sustainability

MDPI

Article

Inside or Outside? The Impact Factors of Zoning–Land Use Mismatch

Guan Li [1,2], Zhongguo Xu [2,3], Cifang Wu [2], Yuefei Zhuo [3,*], Xinhua Tong [4], Yanfei Wei [5] and Xiaoqiang Shen [6]

1 Law School, Ningbo University, Ningbo 315211, China; liguan@nbu.edu.cn
2 Land Academy for National Development, Zhejiang University, Hangzhou 310029, China; mailxzg@zju.edu.cn (Z.X.); wucifang@zju.edu.cn (C.W.)
3 Research Department of Land Science and Real Estate, Zhejiang University, Hangzhou 310029, China
4 School of Geography and Planning, Guangxi Teachers Education University, Nanning 530001, China; tongxh001@163.com
5 School of Land Resources and Surveying, Guangxi Teachers Education University, Nanning 530001, China; gxweiyf121@163.com
6 School of Management, Lanzhou University, Lanzhou 730000, China; shenxq@lzu.edu.cn
* Correspondence: yfzhuo@zju.edu.cn

Received: 10 September 2019; Accepted: 26 December 2019; Published: 28 December 2019

Abstract: A land-use plan is a core policy tool to curb excessive non-agriculturalization of agricultural land. The effect of plan implementation can affect sustainable land use and regional development. Empirical studies have shown that land development commonly and frequently fails to conform to land-use plans. However, neither qualitative nor quantitative studies are conducted to comprehensively explore the reasons for zoning–land use mismatch. To help bridge this gap, this study explored to what extent a plan has been implemented and what factors have affected zoning–land use mismatch. A new deviation discriminant framework of planning implementation was presented. Moreover, the logistics model was applied to discuss which factors substantially affect the zoning–land use mismatch. The plan implementation results were divided into the conformed, exceeded and unused areas. The general land-use plan failed in its spatial control over rural settlements and other built-up lands, with both more than 90% of the newly added construction land beyond zoning. In addition, the newly added construction land of rural settlements, other built-up lands, and transportation lands all exceeded the quota control. Furthermore, the physical factors of distance from the river, the elevation, the slope and the level, and the social-economic factors of the gross domestic product, the fiscal revenue, the fixed assets investments, and the rank of town have prominent effects on zoning–land use mismatch. Enhancing the flexibility of the land-use plan and strengthening the relationship between planning quotas and spatial zoning in the future are necessary to promote the effect of plan implementation.

Keywords: plan implementation; land-use plan; construction land; mismatch; impact factors

1. Introduction

The rapid expansion of cities worldwide and the excessive non-agriculturalization of agricultural land have seriously affected the sustainable development of human civilization [1,2]. To this end, containing the disorderly expansion of built-up land and strengthening the control of land use in recent years are important work for the government [3,4]. The land-use plan is a basic policy tool to allocate land resources. Especially in China, the general land use plan gradually plays a critical role in controlling the built-up land expansion by delimiting growth boundaries or zoning areas [5–9].

However, empirical studies have indicated that whether in Europe, North America, Asia, or elsewhere, land development commonly and frequently fails to conform to land-use plans [5,10]. As a specific category of planning, land-use planning also has the nature of planning, which faces different social, political, and economic uncertainties; and planners hope to confront these uncertainties with their decisions [11]. Therefore, the deviation between the planning implementation results and the planning intentions is inevitable.

Rapid socio-economic changes have a significant impact on the effect of planning implementation, and this impact is particularly evident in China [6,12]. In the context of the transition period, China's spatial planning and implementation are also affected by the transition from the planned to the market economy [7,13,14]. China has experienced a period of rapid development since the reform and opening up in 1978 [15]. Rapid economic growth and tremendous social change pose a serious challenge to planning implementation. In China, the general land-use plan (GLUP) is a comprehensive instrument for controlling built-up land growth [5]. The land development is completely in accordance with the route determined by the economic plan in the planned economy period. Hence, the planning implementation results are close to the planning intention in the dimension of 'timing, scale, type, and location.' However, with the deepening of economic changes, the environment of planning implementation has changed dramatically. Therefore, the demands faced by planning implementation have undergone profound changes, and the results of the planning implementation have been influenced by market mechanisms and many stakeholders [16]. Moreover, the expansion of construction land has become difficult to predict [6,9]. Public policy, as the allocation of intervention resources, has always been a passive way of regulation, which cannot be synchronized with the market and even seriously lags behind the market demand [17]. The implementation problem of zoning–land use mismatch which land use is outside zoning when planning remains unused becomes increasingly serious as the market mechanism gradually starts to affect the allocation of space resources [8,13,18]. Increasing planning practices have shown that plans and land-use outcomes do not perfectly match because of the failure to follow the plan. Hence, the government's position in any future land-use planning or regulatory effects is weakened [10,14]. A mismatch between planning intentions and the actual space development is becoming common. Planning implementation is judged to be able to slow but not fully prevent the rapid expansion of construction land [5]. Tian and Shen (2011) believed that China is in an unprecedented period of rapid development, social transformation, and reform. In addition, the existing rigid planning cannot adapt to such a high degree of future uncertainty, resulting in the common failure of planning [13]. Since 2000, the contradiction of such planning implementation has gradually approached the critical situation that the actual amount of newly-added construction land of the whole nation exceeded the planned goal, while the plan has not reached its deadline [19,20]. The site selection for land development becomes increasingly difficult to predict for planning in the context of rapid urbanization, and a number of organizations or individuals are involved. Furthermore, the impact of planning on space development is weakened [7]. Planning may conflict with the need of economic development when it fails to effectively solve practical problems [21]. Therefore, seeking a way to improve the effectiveness of planning implementation is an important mission for planning researchers and management practitioners.

Scholars attempt to dig into the mechanism of planning implementation to understand the possible relationship between land-use plan and actual land use. However, previous studies have only applied non-conformance as an object of study. Non-conformance results occur when the plan sets aside sufficient space for land development, but the site of land development is outside the scope of the control zone defined by the plan. For this reason, neither qualitative nor quantitative studies are conducted to comprehensively explore the reasons for zoning–land use mismatch. In order to bridge this gap, the major impact factors conducive to built-up land expansion contravention planning intentions need further analysis [22]. The present study explores to what extent a plan has been implemented and what factors have affected zoning–land use mismatch.

2. Literature Review

The prerequisite of improving the effectiveness of planning regulation is continually reviewing and evaluating plans [22,23]. There are two widely used methods to evaluate the planning implementation effects, namely the conformance-based approach and the performance-based approach [24]. In general, comparing plans with their physical outcomes on the basis of spatial concordance is an important basis for judging the effectiveness of planning implementation. This simple and intuitive evaluation method has been widely applied under the support of Geographical Information System (GIS) technology [25–27]. Therefore, the effect of planning implementation depends on the degree of spatial coincidence between the planning implementation results and the planning space control zone. Furthermore, the spatial coincidence degree of planning implementation becomes a symbol of the effectiveness of spatial planning implementation [28,29]. Alterman and Hill introduced a grid overlay method to quantify the 'accordance and deviation' between land-use plan and actual land use [30,31]. Calkins (1979) developed a 'planning monitor' to investigate the degree of realization for planning goals and land use [32]. Brody and Highfield (2005) conducted spatial and statistical analyses to identify significant nonconformity clustering in Florida wetlands [33]. However, the fact that the nature of planning is future-oriented, and future development is uncertain should not be ignored. This uncertainty is in accordance with the developing optimal strategies that social and individual activity of attain to their desired goals [34], which implies the fate of deviation between the results of planning implementation and intention [24]. Therefore, planning is often a failure if you only judge from the results. In the field of public policy, no one can accurately predict the ability of planning policies to influence and guide behaviour. No one can ensure an exact match between planning intentions and results [35]. To this end, Loh (2011) further divided the non-conformance area into three on the basis of a GIS comparison of planned versus actual land use. The objective is to gain a deep understanding of the non-conformance phenomenon in the implementation results of the plan. She believed that not all types of non-conformance mean planning failure. Types A and B non-conformities illustrate that planning processes are not finished but probably working as planned. In addition, most Type C non-conformity, resulting from failure to follow the plan, weaken the government's position in any future land-use planning or regulatory efforts [10]. Slightly different from Loh's work, Padeiro (2016) divided types of non-conformity into alternative three types in detail: (1) non-conversion which includes natural succession and territorial fragmentation; (2) functional which is deviation made up of economic-, residential- and other user-driven deviations; (3) transgression subdivided into transgression of local regulations and boundaries and transgression of specially protected areas [22]. These studies can accurately identify areas of zoning–land use mismatch that is conducive to a deep understanding of the complexity of outcomes. However, the interpretation of such studies can be unclear [10].

Emphasizing that the purpose of the planning evaluation is to investigate the relationships between plans and physical outcomes is important [22,23]. Thus, this process provides planners and planning managers with a framework for understanding and solving planning implementation problems [36–38]. The researchers believe that distinguishing amongst different reasons for areas of non-conformance between plans and actual land use that helps strengthen the land use plan, practically and legally [10]. Identifying factors associated with zoning–land use mismatch can improve plans and the planning process [36,39,40]. Qualitative and policy simulation methods are exploited to explain the causes of planning implementation deviation results. Bulti and Sori (2017) found that the limitation of plan implementation effectiveness is due to the combined result of geographic variables, absence of regular monitoring and evaluation, lack of commitment and political leadership influence [26]. By analyzing 353 permits implementing six local environmental plans in New Zealand, Laurian et al. (2004) revealed that plan implementation is mainly driven by the resources of the planning agencies and by the quality of the plans, rather than by the characteristics of the developers [41]. Shen et al. (2019) built an integrated framework to distinguish the corresponding degrees of planning effectiveness. They emphasized that non-conforming outcomes may be guided by planning goals and hence contribute to realizing them [7]. The qualitative method cannot give a direct causality to how zoning–land use mismatch takes place. Certain scholars attempt to answer this question through quantitative analysis. Padeiro (2016) computed three logistic models to identify the main measurable factors conductive to conformance change. He believed that the uncertainty of social and economic development and the random appearance of new local opportunities for land development are important reasons for land-use deviation from planning expectations [22]. The same explanation also appears in the case of China. Tian and Shen (2011) believed that when market factors are gradually introduced into urban development, deviation from land-use plan may be the market's response to rigid land-use planning [13]. In addition, spatial connectivity is an influencing factor that cannot be ignored [42]. Talen et al. (2016) investigated the disconnection between a parcel's actual land use and its corresponding zoning designation. They found that zoning–land use mismatch is not a random phenomenon. The failure outcomes of regulation are related to the proximity of spatial locations [23]. Local governments in China play multiple roles in non-conforming urban expansion, through which they increase financial revenue, site large-scale development projects and provide public goods [43].

