

ORIGINAL RESEARCH ARTICLE

Performance evaluation of urban two oriented society development in Hunan Province from the perspective of low carbon

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ABSTRACT

According to the requirements of “two oriented” social development, this paper makes an empirical study on the construction performance of 13 prefecture level cities in Hunan Province from a low-carbon perspective by comparing the evaluation index systems of ecological city and low-carbon city. This paper compares and analyzes the changes of 13 prefecture level cities in four aspects: economic development, social development, resource conservation and environmental protection. Before and after Hunan Province became the experimental area of “two oriented” social reform, the results show that in terms of urban economy, 13 cities show a development model of high in the East and low in the west, especially the economic development of Changsha-Zhuzhou-Xiangtan urban agglomeration is significantly faster than that of other prefecture level cities. In terms of urban society, compared with other aspects, the change gap is the smallest, among which Changsha is the fastest and Zhangjiajie is the slowest. In terms of urban resources, the overall level changes greatly compared with other parts. Among them, Changsha, Shaoyang and other cities consume less resources, while Loudi, Yueyang and other cities in the old industrial base consume more resources. In terms of urban environment, most urban environments have improved. In general, the construction of “two oriented cities” in 13 prefecture level cities in Hunan Province has improved in terms of economy, society, resources and environment, but there is still great room for improvement, especially in infrastructure construction, scientific and technological level, utilization rate of “three wastes” and urban environmental governance capacity.

Keywords: Hunan Province; two oriented cities; index system

1. Introduction

As a dense area of population and buildings, a gathering area with developed industry, transportation and commercial logistics, and a

concentration area with high energy consumption and high emission, cities in the world consume 75% of the world’s energy and emit 80% of the world’s greenhouse gases^[1,2]. At home, China’s CO₂ emissions are mostly concentrated in the developed

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eastern coastal provinces dominated by large cities, among which the urban agglomeration areas such as the Bohai economic circle, the Yangtze River Delta and the Pearl River Delta are all high emission areas^[3]. At present, China's CO₂ emissions and urbanization level have been growing synchronously and steadily, and there is still a trend of acceleration, which makes China's inland cities also face great pressure on climate change and resources and environment. China's urban development must take the road of urban construction with Chinese characteristics under the background of global climate change. Since the Chinese government officially proposed the construction of "two oriented society" in 2007, China's cities have made great achievements in resource conservation, environment-friendly and social harmony. Therefore, the construction of "two oriented cities" came into being. The proposal of "two oriented cities" is a new concept of urban development in response to the prominent resource and environmental problems faced by China's urban development at the present stage. At present, there is little research on "two oriented cities". Most scholars study the development of cities from the aspects of "two oriented society", "two oriented industries", "low-carbon city", "ecological city" and "green city"^[4-9]. Until 2006, Wang deduced the concept of "two oriented cities" from the concept of resource-saving and environment-friendly society, that is, building a resource-saving and environment-friendly city^[10]. Zang and Zhu put forward the framework research of "two oriented cities", established the research framework of "two oriented cities" including connotation, objectives, testing tools, fields and policy system, and conducted a preliminary research on "two oriented cities"^[11]. However, the discussion of "two oriented cities" in these studies is mainly at the theoretical level, lack of specific and feasible monitoring and evaluation system and its empirical analysis, and the empirical analysis of "two oriented cities" is still blank.

Therefore, based on the construction of the index system of "two oriented cities", this paper

