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Discussion on the Index System of Intensive Land Use Evaluation in Development Area

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Abstract The establishment of evaluation index system is the key to the evaluation of intensive land use. On the basis of expounding connotation, characteristics and the principle of establishing evaluation index system, and as for the problems existing in *Evaluation Regulation (Trial) of Intensive Land Use in Development Area*, regarding the evaluation index system of intensive land use in the development area, in the light of the connotation of intensive land use in development area, coupled with the practical situation of the land use in China's development area, after referring to the research achievements of domestic and abroad scholars, some suggestions are put forward in order to improve and perfect the evaluation index system of intensive land use in development area.

Key words Intensive land use, Evaluation, Index system, Development area, China

Along with the rapid development of population, industrialization and urbanization, China's contradiction of land demand and supply becomes increasingly acute, while the developmental region is regarded as the key region of urban development and land use, and its performance of land use plays a significant role in promoting the rapid development of economy^[1]. So the central government brings forward that we should research the establishment of assessment indices system of land use status, land use benefit and land management performance, and promote the intensive land use assessment of developmental regions. Based on summarizing the results and experience of intensive land use assessment demonstration point of developmental regions, the ministry of land resources formulated and released *Statute of Intensive Land Use Assessment (Trial)* in July, 2008, and put forward the assessment indices system of intensive land use of national and provincial developmental regions; after the nationwide assessment practice, it released the amended *Statute of Intensive Land Use Assessment (Trial)* in March, 2009^[2].

In the recent years, the domestic scholars designed several assessment indices system from different perspectives, and applied them to assessment practice^[3-13]. According to the current assessment results of intensive land use of developmental regions, the practice of work and the practical situation of land use of China's developmental regions, we put forward suggestions of improvement and perfection, so as to provide theoretical basis of land management of developmental regions for decision-makers.

1 The analysis of assessment indices system establishment basis

1.1 The connotation of intensive land use of developmental regions

The concept of "intensive land use of devel-

opmental regions", in nature, is the extension and development of intensive urban land concept. Different scholars put forward different viewpoints on the basis of different research perspectives. It is generally acknowledged that intensive land use of developmental regions is the medium – level intensive use^[11], and its connotation includes five interrelated aspects: intensification of land resources use type, optimization of internal-regional and interregional land use structure, realization of optimum comprehensive benefit, optimization and allocation of land resources, and dynamic process^[6]. We hold that the intensive land use of developmental regions should include rationalization of land use structure of developmental regions, optimization of land use layout, increase of land use input, increase of land use output, and elevation of land use degree; its goal is not only to pursue the optimization of economic benefit, but also to conduct optimization and allocation of land resources on the basis of reasonable spatial layout of land use, so as to realize the maximization of comprehensive benefit of land use; it is a dynamic, regional, comparable, sustainable, and all-around concept. The developmental stage the developmental regions stay at is the important influencing factors of intensive land use of developmental regions, and there are different intensive levels of land use at different developmental stages; while at the same economic developmental level, the land use structure of developmental regions, land developing rate, the investment degree of per land, the developmental degree of land market of developmental regions and the marketization rate of selling industrial land are the important driving factors influencing intensive land use degree of developmental regions^[14].

1.2 The characteristics of land use in developmental regions

1.2.1

The expansion speed of construction use land is rapid. The developmental regions are generally located in the periphery of city or interdependent industrial mining regions, and the overlapping regions of urban use land and rural use land. A

great deal of agricultural use land and non-use land can be transformed into construction use land in a short time, far more rapid than the expansion speed of general urban use land.

1.2.2 The proportion of industrial use land is high. Most of China's developmental regions, for the time being, take industry as main industrial pattern, and most of the construction use land in developmental regions is industrial use land or the related industrial land which provides matching industrial service.

1.2.3 The proportion of compensable use is high. After the 1990s, the emergence of China's developmental regions is in the period of land use system reform of China, and a great deal of construction use land is supplied in the form of compensable use, selling land, for instance.

1.2.4 The phenomenon of illicit land use is outstanding. As there were two "developmental regions rush" successively in China, in order to develop economy, every region developed the developmental regions blindly which made the land management out of control, so there were phenomena of illicit land use, such as preoccupying land without ratification, idling of land, illicit land transfer and changing land use functions without sanction.