In addition, existing research has a relatively simple method for judging the conformity of planning implementation results. However, when China controls the expansion of construction land, it adopts the combination of top-down quota control and delineation of growth control zones [5,7,14]. Therefore, when discriminating whether the implementation result of planning belongs to non-conformance, the following are necessary: (1) discriminating whether the actual land use is in the scope of planning permission in spatial position, and (2) further discussing whether its land use has planning permission even beyond the scope of planning, that is, the planning reservation newly added land development quota. Given this, this study first provides a conceptual framework for identifying the non-conformance part based on the combined impact of quota and zoning regulations in China. Secondly, we transferred the planning implementation results into a decision probability issue. Then, the inclination of actual land-use zoning within or beyond the scope of planning permission can be translated into the mismatch probability of zoning and actual land use. Lastly, we discussed the factors that affect the mismatch effects.

3. Materials and Methods

3.1. Study Area

Cangwu County is located at the east of Guangxi Province, which is 13 km away from Wuzhou City; 384 km away from Nanning City, the capital of Guangxi Province; and 350 km away from Guangzhou City, the capital of Guangdong Province (Figure 1). That is, this county plays an important role in the connection between Nanning and Guangzhou. In general, Cangwu County is an underdeveloped county, which is still in the rapid development stage of industrialization and urbanization. Considering its current situation of urban development and the key role between Nanning and Guangzhou, a fast development stage should exist for Cangwu County in the next few years. Previous studies have shown that in the rapid stage of socio-economic development, the plan implementation is faced with more uncertainties of economic development, resulting in more prominent contradictions between land development and planning [5,14,43]. That is, Cangwu County likely faces the space control issues which is zoning–land use mismatch. Thus, we select this county as the study area for this research. Moreover, given that the county center is the core of the development in Cangwu, our discussion mainly focuses on this region, as illustrated in the right of Figure 5.

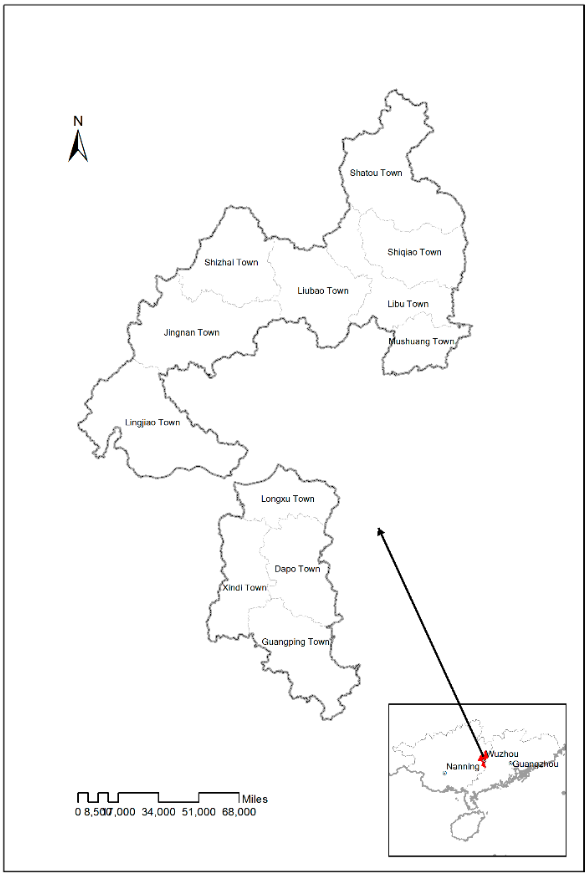


Figure 1. Location and administrative division of the Cangwu County, Guangxi Province.

3.2. Deviation Discriminant Framework of Planning Implementation

China has set up a top-down land use planning system [14]. Its core lies in the quota and zoning system to control the construction land expansion [5,20]. Specifically, the quota system is mainly operated by the quota limits of total construction land and newly-added construction land (which is converted from agricultural land) [44–46]. While, zoning system is another tool to delimit the permitted boundaries of newly-added construction land based on the situation of socio-economic development [47,48]. Zoning system decides the scale and scope for construction land and farmland [49]. In other words, land use planning in China is essentially a "quota with zoning" system [5]. Therefore, each newly-added construction land should meet two goals in general: one is to obtain the permission of quota, and the other is to locate this piece of land within zoning areas. However, there are several exceptions, such as the construction projects of high-way roads and hydropower station. In practice, these special projects are difficult to locate on the zoning map during the formation of land use plan, but they will be written in the planning textbook. Thus, in the identification process of planning implementation deviations, we need to focus not only on the zoning maps, but also on the quota part. Based on this, we develop a deviation discriminant framework of planning implementation in this study.

Firstly, we extract the actual expansion of construction land by overlaying two-period land-use map; one is a land-use map in T_0, and the other is the land-use map in T_1. Secondly, we make another overlay operation for the land-use plan map and extraction result from the previous step. In this way, the implementation effects of the GLUP are picked out. Thirdly, we add the quota of the GLUP to adjust the implementation effects (Figure 2).

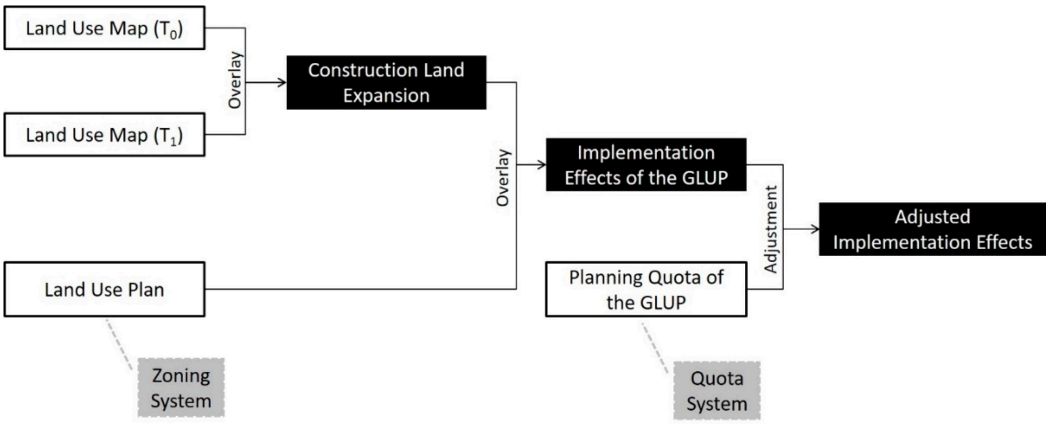


Figure 2. Framework of evaluating adjusted implementation effect.

With this process, we can divide the study region into four categories, namely, conformed, unused, exceeded, and legitimated areas (Figure 3). (1) The conformed area refers to areas where actual land use is consistent with the GLUP. That is, these areas should be located in the zoning area. Normally, the scale of conformed area is less than or equal to the planning quota. (2) The unused area lies in the planning scope which is planned to land development but is not used after implementation. (3) The exceeded area is in contrast to the unused area; Such areas are used but lie outside the zoning area. (4) The legitimated area is part of the exceeded area, but such an exceeded area is legitimated according to the GLUP (GLUP in China is operated through two parallel systems: one is the zoning system. Under this system, most planned areas are located on the map inside the zoning area. Another system is quota system, which is for the areas that are difficult to locate on the map, such as transportation, water conservancy construction land and other built-up lands. These areas can be regulated by the quota system.) during the adjustment procedure. Based on the above discussion, we reclassify these four categories into three main classes: the conformed, unused, and exceeded areas. Here, the legitimated area is categorized into the class of conformed area; this area can be legitimated on the basis of the GLUP despite lying in the exceeded area. We can define these three types of areas through the following conceptual model:

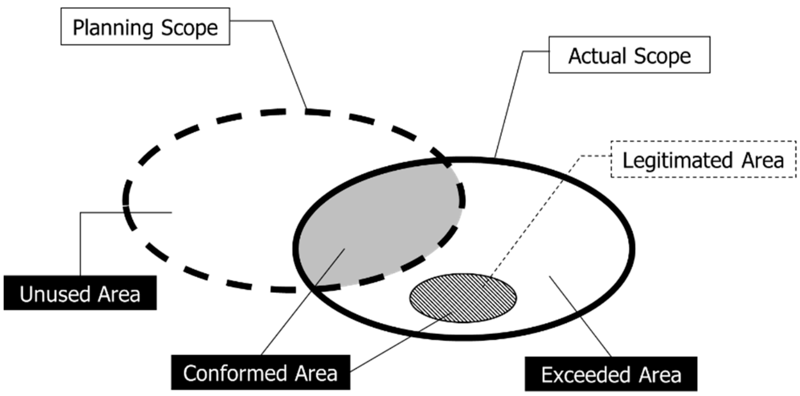


Figure 3. Conceptual framework of the implementation effects.

Figure 3 and Equations (1)–(4) show that the zoning area consists of the unused and conformed areas (excluding the legitimated area). In addition, the actually used area generally includes the conformed and exceeded areas. In that way, we conceptualize the GLUP and actual land use into three kinds of areas. The Cangwu General Land-Use Plan (1998–2010) stated that the construction land is gathered on the basis of six categories of land, namely, urban and town built-up land, rural settlements, industrial/mining land, transportation land, water conservancy construction land and other built-up land (Table 1).

Table 1. Construction land classification system.

Level I	Level II	Descriptions
Construction Land	Urban and Town Built-Up Land	Construction land for urban and town
	Rural Settlements	Construction land for rural settlements
	Industrial/Mining Land	Construction land for public mining companies, quarries, warehouses, and so on
	Transportation Land	Construction land for traffic lines, stations and so on
	Water Conservancy Construction Land	Construction land for reservoirs, hydraulic constructions, and so on
	Other Built-Up Land	Construction land for national defense, places of interest, tourism, cemeteries, and so on

3.3. Logistics Modelling

In theory, land development should be within the scope of planning permission. However, in fact, land development is beyond the planned scope while the permission area is still remaining. Therefore, this study analyzes the impact of construction land-use planning and implementation of space control effect by the logistic regression model, that can provide useful insights [33,42]. Based on sampling, we can determine these significant factors and remove certain non-significant factors. We can also obtain regression coefficients for each significant factor, which can be interpreted as the probability of specific land-use change. This method has been widely used in the land-use pattern evolution and its driving force analysis [50–53].