makes an empirical study on the development degree of "two oriented cities" in Hunan Province, the pilot area of "two oriented society". Hunan Province is located in the middle of China and the middle reaches of the Yangtze River. As the inland core economic hinterland of the national strategic concept, Hunan Province is the transitional belt between the eastern coastal area and the central and western regions, the junction of the Yangtze River open economic belt and the coastal open economic belt. It plays a role of connecting the east and the west, connecting the south and the north, and connecting and integrating the whole province into the Yangtze River economic belt and the coastal open economic belt. The important strategic position makes the realization of two oriented green development in cities in Hunan Province have important demonstration and driving significance. The province governs 13 cities and one autonomous prefecture, namely Changsha, Xiangtan, Zhangjiajie, Hengyang, Jishou, Yueyang, Yiyang, Changde, Yongzhou, Zhuzhou, Loudi, Huaihua, Shaoyang and Xiangxi Tujia and Miao Autonomous Prefecture. In 2015, the urban population of Hunan Province was 35.986 million, accounting for 52.75% of the total population of the province. The per capita consumption of urban residents was RMB 21,420, 1.36 times that of residents in the province. In 2007, Changsha, Zhuzhou, Xiangtan, urban agglomeration in Hunan Province became the first batch of comprehensive supporting reform pilot areas for the construction of resource-saving and environment-friendly society in China. In the subsequent process of urban development, the development of the city is mainly considered from the aspects of resource conservation and environment-friendly with the gradual improvement of the construction of "two oriented society", Hunan Province has developed the "two oriented society" into the construction of "two oriented city". In 2012, the "two oriented city" was put on the important agenda and the trial standard for the construction of "two oriented city" was issued^[12]. In this context, on the basis of considering the trial standards, this paper makes an empirical study on 13 prefecture level cities in Hunan Province, that is, a

comparative study on the development degree of “two oriented cities” before the establishment and after the implementation of the “two oriented society” pilot zone in Hunan Province, in order to better monitor the achievements of the construction of “two oriented cities” in Hunan Province and provide decision-making reference for the construction of “two oriented cities” in various regions in China.

2. Connotation of “two oriented cities” and construction of evaluation index system

2.1. Connotation of “two oriented cities”

“Two oriented” in “two oriented cities” refers to resource conservation and environmental friendliness, while “two oriented cities” has a broader and deeper connotation, including not only the emission reduction emphasized by “low-carbon cities”, but also the ecological environment emphasized by “ecological cities”, with particular emphasis on the position of people and society in urban development and the harmonious interaction between people, society and environment. The specific definition should refer to “people-oriented low-carbon and sustainable development with equal emphasis on economy, so that all departments of the whole urban system can interact and develop harmoniously. Its essence is that the city greatly improves the ecological efficiency while developing the economy”. The specific content should include the following two main aspects: On the one hand, it emphasizes that urban residents adopt production mode, lifestyle and consumption mode conducive to resource conservation, so as to maximize the utilization rate of urban resources and maximize economic and social benefits with the least resources. Lifestyle and consumption mode conducive to environmental protection, so as to make people interact with the environment benign. Therefore, the index system of “two oriented cities” should truly reflect the relationship between urban development and resources and environment, and can effectively monitor the future trend of urban development. Among them, resource-saving means

that the urban economic and social system is based on resource conservation to achieve the goal of minimizing input resources. Environment friendly refers to the minimum pollutant emission of urban economic and social system, so as to achieve the goal of minimizing the impact of urban economic and social system on the environment^[11].

2.2. Determination of evaluation indicators of “two oriented cities”

The evaluation criteria and index system for the construction of “two oriented cities” should be dynamically adjusted with the phased changes of urban sustainable development target model, so that the whole construction process presents a gradual dynamic process. Therefore, it is necessary to build an evaluation system of “two oriented cities” with reasonable design and strong operability, so that the “two oriented society” can be measured and monitored in the process of urban construction, so that the government can clarify the development objectives of “two oriented cities” and master the development process of cities in “two oriented society”, so as to correct the direction of urban development. For the measurement of “two oriented cities”, no single index can comprehensively measure its development degree, which not only reflects the two aspects of resource conservation and environmental friendliness, but also involves economic development, social development, scientific and technological level and so on. Therefore, the evaluation of “two oriented cities” in Hunan Province is mainly through the comparative analysis of measurable, quantifiable and implementable specific indicators, focusing on the index system of “two oriented society”, “low-carbon city” and “ecological city”^[13-15], increasing and decreasing the index system, and establishing a set of comprehensive index system from all aspects and angles to reflect the construction level of “two oriented cities” in Hunan Province.

Table 1 lists the evaluation index system of different institutions and scholars at home and abroad for different urban development goals.

