section, we outline the underlying determinants that affect the plans' effectiveness.

### Underlying Determinants for the Ineffectiveness of Regulation

*Institutional background and governance transition.* Before we analyze the determinants, the introduction of intuitional background can aid in the understanding of the ineffectiveness of plan regulation. A fundamental institutional change from a centrally planned economy toward a more market-oriented economy has occurred in China (Ma 2006; Zhu 2004). The central government gradually decentralizes authority and responsibilities to local governments in order to enhance flexibility and economic growth after opening-up policy. Local governments take responsibilities for their own jurisdictional economic growth and social affairs (Tian and Ma 2009). Based on their performance, local leaders are often nominated by upper-level governments rather than elected by citizens (Chien 2010; Gong and Wu 2012; Liu et al. 2008). In the official assessment system, one gets promoted for a position while others lose. The intergovernmental competition for promotion opportunities exerts a great deal of pressure upon local cadres to fulfill targets during their short terms in office. Economic growth has played a vital role in the promotion and performance assessment of local politicians because other factors, such as ecology and residential satisfaction are difficult for the upper-level government to measure (Chien 2010; Zhang and Wu 2008). The top priority of profit-oriented



A: Nanjing Master Plan (1991–2010); B: Nanjing Master Plan revision in 2001;  
C: Nanjing Master Plan (2007–2020)

FIGURE 5. URBAN-TOWN SYSTEM SPATIAL LAYOUT IN NANJING MASTER PLAN.

Source: Yuan, Gao, and Wu (2016).

economic development changes local state's behavior, leading to entrepreneurial urban governance (Wu, Xu, and Yeh 2007).

Furthermore, the tax-sharing system introduced in 1994 made up for the growing gap between local governments' expenditure and income (Lin and Zhang 2015). Local governments act as an executive agent of the State, managing and providing land to developers in commerce, industry, and real estate (Ding and Lichtenberg 2011). Since the urban housing system reform in 1998 and the land leasing revolution in 2002, developers have been seizing the opportunity to capitalize land in order to generate revenue. This process is often referred to as "land revenue (*tudi caizheng*)" and has become a major business for many local governments (Zhan 2015; Zhong, Chen, and Huang 2016). The large amount of land revenue can be used to improve urban infrastructure, which, in turn, opens up new venues for capital accumulation in urban investment (Xu, Yeh, and Wu 2009).

**State-led planning instrument.** *New developments.* In order to decentralize over-concentrated population, and alleviate limited development space in the urban core, the *Nanjing Master Plan* (1991–2010)<sup>2</sup> proposed the "one belt and two axes" urban-town system spatial layout. The plan was revised in 2001, drawing from concepts of new towns and satellite towns, and the experiences of other cities such as Beijing. It introduced a new policy formed by "a city proper (Zhu Cheng), three new sub-centers (Xing Shi Qu), seven new cities (Xing Cheng), thirteen major towns (Zhong Dian Zhen) and some regular towns (Yiban Xiang Zhen)." The new policy served as the city's primary urban development plan, stretching over a period of 20 years. The new cities were added one by one, and major towns were added in the *Nanjing Master Plan* (2007–2020), which emphasized the development of the new urban areas to accommodate urban growth for the long term (Figure 5).

The expansion of built-up land was also driven by the construction of university towns. The Nanjing municipal government began to construct Xianlin university town in 2002. Fifteen universities and colleges, four middle schools, and some kindergartens were constructed. Due to the good natural environment, premium educational resources and infrastructure (e.g., metro 2), developers have been investing local real estate and commercial development, bringing in turn large land revenue for local government and boosting local construction. It is important to note that the urban built-up area was already 47 km<sup>2</sup> in 2014 and Nanjing has two other university towns.

In light of challenges facing neighboring cities (especially cities in Yangtze River Delta, such as Shanghai, Suzhou, and Hangzhou), the Nanjing municipal government has set high aims regarding city building and the restructuring of the urban spatial configuration for the purpose of improving their role in the region and on a national level. In China, local political elites (especially mayors) have a leading role in urban development (Wei 2005). Between 1997 and 2014, Nanjing had five mayors who had served an average term of about three years. As a result, the role of the city has changed from an industrial harbor city to a modern riverfront city, to a modern international city, to a national central city, and under the leadership of the last mayor, to a regional, green and modern metropolis. The changing vision for the city under different mayors brought inevitable uncertainty and difficulties in urban management during the years 1997–2014.