According to the logistic regression model, the result of an event represented by variable Y can be produced by a set of independent variables X_n. In the present study, Y refers to the situation of exceeding land planning or unused construction land during the planning period; its assignment rule is as follows: $Y = 1$ indicates the newly added construction land use located in the Exceeded Area; $Y = 0$ indicates that the planning construction land is unused, namely, the Unused Area. The probability of exceeding the planning is P, and the unused situation is $1 - P$. Thus, the regression model is as follows:

$$\ln\left[p/(1-p)\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 +, \cdots, +\beta_n x_n \quad (1)$$

In Formula (1), X_1, X_2, ..., X_n represent the n influence factors of outcome Y; α is a constant term; $\beta_1, \beta_2, \ldots, \beta_n$ are the partial regression coefficients of the logistic regression. The probability of occurrence time can be represented by a nonlinear function, which consists of explanatory variables $X_1, X_2, \ldots, X_n$.

$$p = \frac{\exp(\alpha + \beta_1 x_1 + \beta_2 x_2 +, \cdots, +\beta_n x_n)}{1 + \exp(\alpha + \beta_1 x_1 + \beta_2 x_2 +, \cdots, +\beta_n x_n)} \quad (2)$$

The odds ratio is utilized to explain the logistic regression coefficients of independent variables; it can be estimated by the exponent of parameter estimators. The formula is as follows:

$$odd(p) = \exp(\alpha + \beta_1 x_1 + \beta_2 x_2 +, \cdots, +\beta_n x_n) \quad (3)$$

In this study, the Wald statistic evaluates the explanatory variables to predict the contribution of the event. The relative operating characteristics (ROC) is also used to test the fitness of the model.

3.4. Potential Influencing Factors

Although factors influencing the actual land use, especially built-up land development, are diverse and complex [13,23,25,31,43,54]. The existing studies have analyzed the factors that influence the result of planning implementation [22,23,54]. After a literature review, we find that the influence factors are aggregated into two categories for analysis: (1) socio-economic, and (2) physical factors.

As is stated by Brueckner that "land use conversion is guided by the invisible hand of market economy which directs land resources to their highest and best use" [55]. It is generally accepted that socio-economic factors are the core driving forces affecting the expansion of construction land [56,57]. Many scholars believe that the expansion of construction land is mainly driven by population growth, economic development [58–61], and urbanization [15,62]. The demographic factor is an important driving factor affecting the planning implementation results [5]. In addition, studies show that foreign direct investment has a significant impact on local economic development and can bring about large-scale built-up land development [53]. Otherwise, in the context of investment-led economy, which a mode of economic development that many municipality-county-township governments prefer in China, the local governments invest in urban infrastructure through fiscal revenue could bring more land development than planned [5,12]. In this case, the growth of fiscal revenue and fix assets investments are the potential factors which cause deviation of plan implementation. Furthermore, after the reform and opening up, foreign direct investment has become a powerful driving force for local economic development. Studies have shown that in order to pursue foreign investment, local governments even adjust their planning without limit to meet the demand for land development [63,64]. Moreover, in a top-down planning system, the development orientation and function of each town are different, thus forming different town rank that can affect the input of the above factors and directly affect the expansion of built-up land that determine the outcomes of plan implementation [65]. To this end, we select the potential impact factors, including the population density (PD), the rate of urbanisation (URB), the gross domestic product (GDP), the fiscal revenue (FR), the fixed assets investments (FAI), and the rank of town (RT).

In addition to socio-economic factors play a driving role in the expansion of built-up land. Physical factors are the fundamental determinants of the extent and spatial distribution of land development [66]. The suitability and limitations of physical factors must be considered, whether land development or infrastructure site location [54]. The adequate water supply and the land provisions are the foundation of urban development. Thus, distance from the river and topography determines the location of newly-added construction land [66]. To this end, we select the distance from the river (DR), the elevation (ELE), the slope (SLO) and other factors. Moreover, location conditions are influential factors that cannot be ignored. The distance from important traffic trunks is one of the factors affecting land-use change [54,67]. For most towns in China, urban development and industrial enterprise site selection are affected not only by high-grade highways, such as expressways and national highways, but also by provincial and county-level roads. To this end, we divide the road factors into the distance from the road of level-I (DRLI) and the distance from the road of level-II (DRLII). For the interior of the town, the distance from the government resident (DGR) is a factor that cannot be ignored, and it can strongly affect the location of built-up land within the town. In China, many government departments and commercial enterprises always gather around the government resident, which shows the best location conditions of this area. Therefore, DGR could directly affects the results of planning implementation (Table 2).

Table 2. Potential influencing factors.

Potential Influencing Factors		**Description**	**Source**
Spatial Influence Factors	DR	Distance from the river	Land Use Map
	ELE	Elevation	Data Center for Resources and Environmental Sciences, Chinese Academy of Sciences (RESDC) (http://www.resdc.cn)
	SLO	Slope	

Table 2. *Cont.*

Potential Influencing Factors		Description	Source
	DRLI	Distance from the road of level-I	Land Use Map
	DRLII	Distance from the road of level-II	
	DGR	Distance from the government resident	
Social-Economic Influence Factors	PD	Population density	Cangwu Statistical Yearbooks
	URB	Rate of urbanization	
	GDP	Gross domestic product	
	FR	Fiscal revenue	
	FAI	Fixed assets investments	
	RT	Rank of town	Cangwu County Master Plan (2007–2020)

3.5. Data Sampling and Process

This research utilized a rich combination of data sources, including the following: (1) land-use maps of Cangwu County in 1997 and 2009; (2) land-use plan map (1998–2010) of Cangwu County; (3) time-series data on existing land use are obtained from a survey of land-use change in Cangwu County; (4) 30 m resolution digital elevation model of Cangwu County from Data Center for Resources and Environmental Sciences, Chinese Academy of Sciences (RESDC) (http://www.resdc.cn); (5) demographic and other socio-economic data from the Cangwu Statistical Yearbooks.

The value of influence factors in the equation was extracted mainly through the CLUE-S model, which was developed by Verburg [68]. This model is widely used in studies on land use and land cover change [69–72]. Firstly, the relevant variable data were defined into a unified coordinate system of the 30 × 30 m grid layer in ArcGIS platform. Secondly, the spatial distribution of construction land after implementation was extracted through overlaying land use map in 1997, 2009 and land-use planning map (1998–2010). The unused and exceeded construction land block (Y) were distinguished and assigned respectively with the accurate records of land area in six types of land, namely, town, rural settlement, industrial and mining area, land for special use, traffic land, and water facility. Thirdly, all the influence factors (X) were assigned. Socio-economic factors classified the assignment separately according to the variation of PD, URB, the GDP, and the FI of each town and the function level of each town in the Cangwu County master plan (2007–2020). Physical factors were decreasing assignment outward along the river, the road of level-I, the road of level-II, the location of township government, and the rank of elevation and slope. Since the distance effect has a significant attenuation characteristic to land use decision. The classification of physical factors, such as the distance to river, the road of level-I, the road of level-II, the location of township government, were used with 2 km as the buffer threshold [73]. After that, the independent and dependent variables can be converted into '*.asc' file in ArcGIS 10.2 by the toolbox of 'Raster to ASCII' Then, the results are turned into single-record files through the CLUE-S model. Lastly, influence factors that affect the space control in land-use planning implementation were diagnosed by applying the logistic model in the SPSS platform. Figure 4 illustrates the specific operation process, and the Appendix A shows the classification results of the influence factors.

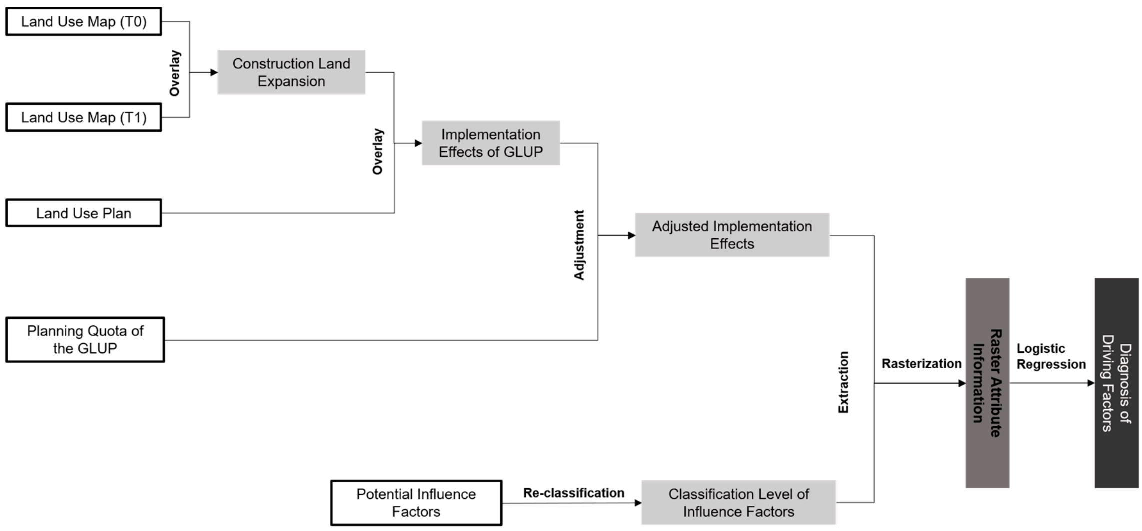


Figure 4. Analysis framework of land-use and zoning mismatch.

4. Results

4.1. Regulation Effectiveness of the GLUP on Spatial Zoning

As stated in the methodological framework, the effectiveness of the GLUP implementation can be extracted through the two steps of overlay operations. Firstly, by overlaying the land use map in 2009 and 1997, the expansion situation of construction land is identified. Secondly, based on this result, we overlay with the land-use plan map (1998–2010) of Cangwu County to determine the implementation effects of the GLUP in Cangwu County (Figure 5).

In line with the analytical framework in Figure 2 and Equations (1)–(4), we divide the implementation effects into three classes. The first one is the conformed area, which includes the original conformed area (the used area is conformed to the planning map) and the legitimated area, which is the 'green' part. The second one is the exceeded area, which refers to the area that is outside the GLUP and cannot be legitimated in the meantime. The last one is the unused area, which is located on the planning map but has not been used in the planning period.

Considering the unpredictable characteristics of most rural residential, other built-up, transportation and water conservancy construction projects which have special requirements for site selection that it is hardly to be located on the map of the GLUP. Therefore, the general regulation effectiveness is not good enough for these kinds of construction land (Figure 5).

Specifically, the conformed area is mainly led by urban and town built-up and industrial/mining lands. Figure 6 displays that these two types of land are mainly located in the center of Cangwu County. Notably, the transportation land, which is labelled in sign 1, is a typical piece of legitimated land. As mentioned in the GLUP, a new high-way road can be built. Such a kind of construction project can be allocated with enough planning quotas, but these quotas are not located on the planning map. Hence, this kind of construction land can be legitimated after the planning implementation. The same applies to most water conservancy construction lands.