Among them, the World Health Organization’s index on “healthy city” focuses more on social development, especially urban medical treatment and education. However, since the United Nations is based on the global perspective, these indicator systems tend to be more theoretical, while the actual situation of different countries is different and their applicability is weak. The indicators of the economist and the world bank have similar shortcomings and lack of applicability to the sustainable development indicators of the United Nations. In addition, the emphasis of the index system constructed by each institution is also different. The “green city” index issued by the economist emphasizes environmental protection and resource conservation in urban development, but pays less attention to economic and social aspects, while the world bank emphasizes human development. The indicators issued by various domestic ministries and commissions are more targeted. For example, the ecological indicators issued by the Ministry of environmental protection emphasize the environment, while the “circular economy” indicators issued by ministries and commissions such as the national development and

Reform Commission pay more attention to industrial development and emphasize economic indicators. The index system selected by scholars also focuses on the research objects and objects considering that the qualitative indicators are not easy to evaluate and cannot be calculated, all indicators adopt quantitative indicators. When comparing and analyzing different index systems such as “two oriented society”, “low-carbon city” and “ecological city”, based on the evaluation index system of different urban development goals proposed by domestic and foreign institutions and different scholars and the construction standards of “two oriented cities” issued by Hunan Province. The evaluation indexes of “two oriented cities” are preliminarily selected, and then combined with the urban development characteristics of Hunan Province, the evaluation index system of “two oriented cities” is constructed. In this study, the evaluation system of “two oriented cities” adopts the method of setting target value and giving weight to each index target, so as to comprehensively evaluate the development degree of “two oriented cities” of cities in different years. Due to the wide classification and variety of target values, and their meaning involves positive,

Table 1. References standards for selection of evaluation indicators of “two oriented cities”

Reference’s standard	Name of index evaluation system	Formulation organization
Institutional reference index	WHO 1999 healthy city index	World Health Organization
	United Nations Sustainable Development Indicators (2007)	The United Nations
	Green city index	Economist
	Social development indicators	World Bank
	Construction indicators of ecological counties, cities and provinces	Ministry of environmental protection
	Scientific evaluation standard of livable city	Ministry of housing and urban construction
	Evaluation index of circular economy	National Development and Reform Commission, Ministry of environmental protection, National Bureau of Statistics
	Construction standards for “two oriented” cities (Trial)	Hunan Provincial Two Oriented Office
	construction standards for “two oriented” buildings (Trial)	Hunan Provincial Two Oriented Office
	Scholar reference standard	Research on the framework of “two oriented cities”
Study on the construction of ecological city evaluation index system in China		Li Hailong, Yu Li
Construction of “two oriented society” monitoring and evaluation system in Shandong Province		Xue long
Construction of low carbon city evaluation index system		Wang Yingzheng, Wang Yuying, et al.

Table 2. Evaluation index system of “two oriented cities”

Primary index	Secondary index	Tertiary indicators	
Urban economy	Economic aggregate	GDP/100 million yuan	
		Gross industrial value/10,000 yuan	
	Economic structure	Per capita gross industrial value/10,000 yuan/person	
		Per capita GDP/yuan	
Urbanization process	Urbanization process	Proportion of secondary industry in GDP/%	
		Proportion of tertiary industry in GDP/%	
	Urbanization process	Urbanization level/%	
Urban society	Scientific and technological level	Number of high-tech enterprises	
		Number of patent applications/piece	
		Proportion of science expenditure in general financial expenditure/%	
	Cultural level	Proportion of education expenditure in general financial expenditure/%	
		Public library collection per 100 people	
Infrastructure	Infrastructure	Urban Road area per capita/m ²	
		Number of buses per 10,000 people/vehicle	
		Number of beds in hospitals and health centers/piece	
Urban resources	Resource consumption	Power consumption of the whole society/10,000 kw·h	
		Industrial water intake above Designated Size/10,000 m ³	
		Energy consumption above Designated Size/10,000 t standard coal	
		Energy consumption per capital/(standard coal/person)	
Land use	Land use	Proportion of urban construction land in urban area/%	
		Waste utilization	Output value of comprehensive utilization of three wastes/10,000 yuan
			Waste disposal rate
Urban environmental governance	Urban environmental governance	Urban domestic sewage treatment rate/%	
		Harmless treatment rate of domestic waste/%	
		Industrial wastewater discharge/10,000 t	
The greening of the city	The greening of the city	Industrial wastewater discharge reaches scalar/10,000 t	
		Industrial sulfur dioxide removal/t	
		Industrial dust removal amount/t	
		Green area/hm ²	
The greening of the city	The greening of the city	Per capita green area/(m ² /person)	
		Greening coverage rate of built-up area/%	