1.3 The principles of constructing assessment indices system of intensive land use of developmental regions

According to the connotation of intensive land use of developmental regions, in conjunction with features and developmental tendency of land use of developmental regions, the principles of constructing assessment indices system of intensive land use of developmental regions are as follows.

1.3.1 Reflect the status quo and developmental tendency of land use in developmental regions comprehensively. The indices should be objective, true, and clear so as to reflect the structure, layout, input and output of land use in developmental regions, and should be able to reflect the quantity and speed of proportion changes of various kinds of land in developmental regions.

1.3.2 Reflect the level of land input and output comprehensively. The input includes land input, capital input, fixed assets input, human resources input, intellectual property input and so on; output should include the aggregate benefit of economy, society, and ecology.

1.3.3 Reflect the function and impact of driving factors of intensive land use comprehensively. The indices should be able to reflect the functioning pattern and path of principal factors impacting intensive land use in the process of intensive land use.

1.3.4 Reflect the governmental policy orientation of land use comprehensively. By using normalized and scientific indices system comparison, we should establish the mechanism of incentive and restriction, guide and promote the fundamental change of economic growth pattern of developmental regions, promote the industrial upgrade, and promote the sustainable development of society, economy, and environment of developmental regions.

1.3.5 Reflect the features of different types of developmental regions comprehensively. For the time being, China's developmental regions include the developmental regions of economy

and technology, industrial developmental regions of high technology, tariff-free regions, export processing regions, boundary economic cooperation regions and so on. The indices should be able to reflect the different levels and socio-economic features of land use in different types of developmental regions.

1.3.6 Reflect the relationship between developmental regions, mother towns and regions comprehensively. We should design the indices which can reflect the relations of economic association, developmental drive and industrial cluster among developmental regions, mother towns and the regions, and analyze the land use difference at high level so as to provide evidence for analyzing the role of propelling regional economic development of developmental regions.

2 The overview of current indices system

2.1 The indices system in *Statute of Intensive Land Use Assessment (Trial)* According to the principles, such as dominance, policy orientation and comprehensiveness, the *Statute of Intensive Land Use Assessment (Trial)* chooses three indices of land use status, land use benefit and management performance, establishes three-level assessment indices system including target, sub-target and index, which can be seen in Table 1.

This indices system is easy to understand with clear structure and easy operation, which provides a unified work platform for assessing intensive land use of the developmental regions at all levels across China. But at the same time, the indices system has some problems which cannot be ignored. They are as follows.

2.1.1 The range of applicable assessment objects is too narrow. In the selected indices from the indices system, the selected indices regarding land use structure status, land use degree, input-output benefit of industrial use land are for industrial use land. This indices system is closed indices system, leaving no space for introduction of surrogate indices, which makes this indices system become incapable under the circumstance that new-type developmental regions emerge which take the emergent industries as dominant industries, such as finance, commerce and trade, logistics, education, animated cartoon making, cultural idea, and technological service in the recent years.

2.1.2 The system cannot reflect the dynamic change of intensive land use of developmental regions. Intensive land use is a dynamic process concept. The indices designed in the system are all stationary indices, which can only reflect the stationary level of intensive land use at certain time but cannot reflect the dynamic change characteristics of intensive land use level of developmental regions.

2.1.3 It lacks the comparability. One of the important aims of conducting intensive land use assessment of developmental regions is to weigh comprehensively and compare the level and potential of intensive land use of developmental regions in every place, so as to provide evidence for relevant decision-making of policies. But due to the demerit of determining ideal value in this indices system, it makes the assessment results difficult ei-

ther to realize the horizontal comparison among developmental regions in nation and province, or to realize the comparison

among different types of developmental regions.