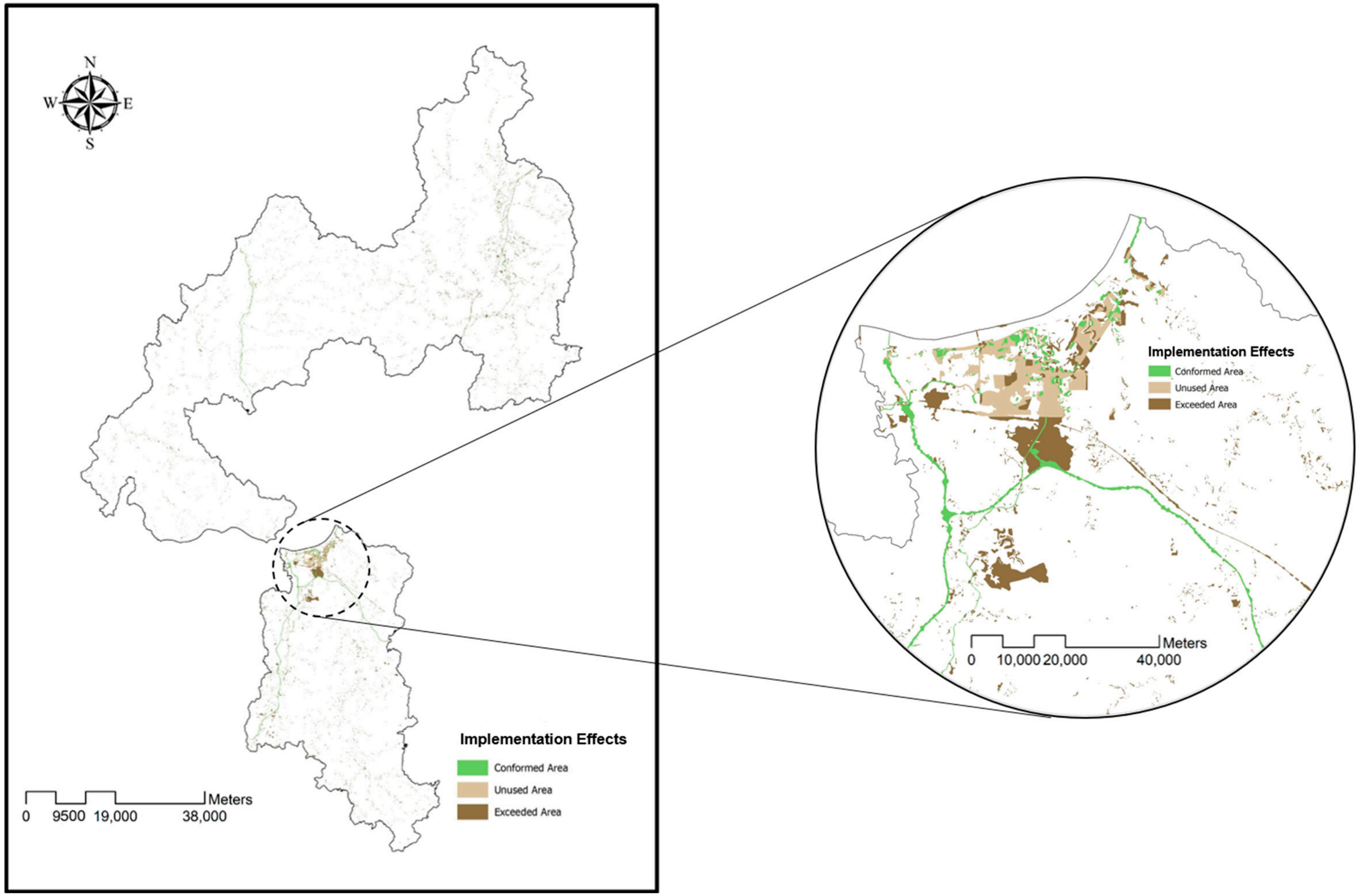


Figure 5. General results of implementation effects.

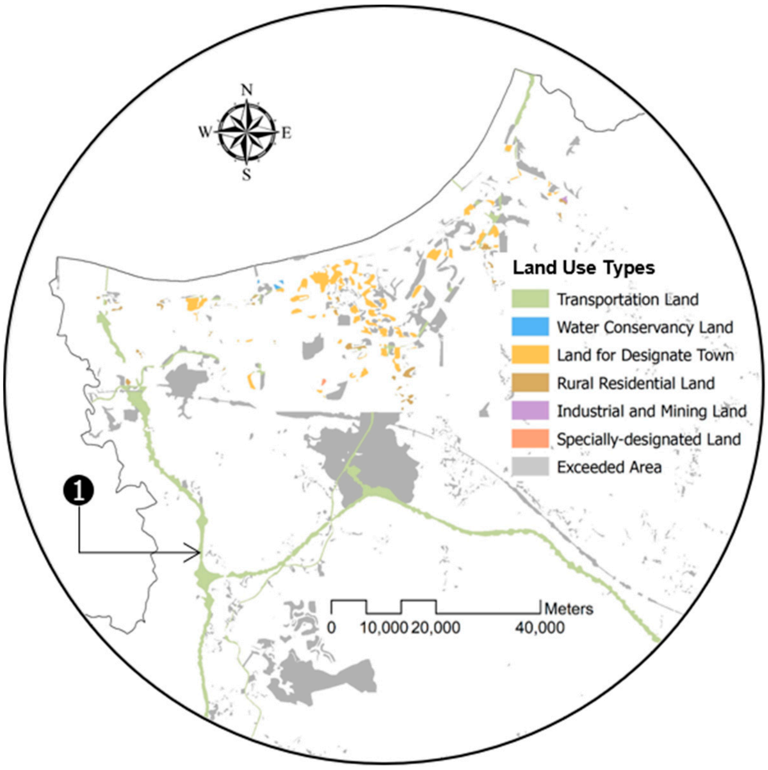


Figure 6. Detailed results of implementation effects—'The Conformed Area'.

The situation is complicated for the exceeded area (Figure 7). Firstly, sign 2 is also a new road. Unlike the former, this road is a high-speed railway. Moreover, this railway is not included in the GLUP. Hence, this kind of transportation land can be classified amongst the exceeded area. Secondly, signs 3 and 4 exceed other built-up lands and rural settlements, respectively. Several rural settlements are occupied to build a scenic spot. On the contrary, rural residential lands are normally sporadic and small. Regulating through the GLUP is difficult. Lastly, industrial development is another major cause for the excess of construction land. For example, a development zone is relocated at sign 5, which leads to a large scale of excess. In addition, sign 6 is a region for innovative industrial companies. Similar to sign 2, this project has not been mentioned in the plan. During the planning period, the local government tries to build a site for renewable energy, which can stimulate local economic development. Furthermore, the location should be far from the county center. Hence, an exceeded situation for industrial/mining land happens in this region.

As for the unused area, the situation is quite clear. Most of this area is in the center of the county and belongs to urban land, which is prepared for real estate development. Figure 8 shows that the scale of this area is large. That is, considerable urban and town built-up land quotas have not been used during this period.

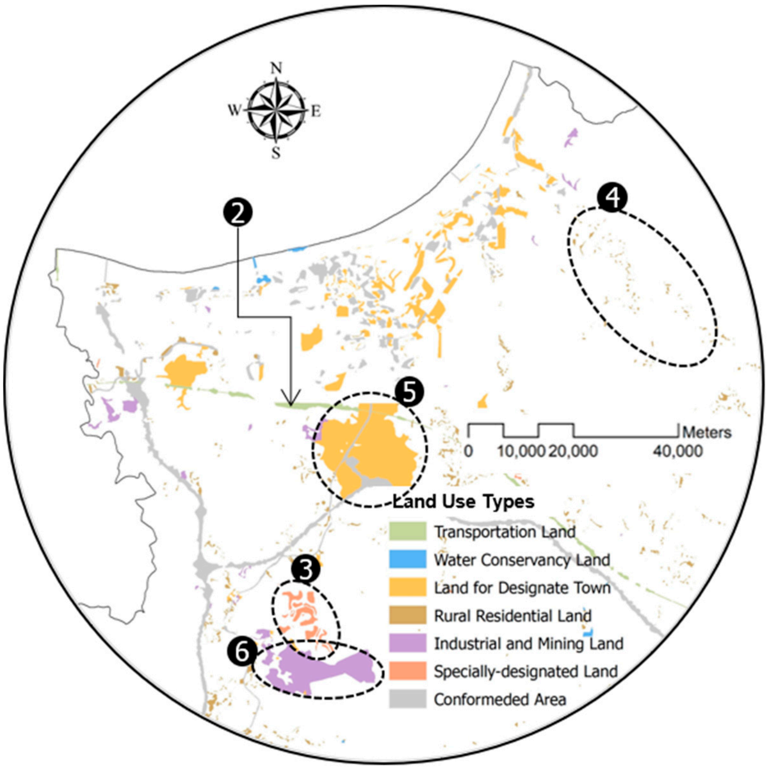


Figure 7. Detailed results of implementation effects—'The Exceeded Area'.

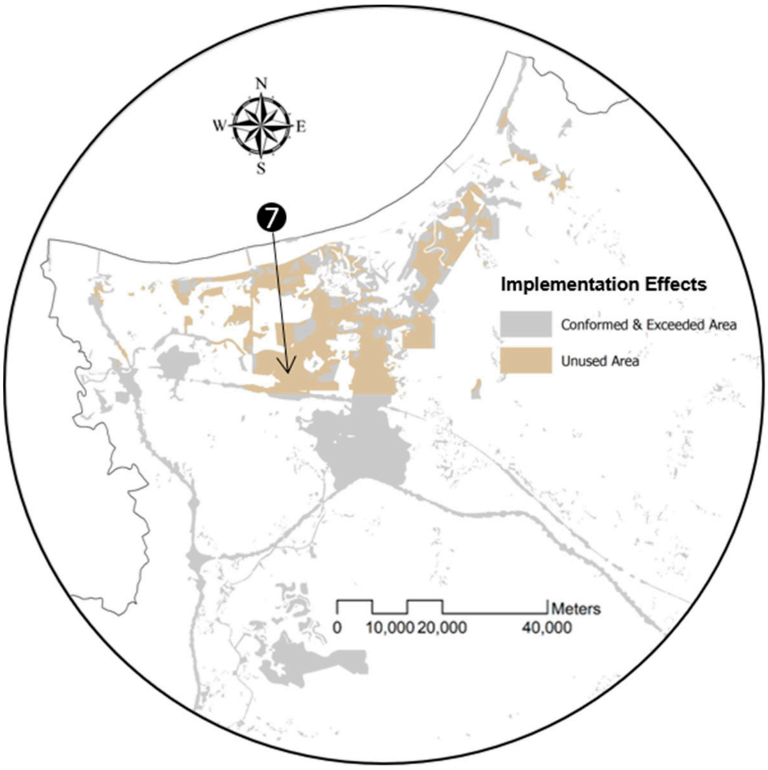


Figure 8. Detailed results of implementation effects—'The Unused Area'.