negative and interval range, the index values are divided into three categories according to the internal meaning of each index, namely positive index, interval index and negative index, and their target values are determined. The whole evaluation index system of “two oriented cities” is divided into three levels: The first level includes four parent categories of economy, society, resources and environment involved in the construction of “two oriented cities”. The second level consists of 12 sub categories: Economic aggregate, economic structure, urbanization process, scientific and technological level, cultural level, infrastructure, resource utilization, land utilization, waste utilization, waste

treatment rate, urban environmental treatment and urban greening. The third level includes 31 indicators, among which the indicators of resource consumption are negative indicators. Through expert scoring and comparison of relevant evaluation standards, the expected values of 32 indicators in the evaluation index system of “two oriented cities” are determined. The results are shown in **Table 2**.

The construction of “two oriented cities” evaluation index system is the first step of empirical analysis. Secondly, it is necessary to set the expected value for each index and determine the weight of the evaluation index to make the evaluation index

dimensionless. Finally, AHP (analytic hierarchy process) method is used to calculate the comprehensive evaluation results.

2.3. Data sources

The data of each index in this study comes from the statistical yearbook of Hunan Province in 2008 and 2015, as well as the statistical yearbooks of Changsha, Xiangtan, Zhuzhou, Zhangjiajie, Hengyang, Yueyang, Yiyang, Changde, Yongzhou, Loudi, Huaihua, Shaoyang and Chenzhou in 2008 and 2015 or the Statistical Bulletins of 2007 and 2014.

3. Empirical analysis on the realization degree of “two oriented cities” in Hunan Province

3.1. Determination of expected value of evaluation indicators of “two oriented cities” in Hunan Province

The common methods of evaluating index weight mainly include principal component analysis and AHP analytic hierarchy process. The principal component analysis method is based on personal experience and has strong subjectivity, which may lead to bias. In the analysis of this paper, AHP is selected to objectively assign the weight.

Dimensionless data processing

First of all, the original data of each index are different units and values before assignment, so it is necessary to unify the standards for each index, Dimensionless processing. In this paper, the deviation standardization method is used to deal with each index dimensionless.

(1) Dimensionless treatment model of positive index:

$$y_{i,j} = \frac{X_{i,j} - \min(x_j)}{\max(x_j) - \min(x_j)}$$

(2) Dimensionless treatment model of negative index:

$$y_{i,j} = \frac{\max(x_j) - X_{i,j}}{\max(x_j) - \min(x_j)}$$

Where, $y_{i,j}$ refer to the comparable values between (0,1) after dimensionless elimination; $\min(x_j)$ refers to the smallest actual value among 13 cities in the same level of indicators; $\max(x_j)$ refers to the actual value with the largest actual value among the 13 cities in the same level of indicators.

Weight determination

Driven by economic and social development, cities pay more attention to economic and social development and the satisfaction of human needs, while the “two oriented” emphasizes the protection of the environment, ecological balance and resource utilization in development therefore, the four aspects of economy, society, environment and resources should account for the same proportion in evaluating the development degree of “two oriented cities” and make the same contribution to “two oriented cities”. In this paper, the four primary indicators are assigned an average value, and the weight of each indicator is 0.25. The secondary and tertiary indicators score the relative importance of different levels and the relative importance of each indicator under the level through investigation and collecting expert opinions, so as to construct a judgment matrix with high reliability in turn. Finally, the weight is calculated according to the judgment matrix, and the results are shown in **Table 3**.

3.2. Evaluation index score of “two oriented cities” in Hunan Province

According to the index system of “two oriented cities”, the scoring results of 13 prefecture level cities in Hunan Province in four aspects of urban economy, urban society, urban resources and urban environment in 2006 and 2014 are shown in **Figure 1~Figure 3**. The score is directly proportional to the development process of economy, society, resources and environment.