Table 1 Evaluation index system of the trying-out criterion

		Index		
Target	Sub-target	High technological industrial development area, provincial high technological industrial park	Economic technological development area, tariff-free zone, export processing area, territorial economic cooperation area, other national development areas, provincial economic development area, and provincial characteristic industrial park	
The status of land use	Land use degree	Land supply rate	Land supply rate	
	The status of land use structure	Land construction rate	Land construction rate	
		Industrial use land rate	Industrial use land rate	
	Land use degree	High technological industrial land use rate	–	
Benefit of land use	Input-output benefit of industrial use land	Comprehensive volume rate	Comprehensive volume rate	
		Construction density	Construction density	
		Comprehensive volume rate of industrial use land	Comprehensive volume rate of industrial use land	
	The performance of management	The disposal rate of expired program use land	The construction coefficient of industrial use land	The construction coefficient of industrial use land
			The fixed assets input degree of industrial use land	The fixed assets input degree of industrial use land
		The output degree of industrial use land	The output degree of industrial use land	
The marketization degree of land supply	The disposal rate of idle land	The output degree of high technological industrial use land	–	
		The disposal rate of expired program use land	The disposal rate of expired program use land	
	The realization rate of compensable use of land	The realization rate of compensable use of land		
		The realization rate of bidding, auctioning and nominal quotation of land	The realization rate of bidding, auctioning and nominal quotation of land	

Note: Data are from reference literature [2].

2.1.4 It has not yet reflected the influencing factors of intensification comprehensively. The level of land price, growth speed of GDP, and the level of regional economy are the important influencing factors of intensive land use of developmental regions. This indices system has not yet reflected the influencing degree and functioning pattern of relevant influencing factors on intensive level of land use in developmental regions.

2.1.5 It cannot reflect the indices of use effect comprehensively. The system cannot reflect the indices of use effect comprehensively. The final goal of intensive land use of developmental regions is to reach the optimization of overall benefit of society, economy and ecology, but the indices system lacks corresponding indices of society and ecological environment.

2.1.6 Some selected indices are irrational. Some indices are selected irrationally. Using fixed assets input cannot reflect the input level of industrial use land comprehensively. For the time being, the proportion of fixed assets input decreases gradually in the total program input of many enterprises, while the input proportion of invisible assets, such as intellectual property and human resources increases prominently, especially in the industries which adopt high technology fully. Using the total output value of industry per unit area to reflect the output degree of

industrial use land cannot reflect the practical output level of land, and cannot make the assessment results be vivid in the emergent industries with high added-value, such as information industry, electronic industry, and biological technological industry.

2.2 The indices system put forward by domestic researchers Jiangsu Province begins the assessment of intensive construction use land use of developmental regions early in China; in 2006, the ministry of land resources chose 10 national-level developmental regions, such as Tianjin Economic and Technological Developmental Region as the sub-program of big survey of land resources in the year (the project of monitoring and investigation of land resources), and conducted assessment work of intensive land use potential of developmental regions; in 2008, the ministry of land resources deployed the assessment work of intensive land use of national-level and provincial-level developmental regions. The domestic researchers have done many researches on intensive land use of developmental regions according to the practical need of work, and have designed assessment indices system from different research perspectives and levels. We arrange the typical ones in Table 2.