Table 3 shows that the major expansion of construction land is contributed by urban growth and transportation infrastructure construction. Amongst these six kinds of construction land, the development of urban and town built-up, industrial/mining, transportation, and water conservancy construction lands essentially consists of the GLUP. Moreover, when we look at the exceeded situation, the rural settlement and other built-up lands are two main contributors.

Table 3. Regulation effectiveness of the general land use plan (GLUP) on spatial zoning.

Categories	Expansion	The Conformed		The Exceeded	
	Area (ha)	Area (ha)	% Expansion	Area (ha)	% Expansion
Urban and Town Built-up Land	1503.04	1322.43	87.98	180.61	12.02
Rural Settlements	563.38	41.75	7.41	521.63	92.59
Industrial/Mining Land	178.26	120.98	67.87	57.28	32.13
Other Built-up Land	75.29	1.76	2.34	75.29	97.66
Transportation Land	1126.45	648.13	57.54	478.32	42.46
Water Conservancy Construction Land	48.31	48.31	100.00	0	0
Total	3494.73	2139.85	323.14	1354.88	276.86

4.2. Regulation Effectiveness of the GLUP on Quota Control

As previously discussed, the analysis of the zoning part is insufficient for evaluating the regulation effectiveness. The quota system should also be considered, especially for lands that have not been located on the land-use planning map.

Specifically, the quota control for industrial/mining and urban and town built-up lands is relatively good. Their expansions are almost equal to their planning quota, which account for 80.96% and 98.90%, respectively. This result may be due to the dual regulation (the construction land is controlled by spatial zoning and planning quotas). These two kinds of construction lands are regulated through two dimensions. On the one hand, the planning quota sets a ceiling for its development during the planning period. On the other hand, these quotas are limited within the zoning areas (Table 4).

Table 4. Quota Control in the GLUP (**I**).

Categories	Planning Quota	Expansion		Remaining Quota
	Area (ha)	Area (ha)	% Quota	Area (ha)
Urban and Town Built-up Land	1519.8	1503.04	98.90	16.76
Rural Settlements	42.11	563.38	1337.88	−521.27
Industrial/Mining Land	220.18	178.26	80.96	41.92
Other Built-up Land	20.66	75.29	364.42	−54.63
Total	1802.75	2319.97	1882.16	−517.22

For rural settlements and other built-up lands, the quota system fails to play its role. The expansion of rural settlements and other built-up lands is almost 13 and 3.6 times to their quotas, respectively. Hence, both kinds of construction land make an enormous contribution to the excess. In contrast to the situation above, they have not been located on the land-use planning map in consideration of their unpredictable property. Therefore, only one-dimensional regulation, that is, a quota system, is introduced for these two kinds.

The regulation of the two other kinds of construction land (Table 5) is quite different from that of the former two. For one thing, predicting the accurate zoning area and quotas for transportation and water conservancy construction lands is difficult. Thus, only parts of their quotas are located on the planning map. For another, most transportation and water conservancy lands are not located on the planning map. Therefore, this kind of situation can normally bring several outcomes: (1) the planning quota cannot accurately cover the actual development; (2) the actual used area cannot be conformed with the planning map. On the basis of these characteristics, both kinds of construction land can be eventually legitimated.

Table 5. Quota Control in the GLUP (**II**).

Categories	Planning Quota	Expansion		Remaining Quota
	Area (ha)	Area (ha)	% Quota	Area (ha)
Transportation Land	828.88	1126.45	135.90	−297.57
Water Conservancy Construction Land	538.5	48.31	8.97	490.19
Total	1367.38	1174.76	144.87	192.62

4.3. Zoning-Land Use Mismatch

In combination with the analytical framework in Figure 2 and Equations (1)–(4), the expansion area can be categorized into three classes: the conformed, unused and exceeded areas. Table 6 shows that the conformed area generally comprises urban and town built-up and industrial/mining lands. For the unused part, although the quota of water conservancy construction land has a large surplus, this kind of land has not been located on the planning map. Thus, this surplus quota of water conservancy construction land can be regarded as unused quotas. Moreover, this area has a little proportion of the expansion.

Table 6. Quota control in the GLUP (**IV**).

Categories	Quota	The Conformed		The Unused		The Exceeded
	Area (ha)	Area (ha)	% Quota	Area (ha)	% Quota	Area (ha)
Urban and Town Built-up Land	1519.8	1322.43	87.01	197.37	12.99	180.61
Rural Settlements	42.11	41.75	99.15	0	0	563.38
Industrial/Mining Land	220.18	120.98	54.95	99.2	45.05	57.28
Other Built-up Land	20.66	1.76	8.52	0	0	75.29
Total	1802.75	1486.92	249.62	296.57	58.04	876.56
Transportation Land	828.88	648.13	78.19	0	0	478.32
Water Conservancy Construction Land	538.5	48.31	8.97	0	0	0
Total	1367.38	696.44	87.16	0	0	478.32

This result is completely different from the situation of the exceeded area. A large part of this area stems from rural settlements and transportation lands. As for rural settlement lands, on the one hand, the planning quota is not that accurate for the actual development. On the other hand, the development of rural settlements is largely spontaneous, which cannot be effectively regulated through quotas and planning. Transportation lands also have an unpredictable development. As previously stated, the two main kinds of outcomes are as follows: one is covered through the planning quota, such as the situation of sign 1 in Figure 6. The other is not mentioned in the GLUP, only as sign 2 in Figure 7.

4.4. Impact Factors

According to the analysis of planning implementation, although the scale of newly added construction land conforms to the planning regulation, certain expansions are incompatible with planning in space control. The expansion of certain types of land use, such as rural settlements and other built-up lands, far exceeds the limit of planning. Meanwhile, the unused and the exceeded coexist for the same type of land use, such as urban and town built-up and industrial/mining lands. Spatial mismatch problems exist in the planning implementation. For this reason, exploring the driving forces is necessary for determining what factors influence space control in construction land-use regulation through building a discriminant between the unused and the exceeded. Lastly, a logistic regression analysis is processed in SPSS.

In order to avoid collinearity problem caused by country of independent variables with large correlation coefficient. In this study, stepwise regression method was adopted to eliminate the independent variables with relatively small influence by setting the test level with p-value less than

0.05. Table 7 presents the results of estimates and the test value of ROC. After eliminating certain impact factors, the ROC value reaches 0.737, indicating that the fitness of simulation is good enough. The following is the regression equation.

$$\begin{aligned}\mathrm{Ln}\left[\frac{p}{1-p}\right] = & -3.665 - 2.136\,DR + 0.556\,ELE + 0.144\,SLO - 0.316\,DRL\,II \\ & + 2.631\,GDP - 0.356\,FR + 0.964\,FAI + 0.567\,RT\end{aligned} \tag{4}$$

Table 7. Evaluation result of the influence factors of construction land expansion exceeding the plan.

Influence Factors	B	S.E.	Wald	df	Exp(B)	95.0% C.I. for EXP(B)	
						Lower	Upper
Distance from the River (DR)	−2.136 ***	0.223	91.851	1	0.118	0.076	0.183
Elevation (ELE)	0.556 ***	0.049	129.14	1	1.743	1.584	1.918
Slope (SLO)	0.144 ***	0.027	28.127	1	1.154	1.095	1.217
Distance from the Road of Level-II (DRLII)	−0.316 ***	0.043	53.796	1	0.729	0.67	0.793
GDP	2.631 ***	0.196	180.814	1	13.882	9.461	20.368
Fiscal Revenue (FR)	−0.356 ***	0.07	26.199	1	0.7	0.611	0.803
Fixed Assets Investments (FAI)	0.964 ***	0.129	56.16	1	2.622	2.038	3.374
Rank of Town (RT)	0.567 ***	0.17	11.189	1	1.763	1.265	2.459
Constant	−3.665 ***	0.087	1782	1	0.026		
ROC				0.737			

Note: *** denotes significance higher than 0.001.

That is, we can obtain a simulated model to explain the kind of factors that can affect the space control in land-use planning implementation. In general, spatial and socio-economic factors have an impact on the implementation of space control in construction land-use planning. The physical factors of DR, ELE, SLO, and DRLII and the social-economic factors of GDP, FR, FAI, and RT have prominent effects. According to Wald χ^2 statistics, the probability of the implementation result deviating from the planning expectation can decrease as the DR and road of level-II increase, with other conditions being constant. In addition, the decrease of local FR can reduce the deviation of planning implementation results. On the contrary, in physical factors, if the elevation and slope levels increase, then the deviation probability of planning implementation results also increases. In socio-economic factors, if the GDP, FAI, and RT levels increase, then the probability of planning implementation results deviating from expectations can be significantly increased. The explanatory variables that influence the deviation of the planning implementation results are as follows: GDP, ELE, DR, FAI, DRLII, SLO, FI, and RT (Table 6).

5. Discussion

5.1. Economic Development Brings Significant Uncertainty to the Implementation Results

Plan making is currently driven by a logic of certainty and rationality. However, implementation intentions can change due to the rapid development of regional economy and urbanization, which is always accompanied by the new demand, not only in quota but also in spatial layout for newly-added construction land that causes a situation of great uncertainty. This process inevitably leads to the paradox of planning [74].

GDP is the most significant factor affecting the implementation of the plan. As shown in the example, the gross regional product of Cangwu reached 7.218 billion yuan in 2009, increasing 250% from 1997. Logistics regression results show that the occurrence probability of exceeded the plan would increase by nearly 13 times for every 30 million RMB increased in GDP. It also has been confirmed by previous studies that construction land expansion is prominently influenced by increase in gross domestic product (GDP), which usually promotes land development more than expected in the context of rapid development [5,75,76].

Moreover, investment in fixed assets (FAI) is another significant influencing factor. In recent years, in order to improve the regional investment environment and people's welfare, both the central and local governments have stepped up investment in infrastructure to build a lot of new high-speed railways and expressways which are not part of the original plan through fixed asset investment. Meeting such a demand for local development becomes difficult, especially for the traffic land expansion in this case. Therefore, the increase of fixed asset investment brings more uncertainties to the implementation of the plan that much of the demand for land development has exceeded planning expectations. This is also an important reason for the zoning-land use mismatch. As regression result show that when fixed investment increased by one unit, the mismatch probability increased by 162.2%.

Moreover, the rank of town reflects the importance of the economic development of each township within a county. If the township is on a higher rank which is given by national economic and social development planning, it will get more investment from the upper government that more infrastructure projects and investment will be prioritized located in these townships [65]. It also means that planning is more likely to face the situation that development needs and land development requirements is out of expected. The empirical results show that rank of town (RT) significantly affects the result of plan implementation. When the RT increased by one level, the mismatch probability increased by 76.3%.