Table 3. Index weight values of “two oriented cities” evaluation system in Hunan Province

Target	Primary indicator A	Weights	Secondary indicator B	Weights	Level III indicator C		Total weight
					Name	Weights	
“Two oriented” cities	Urban economy	0.25	Economic aggregate	0.80	GDP/100 million yuan	0.096	0.019
					Current price of industrial value above designated size/10,000 yuan	0.122	0.024
					Per capita gross industrial value/10,000 yuan	0.102	0.020
					Per capita GDP/yuan	0.251	0.050
					Proportion of secondary industry in GDP/%	0.115	0.023
					Proportion of tertiary industry in GDP/%	0.314	0.063
					Urbanization process	0.20	Urbanization level/%
	Urban society	0.25	Scientific and technological level	0.40	Number of high-tech enterprises	0.443	0.044
					Number of patent applications/piece	0.170	0.017
					Proportion of science expenditure in general financial expenditure/%	0.387	0.039
			Cultural level	0.30	Proportion of education expenditure in general financial expenditure/%	0.833	0.063
					Public library collection per 100 people	0.167	0.013
			Infrastructure	0.30	Urban road area per capita/m ²	0.539	0.040
					Number of buses per 10,000 people/vehicle	0.163	0.012
	Number of beds in hospitals and health centers/piece	0.297			0.022		
	Power consumption of the whole society/10,000 kw·h	0.157			0.023		
	Urban resources	0.25	Resource utilization	0.60	Industrial water intake above designated size/10,000 m ³	0.231	0.035
					Energy consumption above designated size/10,000 t standard coal	0.319	0.048
					Energy consumption per capita/(t standard coal/person)	0.293	0.044
			Land use	0.40	Proportion of urban construction land in urban area/%	1.000	0.100
	Urban environment	0.25	Waste disposal rate	0.20	Comprehensive utilization rate of industrial solid waste/%	0.500	0.025
					Urban domestic sewage treatment rate/%	0.250	0.013
					Harmless treatment rate of domestic waste/%	0.250	0.013
			Urban environmental governance	0.30	Industrial wastewater discharge/10,000 t	0.196	0.015
					Industrial sulfur dioxide removal/t	0.173	0.013
					Industrial sulfur dioxide emission/t	0.117	0.009
					Industrial dust removal amount/t	0.140	0.011
Industrial smoke emission/t					0.093	0.007	
Output value of comprehensive utilization of three wastes/10,000 yuan			0.280	0.021			
The greening of the city			0.50	Green area/hm ²	0.250	0.031	
	Per capita green area/m ²	0.250		0.031			
				Greening coverage rate of built-up area/%	0.500	0.063	

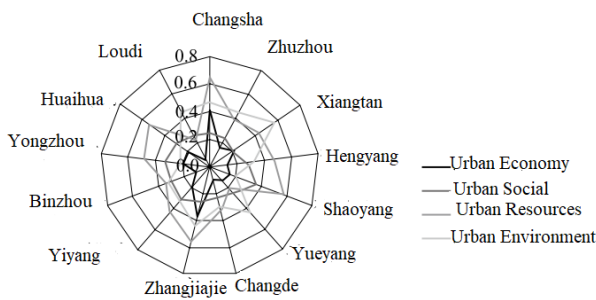


Figure 1. Grade I index score of “two oriented cities” monitoring and evaluation system in Hunan Province in 2006.

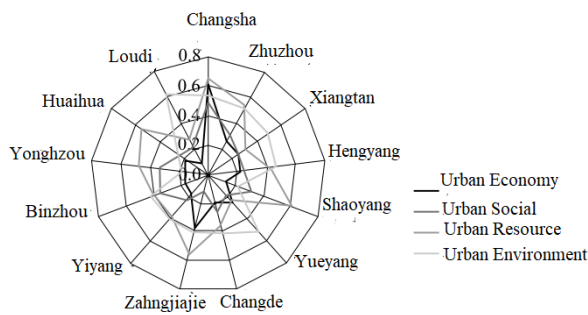


Figure 2. Grade I index score of monitoring and evaluation system of “two oriented cities” in Hunan Province in 2014.