Table 2 Evaluation index system propounded by some domestic researchers

The year of propounding	Researcher	Starting point of index design	Main index	The quantity of evaluation factors	Characteristics of index system
2004	Wang Mei and Qu Futian	Based on land intensive high efficiency, and the restriction conditions, degree, efficiency, and use tendency of sustainable use,	Investing degree, use degree and output efficiency	6	Pay attention to economic benefit index, and have good discrimination degree on different industrial types
	Pan Xihui Lei Yalin	Pay attention to the relationship between input and output	The basic situation of land use, the efficiency of land input and output, and land use structure effect	28	There are comprehensive input and output indices
2006	Zhai Wenxia, Huang Xianjin, Zhangqiang	Consider the land input-output comprehensively	Land input, land output and land use structure and sustainable use degree	23	The input includes capital and human resources; the output includes economic, social and ecological benefit
	Zhai Wenxia, Huang Xianjin	Taking input-output of land as core	Land use structure, land input, land output and land prices	14	Pay attention to land price level, and comparative profit
	Wu Yuling, Qu Futian	In the perspective of input-output, the problems of intensive use of land in development areas, land use structure and land development progress	Land use status, land use structure, land development progress, land input-output level	15	Take land output into full consideration
	Yu Jinyu, Shen Shiqin, Wang Shujuan	Based on the land use level of development areas	The area of land in development areas, the proportion of multi-storied factory, density of industrial facility, the land revenue, comparative benefit with the city, and rate of operation of program	14	Pay attention to land price level, and comparative profit
2007	Niu Xing, Ou Minghao	Consider input-output comprehensively	Land input degree, land economic output, land use degree, urban environmental quality	6	Pay attention to environmental variation
2008	Chenyi, Huang Xianjin, Chen Zhigang and so on	The relationship between urban planning and intensive level	Land input-output status, land carrying status, land use ecological effect	11	Pay attention to ecological impact
	Li Shuangsheng, Shao Yongdong, Zhang Xiaodong and so on	The correlation with intensive level	Land development progress, land use status, land supply structure and level, land input-output level, industrial use land benefit, and the land price in development area	19	Pay attention to industrial use land benefit index and land price
	Wangkun, Chen Yinrong	Based on the characteristics of land use	Land use structure, land use layout, land use input, land use output and land use degree	16	Pay attention to the impact of land use layout on intensive land use
2010	Lilan, Zhu Hongmei, Zhou Mi and so on	Sustainable development	Land input level, land use degree, land use efficiency, ecological benefit of land	16	Pay attention to ecological environmental impact

Note: Data are from reference literature [3 – 13].

3 Suggestions of perfecting indices system

The assessment indices system of intensive land use of developmental regions should be designed rationally with clear caliber. In addition, it should be able to reflect the characteristics of

different developmental regions and to be applied to the developmental regions assessment of all kinds and all levels. Based on the preceding research accomplishments, and considering deliberately the scientificity, wholeness, hierarchy, regionality, dynamicity, forward-looking and operability, we put forward our own

assessment indices system, which can be seen in Table 3.

Table 3 Suggested index system

Target	Sub-target	Index	Direction	
Land use status	Land use degree	Land use rate		
		Land development rate		
		Land supply rate		
		Land idling rate		
		Land construction rate		
		Construction density		
		Comprehensive volume rate		
		The construction coefficient of industrial use land	Choose according to the types of the industries in development areas	
		Comprehensive volume rate of industrial use land	Choose according to the types of the industries in development areas	
		The ratio of multi-storied factories	The ratio of multi-storied standard factories and industrial use land	
		Population density	The ratio of the total population of development areas and the total land area of development areas	
		The per capita construction use land area		
		The per capita road area		
		Land price index	The ratio of average land price of land use in development areas and the average land price in the city	
		Land use structure	Land scale coefficient	The total area of land in development area
	Industrial use land rate			
	The dominant industrial use land rate		The ratio of the total area of dominant industrial use land in development areas and the total area of development areas	
	The ecological use land			
	The land use rate of infrastructure		The ratio of total area of facilities use land, such as transportation, water disposal, energy, and total area of construction use land	
	High technological industrial use land rate			
	Residential use land rate		The ratio of the total area of residential use land and total area of construction use land	
	Collective construction use land rate		The proportion of area of rural construction use land in total area of construction use land	
	Land input degree		Unit area fixed assets investment	
			Unit area infrastructure investment	
		Unit area the total assets of enterprise	Belonging to the secondary and tertiary industrial use land	
		Unit area input of research and development	Belonging to the secondary and tertiary industrial use land	
		Unit area employees	Belonging to the secondary and tertiary industrial use land	
		Unit area personnel of research and development	Belonging to the secondary and tertiary industrial use land	
		The adequacy degree of infrastructure	The matching degree of facilities of water, electricity, heat, gas and road	
	Land use effect	Economic benefit	GDP per unit area	
			GDP adequacy	
			Unit area the added value of the secondary and tertiary industry	
Unit area the added value of the secondary and tertiary industry of high technological industrial use land				
The comparative benefit of land			Unit area GDP ratio of development areas and the city	
Social benefit		The revenue per unit area of industrial use land		
		Unit the absorbed labor forces by construction use land		
		Unit area the quantity of enterprises	The quantity of enterprises within the area of industrial use land	
Environmental benefit		The green land rate		

Continued (Table 3)