By contrast, for every increase in fiscal revenue (FR), the occurrence probability of exceeded the plan decreases by 30%. Because FR reflects the level of regional socio-economic development, the higher level of fiscal revenue, the stronger the regional economic strength. For economically underdeveloped areas, large scale of land development which is more than planned could promote regional economic development which means local governments can competing for greater political promotion advantages [77,78] Thus, for the underdeveloped areas which is at the lower level of fiscal revenue, when a project is inconsistent with the plan, local government is more likely to violate the plan to ensure the implementation of the project. This is one of the reasons why planning is often violated [5].

5.2. Location Conditions Can Also Lead to Zoning–Land Use Mismatch

Planning implementation is also the process of land use decision-making. Previous studies have confirmed that location characteristics, such as land value and accessibility, are one of the significant factors that influence the decision of land use and development in the plan implementation [55,79–81]. Land developers are more likely to choose better locational conditions. In Cangwu County, since most of the area is mountainous and hilly, elevation and slope are usually restrictive factors to land development that land developers will be more inclined to choose [81]. The results show that whenever ELE and SLO raise a level, the mismatch probability increased by 74% and 15% respectively.

Otherwise, transportation convenience is also a key consideration for land developers in the process of site selection. Lower commuting costs not only make the county more attractive to manufacturers, but also promote construction land expansion [54,79]. Thus, land development is guided by the economist's 'invisible hand' which directs land developers to choose the best location that is even though out of plan regulation [55]. The results of this study also confirm this view. The occurrence probability of exceeded the plan decreases by 27.1% while distance from road level-II is increased by 2 km.

Distance to a river is usually a restrictive factor to urban expansion, especially for areas with low development level [82]. Scholars believe that a river is not only restrict the spatial distribution of urban expansion, but also benefit urban development due to water resources advantages which is presented by the river [81,83]. Therefore, when land developer would face with a location choice that is closer to the river or within the planning scope but further away from the river. As a rational person, he is more likely to choose the former. This study also confirms this viewpoint that the occurrence probability of exceeded the plan would be decrease by 88.2% for the distance from a river be increased by 2 km.

5.3. Rigid Control Measures vs. Rapid Economic Development

Rigid space control measures are difficult to adapt to the uncertainty caused by rapid economic development. As previously mentioned, due to the rapid economic development, the development of construction land is uncertain not only in quota but also in the location [12]. However, the quota of newly added construction land has been fixed in specific spatial locations. We cannot freely allocate planning quota of newly added construction land according to the actual development. Hence, zone for flexibility in practice is limited [43]. As sign 2 in Figure 7, the high-speed railway which is meet the needs of rapid economic development has not been mentioned in GLUP. Although newly-added construction land quota and zoning still have surplus. The remaining quota cannot be directly transferred to this project. After implementation, this new construction project is out of plan.

Moreover, in the plan-making stages, the spatial allocation of newly added quota accurately meets the requirement of land development only for the last 3 to 5 years. In practice, projects at the time of site selection needs a comprehensive analysis of various types of factors, including spatial factors. The projects can select the location even if such a selection is out of the existing planning. Therefore, the scale of the unused is closed to the exceeded for the town and the industrial and mining area.

In sum, because of the rigid control measures of land use plan, the new demand of newly added quotas and spatial allocation which is due to the rapid development of social economy and policy change cannot be consistent with the existing planning. Thus, the problem of spatial mismatch between the exceeded and the unused can appear.

5.4. Policy Implications

Although the planning plays a certain role in regulating the expansion of construction land, the regulatory effect on the expansion of specific construction land is not evident. Rigid control measures which is adopted by land use plan could not adapt to the uncertainty and irrational expansion of construction land. Therefore, the existing space control approach of GLUP needs to be improved. The most important point is to increase the flexibility of spatial control to adapt to the uncertainty of social and economic development. During the planning implementation period, the newly added construction land should be allocated according to the specific needs of construction. The expansion of built-up land can be managed from the source by implementing the flexible quota mechanism of construction land planning. Moreover, the newly added quota of construction land is not tied to the specific construction land types. Hence, the newly added quota of construction land can be added and floated amongst various construction lands to meet all kinds of uncertain demand for the expansion of construction land.

To prevent plans from being shelved and dusty, the planning must provide a clear view for people. The spatial distribution of newly added construction land indicators directly affects the implementation of construction land planning. According to the theory of irrationality, uncertainty and elasticity of land-use planning [62], the construction land expansion planning area is established. The spatial expansion of construction land is regulated by delimiting the expansion of construction land. The idea is not to ban the newly added construction land quota to a specific spatial position. The purpose is to enhance the flexibility of the spatial layout of construction land by adding newly added construction land quota to the floating layout of the construction land expansion area.

Moreover, based on the analysis of spatial zoning and quota control, many planning quotas are sitting unused, and the excess problem of construction land frequently crops up. In combination with these two situations, the GLUP formulation must strengthen the relationship between planning quotas and spatial zoning in the future. For these spatial mismatch problems, efforts should be made to figure out the implementation mechanism of the GLUP and consider in conjunction with the event-driven system [63] for land-use plan in the future.

6. Conclusions

The purpose of executing land-use plans is to ensure the full realization of planning intention. For zoning, which aims to control the expansion of construction land in land-use planning, reducing the deviation of actual land use and planning intention is important to improve the effectiveness of planning implementation. Research on the impact factors of actual land use and zoning mismatch is an important path for improving the effect of land-use plan. The study first improves the method for identifying the deviation of planning implementation according to the complex regulation system, which controls the built-up land expansion combined quota and zoning in land-use plan. In addition, the impact factors affecting the implementation deviation of the planning are investigated through the analysis of logistic regression. Our conclusions are summarized below.

According to the deviation discriminant framework of planning implementation, we divided the expansion area into three main classes: the conformed, unused and exceeded areas. Then, we further discussed the implementation effects of the GLUP in Cangwu County, including the spatial zoning and quota control aspects. In general, GLUP can control the expansion of most construction lands, but for different types of construction land, its control ability varies. Firstly, the vast majority of newly added urban and town built-up lands conforms to the scope of GLUP spatial control in the spatial zoning. However, GLUP failed in its spatial control over rural settlement and other built-up lands, with more than 90% of newly added construction land beyond zoning due to their unpredictable property that have not been located on the land-use planning map. Secondly, from the perspective of quote control, the newly added construction land of rural settlements and other built and transportation lands all exceeded the quota control.

The influence factors that affect space control in land-use planning implementation were diagnosed by applying CLUE-S and logistic models. The results revealed that the physical factors of DR, ELE, SLO, and DRLII and the social-economic factors of GDP, FR, FI, and RT have prominent effects. The uncertainty of research and economic development can significantly affect the planning implementation results. In addition, the planning space control is too rigid, and the mismatch between actual land-use and zoning is inevitable. Moreover, physical factors can significantly affect the site selection preferences of the construction land, resulting in the location of newly added construction land deviating from the scope of planning control.

The zoning and land use mismatch and its impact factors in the process of land-use plan implementation were analyzed in this study. However, considering all dimensions and impact factors is difficult, and only two dimensions and 12 factors were selected for the current research. Furthermore, planning implementation results are a collection of behaviors, which are determined by different land-use entities at different times. In the application of this method, it is considered that land developers are homogeneous agent who have similar preferences for land use decisions. However, in actual land use, even the same agent will make different land use decisions under different situations. Thus, the method adopted in this study cannot explain the land use behavior of the heterogeneous agent. The present study is only a preliminary exploration. Future research must explore the deviation of planning implementation results by establishing an individual-based planning implementation behavior decision-making framework.

Author Contributions: Conceptualization, G.L. and Y.Z.; formal analysis, G.L., C.W., X.T., Y.W., and X.S.; methodology, G.L. and Z.X.; writing—original draft, G.L.; writing—review and editing, Y.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was sponsored by K.C. Wong Magna Fund in Ningbo University, the Key Program of National Social Science Foundation of China (Grant No. 14ZDA039); the National Natural Science Foundation of China (Grant No. 41861039 and 71904072) and the Guangxi Philosophy and Social Science Planning Research Project (Grant No. 17FGL014 and 17FGL016).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Classification results of potential influencing factors.

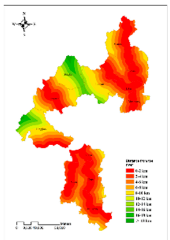
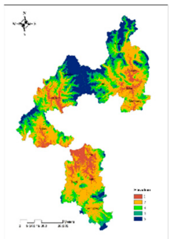
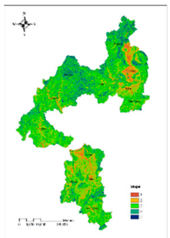
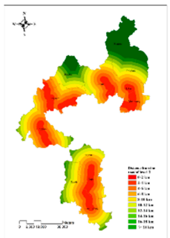
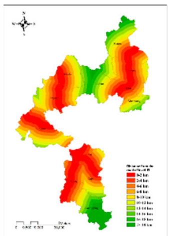
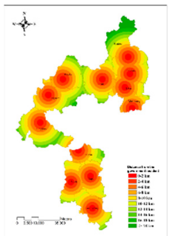
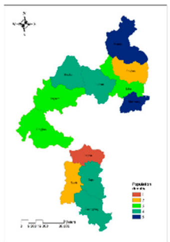
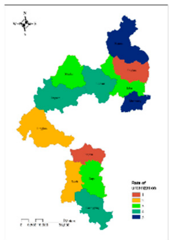
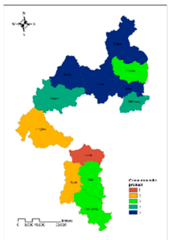
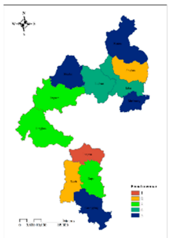
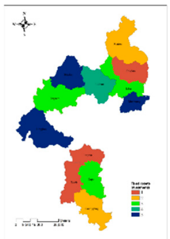
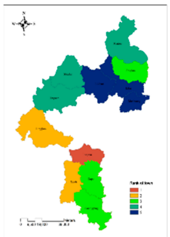
Potential Influencing Factors		Description	Assignment	Results
Spatial Influence Factors	DR	Distance from the river	Decreasing assignment outward along the river, interval of 2 km.	
	ELE	Elevation	5, (ELE < 50 m) 4, (150 m < ELE ≤ 50 m) 3, (250 m < ELE ≤ 150 m) 2, (250 m < ELE ≤ 350 m) 1, (ELE ≥ 350 m)	
	SLO	Slope	5, (2° < SLO ≤ 0°) 4, (5° < SLO ≤ 2°) 3, (15° < SLO ≤ 5°) 2, (25° < SLO ≤ 15°) 1, (SLO ≥ 25°)	
	DRLI	Distance from the road of level-I	Decreasing assignment along the road of level-I that include national roads and provincial roads, interval is 2 km.	
	DRLII	Distance from the road of level-II	Decreasing assignment along the county roads, interval is 2 km.	
	DGR	Distance from the government resident	Decreasing assignment along the location of township government, interval is 2 km.	