*Development zones.* To capitalize off of globalization, China's development zones are efficiency oriented (Wei 2010), enjoying preferential government policies including lower business income tax for foreign investment, lower tariffs on imports, tax breaks for exports. As a result, these development zones have become the main focus of foreign direct investment (FDI) in China (Wei and Li 2002). Noticing the financial benefits, many cities built development zones in order to attract foreign investment and companies. Such development zones do feature a negative side: deindustrialization in the city can provide more space for tertiary development and prevent industrial pollution. Local governments reorganize industrial spatial layout, encouraging secondary industries to move to industrial parks. Nanjing is no exception. Globalization has intensified the development of—and the competition within—technology and knowledge economies of cities. A “race to the bottom” strategy with a focus on cost reductions was swapped for a “race to the top” strategy striving for innovation and technological advancement in products and production (Chien 2008). Nanjing also built economic and technological development zones, and high-tech development zones in order to develop advanced-business service industries, strengthening the city's position as a high-tech incubation hub centered on a knowledge-oriented economy.

In addition, the governments aimed to upgrade the level of development zones in order to achieve more administrative rights. Punishment for exceeding land-use quotas in national-level development zones is rare (Wei 2010). The layout area of these zones thus continued to increase. The Nanjing Yuhua Economic Development Zone was initially established with 4.7 km<sup>2</sup> in 2000, but was planned with 28 km<sup>2</sup> when it became a provincial development zone in 2006. Besides the national and provincial development zones (Figure 6), almost every town has its own industrial park. The township and village industrial parks are small and sparsely distributed, with an average area of 2.2 km<sup>2</sup> (Qian 2013). After 2000, the municipal government integrated the development of industrial parks and new cities (Xing Cheng), which accelerated the expansion of built-up land (Chen et al. 2013).

*Market forces.* *Housing market and population migration.* Prognoses for population growth served as the basis for the planning of urban spatial organization, land for future growth, and infrastructure. More reliable information on land demand could effectively prevent under or oversupply developable land, which improved plan formulation and implementation (Abrantes et al. 2016; Siedentop, Fina, and Krehl 2016). The population growth in the LUMP (1997–2010) was estimated