Target	Sub-target	Index	Direction
Land use trend	Increase quality	Per capita green land area	
		The rate of industrial wastewater discharge up to standard	
		The days of air quality up to standard	
		Unit area energy consumption	
		The increase elasticity index of population and construction use land	
	Sustainability	The ratio of population increase rate and construction use land increase rate	
		The increase elasticity index of construction use land and GDP	The ratio of increase rate of GDP and construction use land
		The increase elasticity coefficient of fixed assets investment and construction use land	The ratio of increase rate of fixed assets investment and construction use land
		The expansion coefficient of construction use land	The proportion of increased quantity of construction use land area annually in the total area of development areas
		The increase coefficient of land prices	The annual increase rate of average land price of industrial use land
Land use management	Land use supervision	The continuous supply ability of land	The ratio of supply land and annual supply land
		Disposal rate of expired program use land	
		Disposal rate of idle land	
		Illegal use land rate	The ratio of area of non-ratified preoccupied land, illegally ratified land and the increased construction use land in the year
	The marketization degree of land supply	Disposal rate of Illegal use land	
		The rationality index of land use layout	The proportion of land area of constructed land conforming to planning in total land area of development areas
		The compensable land use rate	
		The rate of bidding, auctioning and nominal quotation of land	

In the specific practice, we can select assessment indices according to the types of developmental regions and practical need; the weight values of all indices can adopt Delphi method and the method of analytic hierarchy process and so on.

In comparison with the assessment indices system in *Statute of Intensive Land Use Assessment (Trial)*, in this indices system, the target, sub-target and index increase from 3, 6 and 15 to 4, 10 and 54 respectively. It mainly increases the indices regarding input, output and developmental tendency, for example, the input indices takes economic input and intellectual input into fully consideration. The output increases the indices of socialist benefit and ecological benefit. The developmental tendency takes the growth quality of land use and sustainability into consideration, and adjusts the irrational indices in *Statute of Intensive Land Use Assessment (Trial)*. On the whole, using this indices system can increase the amount of survey and calculation of assessment work, but the relevant basic data can be acquired by statistical data and technological means, and it forms no obstacle to assessment operation; but the assessment results obtained from the assessment indices system have more practical value, which can be shown in the following aspects: it can reflect the status quo and change tendency of land use in developmental regions more specifically; it can meet the assessment need of different types of developmental regions; it can reflect the level of intensive land use of developmental regions more comprehensively; it can conduct horizontal

and vertical comparison of intensive land use conveniently.

4 Conclusion

The assessment of intensive land use of developmental regions is an important part of researches of intensive land use of construction use land, which has theoretical and practical significance to elevating the level of China's urban intensive land use, protecting land, and realizing the radical change of economic growth model and land use pattern. The construction of assessment indices system is the key to assessment work of intensive land use of developmental regions. This research tries to reflect the practical level of intensive land use of developmental regions more scientifically, comprehensively and conveniently on the basis of referring to the relevant research accomplishments currently at home, in conjunction of our practical experience, so as to provide reference for promoting intensive land use of developmental regions of management departments better. Due to our limited level and ability, part of the selected indices may be irrational, and the indices amount in sub-target is out of balance to some extent, yet to be further discussed and perfected.

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distribution^[7]. In addition, the location of storehouse, the location of supermarket and the decisions on transportation should be considered carefully.

4.5 The long tail of personnel The development of supermarket, the construction of distribution center and the information-based management of rural supermarkets all need the talents who master management, computer and promotion techniques. But in rural areas, there are no such talents. The long tail of personnel in rural supermarket chain refers to the cultivation of talents should combine the assignment of enterprise with local recruitment. Some large scale distribution firms, with brand advantage, are easy to recruit talents. Some firms can recruit talents and distribute them in the firms, and then assign some talented and hard-working people to the stores in the counties and rich villages as shopkeepers. The shopkeepers instruct the chain shops around the areas regularly. Besides, the primary-level workers, for example, tally check, cashiers, etc. who do not need the technical contents, can go to work directly after simple training. The firms should make full use of the labor resources in rural areas to recruit and cultivate the workers at local place. In the future, the firms can improve the workers' working skills through training at irregular intervals^[8].

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