Table A1. *Cont.*

Potential Influencing Factors		Description	Assignment	Results
Social-Economic Influence Factors	PD	Population density	Classify the assignment according to population density variation (p/km^2) of each town in 1998–2009. 5, (1320 ≤ PD) 4, (113 ≤ PD < 1320) 3, (28 ≤ PD < 113) 2, (1 ≤ PD < 113) 1,(PD > 1)	
	URB	Rate of urbanization	Classify the assignment according to variation of the rate of urbanization (%) of each town. 5, (12 ≤ URB) 4, (8 ≤ URB < 12) 3, (4 ≤ URB < 8) 2, (1 ≤ URB < 4) 1, (URB > 1)	
	GDP	Gross domestic product	Classify the assignment according to variation of the gross domestic product (million RMB) of each town. 5, (120 ≤ GDP) 4, (90 ≤ GDP < 120) 3, (60 ≤ GDP < 90) 2, (30 ≤ GDP < 60) 1, (GDP > 30)	
	FR	Fiscal revenue	Classify the assignment according to variation of the fiscal revenue (million RMB) of each town. 5, (60 ≤ FR) 4, (45 ≤ FR < 60) 3, (30 ≤ FR < 45) 2, (15 ≤ FR < 30) 1, (FR > 15)	
	FAI	Fixed assets investments	Classify the assignment according to variation of the fixed assets investments (million RMB) of each town. 5, (FAI ≥ 40) 4, (30 ≤ FAI < 40) 3, (20 ≤ FAI < 30) 2, (10 ≤ FAI < 20) 1, (FAI < 10)	
	RT	Rank of town	Classify the assignment according to function level of each town in *the Cangwu county master plan (2007–2020)* 5, level 1 4, level 2 3, level 3 2, level 4 1, level 5	

References

1. Tan, R.; Qu, F.; Heerink, N.; Mettepenningen, E. Rural to urban land conversion in China—How large is the over-conversion and what are its welfare implications? *China Econ. Rev.* **2011**, *22*, 474–484. [CrossRef]

2. Vojnovic, I. Urban sustainability: Research, politics, policy and practice. *Cities* **2014**, *41*, S30–S44. [CrossRef]
3. Ewing, R. Is Los Angeles-Style Sprawl Desirable? *J. Am. Plan. Assoc.* **1997**, *63*, 107–126. [CrossRef]
4. Zhang, Y.; Su, Z.; Li, G.; Zhuo, Y.; Xu, Z. Spatial-Temporal Evolution of Sustainable Urbanization Development: A Perspective of the Coupling Coordination Development Based on Population, Industry, and Built-Up Land Spatial Agglomeration. *Sustainability* **2018**, *10*, 1766. [CrossRef]
5. Zhou, Y.; Huang, X.; Chen, Y.; Zhong, T.; Xu, G.; He, J.; Xu, Y.; Meng, H. The effect of land use planning (2006–2020) on construction land growth in China. *Cities* **2017**, *68*, 37–47. [CrossRef]
6. Wu, Y.; Fan, P.; Li, B.; Ouyang, Z.; Liu, Y.; You, H. The Effectiveness of Planning Control on Urban Growth: Evidence from Hangzhou, China. *Sustainability* **2017**, *9*, 855. [CrossRef]
7. Shen, X.; Wang, X.; Zhang, Z.; Lu, Z.; Lv, T. Evaluating the effectiveness of land use plans in containing urban expansion: An integrated view. *Land Use Policy* **2019**, *80*, 205–213. [CrossRef]
8. Long, Y.; Gu, Y.; Han, H. Spatiotemporal heterogeneity of urban planning implementation effectiveness: Evidence from five urban master plans of Beijing. *Landsc. Urban Plan.* **2012**, *108*, 103–111. [CrossRef]
9. Tian, L.; Ge, B.; Li, Y. Impacts of state-led and bottom-up urbanization on land use change in the peri-urban areas of Shanghai: Planned growth or uncontrolled sprawl? *Cities* **2017**, *60*, 476–486. [CrossRef]
10. Loh, C.G. Assessing and Interpreting Non-conformance in Land-use Planning Implementation. *Plan. Pract. Res.* **2011**, *26*, 271–287. [CrossRef]
11. Shahab, S.; Clinch, J.P.O.; Neill, E. Impact-based planning evaluation: Advancing normative criteria for policy analysis. *Environ. Plan. B Urban Anal. City Sci.* **2019**, *46*, 534–550. [CrossRef]
12. Wei, X.; Wei, C.; Cao, X.; Li, B. The general land-use planning in China: An uncertainty perspective. *Environ. Plan. B Plan. Des.* **2016**, *43*, 361–380. [CrossRef]
13. Tian, L.; Shen, T. Evaluation of plan implementation in the transitional China: A case of Guangzhou city master plan. *Cities* **2011**, *28*, 11–27. [CrossRef]
14. Zhong, T.; Mitchell, B.; Huang, X. Success or failure: Evaluating the implementation of China's National General Land Use Plan (1997–2010). *Habitat Int.* **2014**, *44*, 93–101. [CrossRef]
15. You, H. Agricultural landscape dynamics in response to economic transition: Comparisons between different spatial planning zones in Ningbo region, China. *Land Use Policy* **2017**, *61*, 316–328. [CrossRef]
16. Ma, L.J.C. Urban Transformation in China, 1949–2000: A Review and Research Agenda. *Environ. Plan. A Econ. Space* **2002**, *34*, 1545–1569. [CrossRef]
17. Bao, X.H. Analysis on Land Planning Policies and Housing Supply in the UK. *China Land Sci.* **2013**, *27*, 60–63. [CrossRef]
18. Shen, X.; Wang, L.; Wu, C.; Lv, T.; Lu, Z.; Luo, W.; Li, G. Local interests or centralized targets? How China's local government implements the farmland policy of Requisition–Compensation Balance. *Land Use Policy* **2017**, *67*, 716–724. [CrossRef]
19. Gar-on Yeh, A.; Wu, F. The transformation of the urban planning system in China from a centrally-planned to transitional economy. *Prog. Plan.* **1999**, *51*, 167–252. [CrossRef]
20. Cai, Y.; Zhang, W.; Zhao, Y.; Shi, K. Discussion on evolution of land-use planning in China. *China City Plan. Rev.* **2009**, *18*, 32–37.
21. Faludi, A. Conformance VS. Performance: Implications for Evaluation. *Impact Assess.* **1989**, *7*, 135–151. [CrossRef]
22. Padeiro, M. Conformance in land-use planning: The determinants of decision, conversion and transgression. *Land Use Policy* **2016**, *55*, 285–299. [CrossRef]
23. Talen, E.; Anselin, L.; Lee, S.; Koschinsky, J. Looking for logic: The zoning—land use mismatch. *Landsc. Urban Plan.* **2016**, *152*, 27–38. [CrossRef]
24. Alexander, E.R.; Faludi, A. Planning and Plan Implementation: Notes on Evaluation Criteria. *Environ. Plan. B Plan. Des.* **1989**, *16*, 127–140. [CrossRef]
25. Alfasi, N.; Almagor, J.; Benenson, I. The actual impact of comprehensive land-use plans: Insights from high resolution observations. *Land Use Policy* **2012**, *29*, 862–877. [CrossRef]
26. Bulti, D.T.; Sori, N.D. Evaluating land-use plan using conformance-based approach in Adama city, Ethiopia. *Spat. Inf. Res.* **2017**, *25*, 605–613. [CrossRef]
27. Laurian, L.; Day, M.; Berke, P.; Ericksen, N.; Backhurst, M.; Crawford, J.; Dixon, J. Evaluating Plan Implementation: A Conformance-Based Methodology. *J. Am. Plan. Assoc.* **2004**, *70*, 471–480. [CrossRef]

28. Chapin, T.S.; Deyle, R.E.; Baker, E.J. A parcel-based GIS method for evaluating conformance of local land-use planning with a state mandate to reduce exposure to hurricane flooding. *Environ. Plan. B Plan. Des.* **2008**, *35*, 261–279. [CrossRef]
29. Lyles, W.; Berke, P.; Smith, G. Local plan implementation: Assessing conformance and influence of local plans in the United States. *Environ. Plan. B Plan. Des.* **2016**, *43*, 381–400. [CrossRef]
30. Alterman, R.; Hill, M. Implementation of Urban Land Use Plans. *J. Am. Inst. Plan.* **1978**, *44*, 274–285. [CrossRef]
31. Ju, H.; Zhang, Z.; Zuo, L.; Wang, J.; Zhang, S.; Wang, X.; Zhao, X. Driving forces and their interactions of built-up land expansion based on the geographical detector—A case study of Beijing, China. *International J. Geogr. Inf. Sci.* **2016**, *30*, 2188–2207. [CrossRef]
32. Calkins, H.W. The planning monitor: An accountability theory of plan evaluation. *Environ. Plan. A* **1979**, *11*, 745–758. [CrossRef]
33. Brody, S.D.; Highfield, W.E. Does Planning Work?: Testing the Implementation of Local Environmental Planning in Florida. *J. Am. Plan. Assoc.* **2005**, *71*, 159–175. [CrossRef]
34. Mastop, H.; Faludi, A. Evaluation of strategic plans: The performance principle. *Environ. Plan. B Plan. Des.* **1997**, *24*, 815–832. [CrossRef]
35. Pressman, J.L.; Wildavsky, A.B. *Implementation: How Great Expectations in Washington are Dashed in Oakland; Or, Why It's Amazing that Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals on a Foundation of Ruined Hopes*; University of California Press: Berkeley, CA, USA, 1984.
36. Berke, P.; Backhurst, M.; Day, M.; Ericksen, N.; Laurian, L.; Crawford, J.; Dixon, J. What makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand. *Environ. Plan. B Plan. Des.* **2006**, *33*, 581–600. [CrossRef]
37. Mastop, H. Performance in Dutch spatial planning: An introduction. *Environ. Plan. B Plan. Des.* **1997**, *24*, 807–813. [CrossRef]
38. Talen, E. Do Plans Get Implemented? A Review of Evaluation in Planning. *J. Plan. Lit.* **1996**, *10*, 248–259. [CrossRef]
39. Oliveira, V.; Pinho, P. Evaluating Plans, Processes and Results. *Plan. Theory Pract.* **2009**, *10*, 35–63. [CrossRef]
40. Talen, E. Success, failure, and conformance: An alternative approach to planning evaluation. *Environ. Plan. B Plan. Des.* **1997**, *24*, 573–587. [CrossRef]
41. Laurian, L.; Day, M.; Backhurst, M.; Berke, P.; Ericksen, N.; Crawford, J.; Dixon, J.; Chapman, S. What drives plan implementation? Plans, planning agencies and developers. *J. Environ. Plan. Manag.* **2004**, *47*, 555–577. [CrossRef]
42. Talen, E. After the Plans: Methods to Evaluate the Implementation Success of Plans. *J. Plan. Educ. Res.* **1996**, *16*, 79–91. [CrossRef]
43. Shen, X.; Wang, L.; Wang, X.; Zhang, Z.; Lu, Z. Interpreting non-conforming urban expansion from the perspective of stakeholders' decision-making behavior. *Habitat Int.* **2019**, *89*, 102007. [CrossRef]
44. Tan, R.; Beckmann, V.; van den Berg, L.; Qu, F. Governing farmland conversion: Comparing China with the Netherlands and Germany. *Land Use Policy* **2009**, *26*, 961–974. [CrossRef]
45. Tan, R.; Beckmann, V. Diversity of Practical Quota Systems for Farmland Preservation: A Multicountry Comparison and Analysis. *Environ. Plan. C Gov. Policy* **2010**, *28*, 211–224. [CrossRef]
46. Qu, F.; Heerink, N.; Wang, W. Land administration reform in China. Its impact on land allocation and economic development. *Land Use Policy* **1995**, *12*, 193–203. [CrossRef]
47. Huang, Q.H.; Li, M.C.; Liu, Y.X.; Hu, W.; Liu, M.; Chen, Z.J.; Li, F.X. Using Construction Expansion Regulation Zones to Manage Urban Growth in Hefei City, China. *J. Urban Plan. Dev.* **2013**, *139*, 62–69. [CrossRef]
48. Huang, Q.H.; Liu, Y.X.; Li, M.C.; Mao, K.; Li, F.X.; Chen, Z.J.; Chen, C.; Hu, W. Thematic maps for county-level land use planning in Contemporary China. *J. Maps* **2012**, *8*, 185–188. [CrossRef]
49. Cheng, Q.; Jiang, P.; Cai, L.; Shan, J.; Zhang, Y.; Wang, L.; Li, M.; Li, F.; Zhu, A.; Chen, D. Delineation of a permanent basic farmland protection area around a city centre: Case study of Changzhou City, China. *Land Use Policy* **2017**, *60*, 73–89. [CrossRef]
50. Alqurashi, A.; Kumar, L.; Al-Ghamdi, K. Spatiotemporal Modeling of Urban Growth Predictions Based on Driving Force Factors in Five Saudi Arabian Cities. *ISPRS Int. J. Geogr. Inf.* **2016**, *5*, 139. [CrossRef]