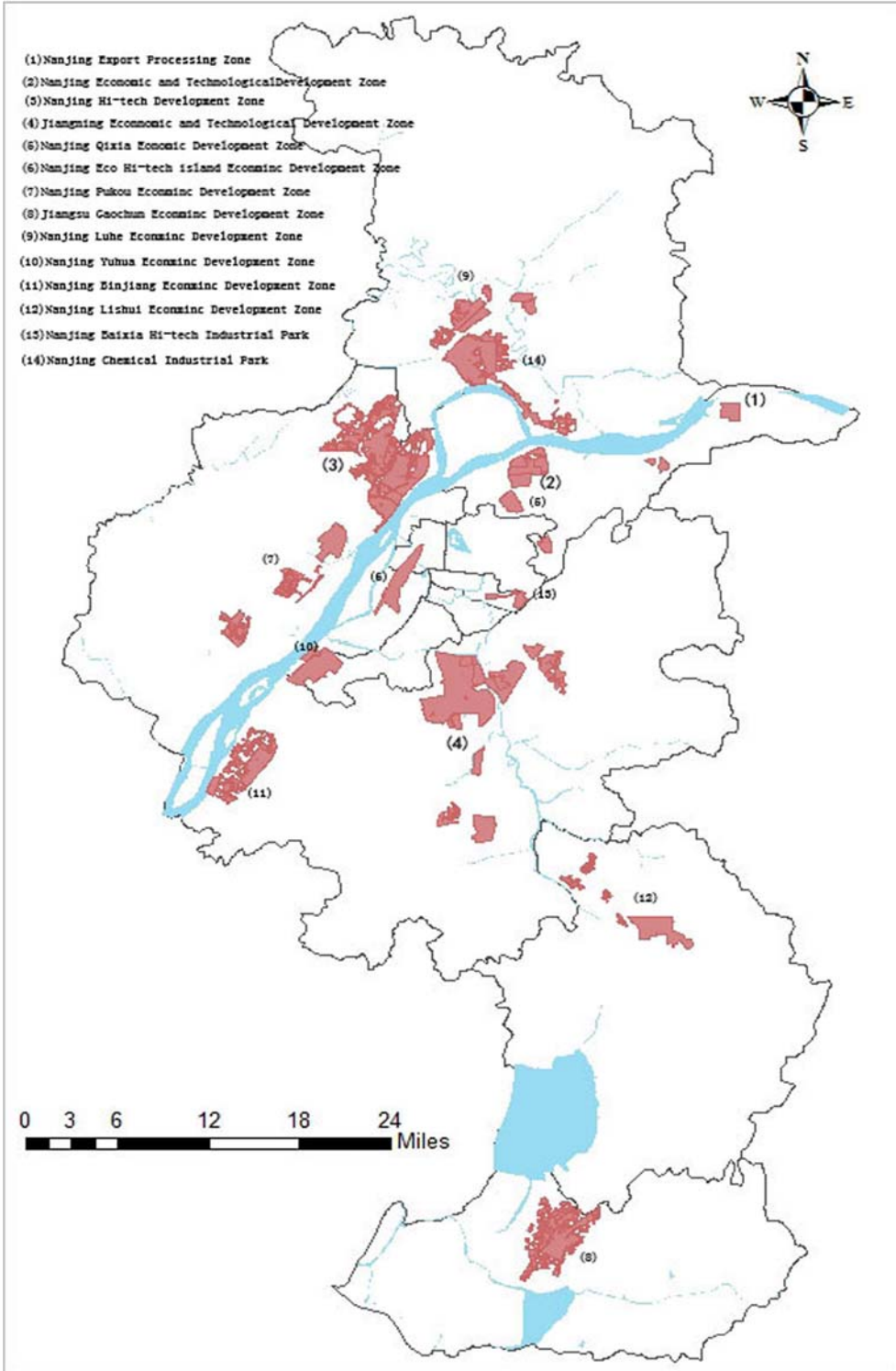


FIGURE 6. NATIONAL AND PROVINCIAL ZONES IN NANJING.

at 5.6 million in 2000 and 6.3 million in 2010. The population however grew much faster than expected, reaching 8.0 million in 2010 (Nanjing Statistical Bureau 2011), 1.7 million more than originally expected. The rapid population growth put a burden on urban public facilities and infrastructure in the old city. In order to alleviate over-population in the city center and provide space for migrant workers in the suburban areas, large infrastructure development, and public facilities were built in the form of new towns in the urban peripheries.

The booming real estate market contributed to the built-up land expansion. The housing prices in Nanjing have grown at an explosive speed as a result of the economic growth and increase in population. The average price in the center increased from 3,000 RMB/m<sup>2</sup> in 2000 to 20,000 RMB/m<sup>2</sup> in 2015 (Song et al. 2017). More and more middle and low-income households began purchasing houses in the suburbs due to the unaffordable prices in the city center. The subway extensions, belt freeway and main roads improved the accessibility to the more affordable homes outside of the city center.

*Foreign direct investment and infrastructure construction.* Following the poor financial position of China in the late 1970s, the addition of development zones in coastal cities served a crucial role in the attraction of FDI (Chien 2008). In 1985, in order to catch up with these frontrunners, Nanjing began to build development zones aimed at attracting foreign investors to set up factories and enterprises (Yuan, Gao, and Wu 2016). After China entered the World Trade Organization in 2001, the competition for attracting FDI became a priority for Chinese cities. Competing for FDI is an important part of promoting local economic development and there exists a strong correlation between the intensity of competition for FDI and improvements in the business environment (Chien 2008). In order to attract inflow foreign capital, local governments give not only give preferential policies (e.g., highly negotiable taxation), but also make improvements to the local investment environment. A competitive urban infrastructure and living environment are crucial factors in attracting capital (Lin 2009; Tsui 2011; Wang et al. 2011). Large-scale infrastructure, central business districts and image-engineering projects (e.g., huge squares) were built across China. In Nanjing, FDI was 244 million dollars in 1997 and reached 3,291 million dollars in 2014 (Figure 7). Nanjing has become one of the hotspots for the headquarters and regional centers of Fortune Global 500 firms.

Besides improving urban landscapes and images, the construction of infrastructure undoubtedly improves traffic accessibility and satisfies the demands of residents for better working and living conditions. The investment in infrastructure can contribute significantly to GDP growth (Fan, Zheng, and Shi 2016; Tsui 2011), and produce “visible” political achievements (Yew 2012), which benefit

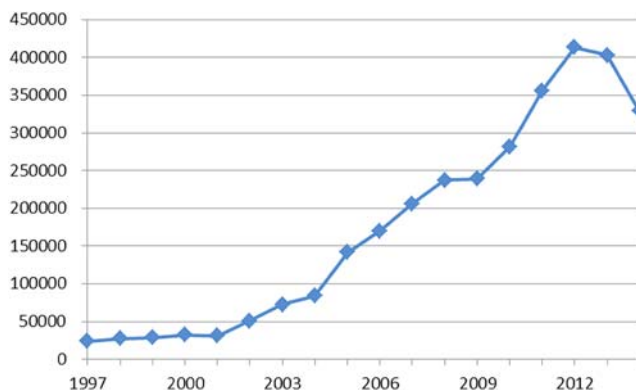


FIGURE 7. FDI IN NANJING FROM 1997 TO 2014.

official assessment (Chien 2010; Zhang and Wu 2008). The revenue from national and provincial governments is insufficient for local governments to construct and maintain infrastructure. However, the improvement of urban public infrastructure will increase land prices, allowing the government to lease land in return for substantial revenues that can then be used to invest in infrastructure (Lin and Yi 2011). The above phenomenon unleashes a strong land demand for urban infrastructure construction. During the study period, Nanjing has built a well developed infrastructure such as Nanjing Olympic Sports Center, Nanjing South Railway Station, Lukou International Airport extension project, Beijing–Shanghai High-Speed Railway (Nanjing section), and extensions to the Nanjing metro.

The above determinants are not independent, but instead interact with each other on challenging the LUMP. Fierce intergovernmental competition encourages local governments to attract foreign capital in order to further develop the local economy, which leads to large numbers of development zones' construction. Investment-driven economic policy is linked to diverse forms of infrastructure investment and property-led economic growth (Xu and Yeh 2009), which attract population migration. The large demand for housing boosts prices, providing local governments with the opportunity to lease land in exchange for revenue. In addition, governments alleviate over-concentrated population by developing new space.

## Conclusion

Planners and policymakers use plans to shape the physical development and often expect them to influence outcomes (Burby and May 1997; Loh 2011). Our case study indicates the inability of plans to control urban expansion and protect farmland under the existing top-down planning regulatory system in China. For example, targets for built-up land outlined in the LUMP (2006–2020) were already surpassed in 2014. In light of globalization and market-oriented reforms, Chinese cities are currently witnessing a dramatic restructuring and urban expansion is occurring at an unprecedented rate (Gu, Wei, and Cook 2015). Political and institutional contexts often affect the behaviors and development activities of stakeholders (Zhao, Lü, and Woltjer 2009). In China, economic growth and political promotion enjoy higher priority than plans, leading to inconsistent results between growth management objectives and development facts. Local cadres make great efforts to construct new development space zones, improve local infrastructure, and attract FDI. These short-term, economic-oriented developments make it difficult for the LUMP to influence land-use conversions and ultimately unable to achieve goals and objectives. However, the obvious departures from the regulatory-quotas in the plan cannot tell the complete plan failure. This land urbanization and urban expansion satisfy the demands of residents for infrastructure and houses, generate local fiscal revenue and improve local competitiveness to some extent.