51. Shu, B.; Zhang, H.; Li, Y.; Qu, Y.; Chen, L. Spatiotemporal variation analysis of driving forces of urban land spatial expansion using logistic regression: A case study of port towns in Taicang City, China. *Habitat Int.* **2014**, *43*, 181–190. [CrossRef]
52. Tayyebi, A.; Delavar, M.R.; Yazdanpanah, M.J.; Pijanowski, B.C.; Saeedi, S.; Tayyebi, A.H. *A Spatial Logistic Regression Model for Simulating Land Use Patterns: A Case Study of the Shiraz Metropolitan Area of Iran*; Springer: Dordrecht, The Netherlands, 2010; pp. 27–42.
53. Xie, H.; Li, B. Driving forces analysis of land-use pattern changes based on logistic regression model in the farming-pastoral zone:A case study of Ongiud Banner, Inner Mongolia based on logistic. *Geogr. Res.* **2008**, *27*, 294–304. [CrossRef]
54. Brody, S.D.; Highfield, W.E.; Thornton, S. Planning at the Urban Fringe: An Examination of the Factors Influencing Nonconforming Development Patterns in Southern Florida. *Environ. Plan. B Plan. Des.* **2006**, *33*, 75–96. [CrossRef]
55. Brueckner, J.K. Urban Sprawl: Diagnosis and Remedies. *Int. Reg. Sci. Rev.* **2000**, *23*, 160–171. [CrossRef]
56. Serra, P.; Pons, X.; Saurí, D. Land-cover and land-use change in a Mediterranean landscape: A spatial analysis of driving forces integrating biophysical and human factors. *Appl. Geogr.* **2008**, *28*, 189–209. [CrossRef]
57. Lambin, E.F.; Meyfroidt, P. Land use transitions: Socio-ecological feedback versus socio-economic change. *Land Use Policy* **2010**, *27*, 108–118. [CrossRef]
58. Deng, X.; Huang, J.; Rozelle, S.; Uchida, E. Growth, population and industrialization, and urban land expansion of China. *J. Urban Econ.* **2008**, *63*, 96–115. [CrossRef]
59. Deng, X.; Huang, J.; Rozelle, S.; Uchida, E. Economic Growth and the Expansion of Urban Land in China. *Urban Stud.* **2009**, *47*, 813–843. [CrossRef]
60. Liu, J.; Zhan, J.; Deng, X. Spatio-temporal Patterns and Driving Forces of Urban Land Expansion in China during the Economic Reform Era. *AMBIO J. Hum. Environ.* **2005**, *34*, 450–455. [CrossRef]
61. Liu, J.; Zhang, Z.; Xu, X.; Kuang, W.; Zhou, W.; Zhang, S.; Li, R.; Yan, C.; Yu, D.; Wu, S.; et al. Spatial patterns and driving forces of land use change in China during the early 21st century. *J. Geogr. Sci.* **2010**, *20*, 483–494. [CrossRef]
62. You, H.; Yang, X. Urban expansion in 30 megacities of China: Categorizing the driving force profiles to inform the urbanization policy. *Land Use Policy* **2017**, *68*, 531–551. [CrossRef]
63. Lichtenberg, E.; Ding, C. Local officials as land developers: Urban spatial expansion in China. *J. Urban Econ.* **2009**, *66*, 57–64. [CrossRef]
64. Chen, J.; Gao, J.; Chen, W. Urban land expansion and the transitional mechanisms in Nanjing, China. *Habitat Int.* **2016**, *53*, 274–283. [CrossRef]
65. Chen, S.; Li, G.; Xu, Z.; Zhuo, Y.; Wu, C.; Ye, Y. Combined Impact of Socioeconomic Forces and Policy Implications: Spatial-Temporal Dynamics of the Ecosystem Services Value in Yangtze River Delta, China. *Sustainability* **2019**, *11*, 2622. [CrossRef]
66. Li, X.; Zhou, W.; Ouyang, Z. Forty years of urban expansion in Beijing: What is the relative importance of physical, socioeconomic, and neighborhood factors? *Appl. Geogr.* **2013**, *38*, 1–10. [CrossRef]
67. Long, Y.; Han, H.; Tu, Y.; Shu, X. Evaluating the effectiveness of urban growth boundaries using human mobility and activity records. *Cities* **2015**, *46*, 76–84. [CrossRef]
68. Verburg, H.P.; Soepboer, W.; Veldkamp, A.; Limpiada, R.; Espaldon, V.; Mastura, S.A.S. Modeling the Spatial Dynamics of Regional Land Use: The CLUE-S Model. *Environ. Manag.* **2002**, *30*, 391–405. [CrossRef]
69. Ahmed, S.J.; Bramley, G.; Verburg, P.H. Key Driving Factors Influencing Urban Growth: Spatial-Statistical Modelling with CLUE-s. In *Dhaka Megacity: Geospatial Perspectives on Urbanisation, Environment and Health*; Dewan, A., Corner, R., Eds.; Springer: Dordrecht, The Netherlands, 2014; pp. 123–145.
70. Verburg, P.H.; Overmars, K.P. Dynamic Simulation of Land-Use Change Trajectories with the Clue-S Model. In *Modelling Land-Use Change: Progress and Applications*; Koomen, E., Stillwell, J., Bakema, A., Scholten, H.J., Eds.; Springer: Dordrecht, The Netherlands, 2007; pp. 321–337.
71. Xu, L.; Li, Z.; Song, H.; Yin, H. Land-Use Planning for Urban Sprawl Based on the CLUE-S Model: A Case Study of Guangzhou, China. *Entropy* **2013**, *15*, 3490. [CrossRef]
72. Zhang, L.; Zhang, S.; Huang, Y.; Cao, M.; Huang, Y.; Zhang, H. Exploring an Ecologically Sustainable Scheme for Landscape Restoration of Abandoned Mine Land: Scenario-Based Simulation Integrated Linear Programming and CLUE-S Model. *Int. J. Environ. Res. Public Health* **2016**, *13*, 354. [CrossRef]

73. Liu, R.; Zhu, D.; Zhu, Z.; Yang, W. Analysis of the Driving Forces of Urban Sprawl in Dezhou City Based on a Logistic Regression Model. *Resour. Sci.* **2009**, *31*, 1919–1926.
74. Wu, C.; Shao, X. A Study on the Irrational, Uncertain and Flexible Theory of Land Use Planning. *J. Zhejiang Univ. (Humanit. Soc. Sci.)* **2005**, *04*, 98–105.
75. Tan, M.; Li, X.; Xie, H.; Lu, C. Urban land expansion and arable land loss in China—A case study of Beijing–Tianjin–Hebei region. *Land Use Policy* **2005**, *22*, 187–196. [CrossRef]
76. Ma, Y.; Xu, R. Remote sensing monitoring and driving force analysis of urban expansion in Guangzhou City, China. *Habitat Int.* **2010**, *34*, 228–235. [CrossRef]
77. Liu, Y.; Yue, W.; Fan, P.; Peng, Y.; Zhang, Z. Financing China's Suburbanization: Capital Accumulation through Suburban Land Development in Hangzhou. *Int. J. Urban Reg. Res.* **2016**, *40*, 1112–1133. [CrossRef]
78. Li, H.; Zhou, L.-A. Political turnover and economic performance: The incentive role of personnel control in China. *J. Public Econ.* **2005**, *89*, 1743–1762. [CrossRef]
79. Wu, F.; Yeh, A.G.-O. Changing Spatial Distribution and Determinants of Land Development in Chinese Cities in the Transition from a Centrally Planned Economy to a Socialist Market Economy: A Case Study of Guangzhou. *Urban Stud.* **1997**, *34*, 1851–1879. [CrossRef]
80. Pendall, R. Do Land-Use Controls Cause Sprawl? *Environ. Plan. B Plan. Des.* **1999**, *26*, 555–571. [CrossRef]
81. Li, G.; Sun, S.; Fang, C. The varying driving forces of urban expansion in China: Insights from a spatial-temporal analysis. *Landsc. Urban Plan.* **2018**, *174*, 63–77. [CrossRef]
82. Braimoh, A.K.; Onishi, T. Spatial determinants of urban land use change in Lagos, Nigeria. *Land Use Policy* **2007**, *24*, 502–515. [CrossRef]
83. Luo, J.; Wei, Y.H.D. Modeling spatial variations of urban growth patterns in Chinese cities: The case of Nanjing. *Landsc. Urban Plan.* **2009**, *91*, 51–64. [CrossRef]