## Discussion

*The ineffectiveness of planning on urban expansion.* Despite the massive time and effort invested in preparing and authorizing the LUMP, this appears not to be an effective planning tool in terms of containing urban expansion. The result is not in line with other studies, such as Zhou et al. (2017). The ineffectiveness of planning regulation on urban expansion could result from many reasons. Urban population growth pushes local governments to provide land for the living requirements of residents and results in urban expansion. This is also found in other studies, such as Huynh (2015), Paulsen (2012), Yue, Liu, and Fan (2013). The prosperous real estate market supplies local government with financial resources, leading to the provision of more land for development. This finding echoes those of Abrantes et al. (2016), Padeiro (2016), Tang, Wong, and Liu (2011). When

economic growth is a priority, especially in developing countries, cities demand more land for real estate and manufacturing industries in the pursuit for economic growth and supplying people jobs. The ambitious local government often sets high economic targets and shapes the development with governmental decisions. There seems to more motivation for local government to convert agricultural land to construct development zones and attract foreign capital. This process is usually highly profitable for local government directly and on the long term and the LUMP is often changed. When city development becomes growth-led and centered on entrepreneurial governance, it is impossible for the LUMP to control urban expansion. This phenomenon exists not only in Nanjing, but also in other cities, such as Vientiane (Sharifi et al. 2014), Lisbon (Padeiro 2016), Barcelona (Pail and Tonts 2005).

Moreover, urban planning is not just a purely technical process, but an especially political and power struggle process (Gu, Wei, and Cook 2015). There is no singular individual or agency that can determine the spatial configuration and growth process of a city (Qian 2013). Therefore, it is impossible for planners to anticipate on the demand for land due to the transitional institutions, uncertain economic development, and power struggles among actors, especially under globalization and liberalization. As a result, planning instruments are often limited in their ability to control urban expansion.

***Planning in authoritarian regimes.*** In authoritarian regimes, the central government holds decisive power within a vertically coherent institution. The top-down planning approval system inheriting from the ideology of planned economy highly centralizes the plan-making process. It means subordinated governmental plans have to follow the central plan; otherwise, they cannot be approved by the central government. This top-down institutional framework often cannot satisfy local land ambition with regard to socioeconomic development (Wang et al. 2010). And the facts show that the LUMP does not contain urban expansion effectively even under the top-down planning system.

The central government decentralizes the power to local governments in order to get more insight into the demands of local residents. It also aims to balance economic development and resource protection, curb urban expansion and enhance effective land use in order to enhance sustainable long-run economic growth. However, the central-local fiscal institutional structure and political incentives set by the central government provide more incentives for local governments to chase short-term economic growth (Ran 2013). This conflict of interest between the central and local government tends to challenge the implementation of urban containment strategy even in authoritarian regimes.

A powerful trend of decentralized power and shuffling responsibility to local governments has led to growing local autonomy. The decentralization also gives districts or counties governments in a municipality more power and responsibility (Zhao, Lü, and Woltjer 2009). Local governments are transformed from providers of public goods and services to developmental and entrepreneurial states, which promote urban economic growth and competitiveness (Hall and Hubbard 1998). The demand for increasing local revenue and GDP creates a growth-oriented environment and encourages intragovernmental competition aimed at promoting local economic growth (Qian 2013). In order to obtain more economic growth, local governments often take self-interested measures to circumvent and challenge policies and regulation from the central government. This leads not only to a weak monitoring capacity over plan implementation, but also to gaps between policy and implementation (Lorentzen, Landry, and Yasuda 2013). Therefore, plans' failure sometimes cannot only attribute to local governments, but the improper motivation mechanism from the central government, improper financial institution, and/or taxes distribution between central and local government.



These issues not only require taking measures to enhance the capacity of planning regulation, but also to reform financial institutions and official assessment system to reconcile central-local different interests. The top-down planning culture rarely involves public participation. Whether public participation and collaborative planning in Western countries can enhance planning regulation capacity in authoritarian regime, requires further observation.

#### NOTES

1. The state had changed the land use classification during the second national land use survey in 2009. For example, “unused grassland” was classified into “other land” before 2009, and was classified into “grassland” after 2009. However, the official data we got had already been adjusted and therefore kept continuity and comparison. Transportation land includes rural roads in the second LUMP (1997–2020); but excludes rural roads in the third LUMP (2006–2020).
2. Urban Master Plan contains all arrangement and implementation measures of the designated function, development goal, layout, and construction in a city. LUMP makes the overall arrangement and layout for the utilization, regulation, and protection of lands in space and time (for a more detailed relationship, see Wang and Shen 2017; Zhou et al., 2017).

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