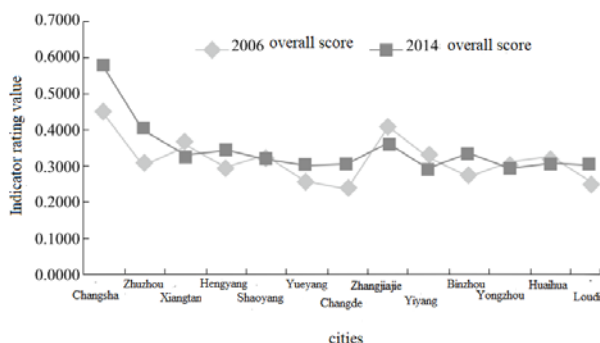


Figure 3. Comprehensive score of the overall objectives of the monitoring and evaluation system of “two oriented cities” in Hunan Province in 2006 and 2014.

Economic results of “two oriented cities”

The results of economic development of “two oriented cities” are mainly reflected in three aspects: a. three indicators under the secondary index of economic aggregate; b. Two indicators under the secondary indicators of industrial structure; c. One index under the secondary index of urbanization process. From the comprehensive economic score of “two oriented cities”, it can be seen that there is a large economic gap between cities at all levels and Changsha. Changsha is much higher than

Zhangjiajie, which ranks second. As the provincial capital city, Changsha has strong economic strength, so the score in the comprehensive economic score of “two oriented cities” is much higher than that of other prefecture level cities Zhangjiajie, a city located in the west of China, has a higher comprehensive score in the “two oriented” urban economy, mainly due to its higher index score in the proportion of the tertiary industry. Yongzhou has the lowest comprehensive score of “two oriented” economy, which is mainly due to its low scores of all three-level indicators, which are lower than the urban average level, resulting in poor overall strength. On the whole, the economic development degree of “two oriented cities” in Hunan Province is low in the northeast and West. In particular, the three cities of Changsha, Zhuzhou and Xiangtan have certain advantages over other cities due to the first experiment of the “two oriented” social reform experimental area, and the economic development of western cities needs to be further strengthened.

Social effects of “two oriented cities”

The effect of social progress of “two oriented cities” is mainly reflected in three aspects: 1) three indicators under the secondary index of scientific and technological level; 2) two indicators under the secondary indicators of cultural level; 3) three indicators under the secondary indicators of infrastructure.

From the comprehensive social score of “two oriented cities”, it can be seen that the social construction gap of “two oriented cities” in Hunan Province is relatively small compared with the other three parts. Among them, Changsha has the highest score, followed by Chenzhou. The overall level of the two cities is relatively balanced in terms of the secondary indicators of the scientific and technological level index, the cultural level index and the infrastructure index, making the two cities have a higher score in the primary indicators. Among other cities, Zhuzhou, Yongzhou and Shaoyang also have higher social progress indexes. The lowest is Zhangjiajie City, which is mainly affected by the low scores of the scientific and technological level index

and the cultural level index in the social classification index. Among them, the number of high-tech enterprises and patents under the scientific and technological level index, all the three-level indicators under the cultural level index and the number of beds in hospitals and health centers under the infrastructure index are the lowest in the province.

Resource effectiveness of “two oriented cities”

The resource conservation of “two oriented cities” is mainly reflected in the following aspects: 1) resource consumption, including four indicators; 2) land use, including 1 index; 3) waste utilization, including 1 index. Among them, four indicators in resource consumption are inverse indicators. According to the comprehensive resource score of “two oriented cities”, the overall level is higher than that of the other three parts. Among them, Changsha is the highest, followed by Shaoyang. Zhuzhou, Zhangjiajie and Huaihua are also cities with index scores above 0.5, which is related to the relatively low four indicators under the secondary index of resource consumption in these cities. The cities with the lowest scores are Loudi City and Yueyang City, both of which are heavy old industrial bases in Hunan Province, with large resource consumption. These cities need further improvement in the transformation of “two oriented cities”. They should pay more attention to the adjustment of industrial structure and energy structure and develop circular economy.

Environmental effects of “two oriented cities”

The environmental friendliness of “two oriented cities” is mainly reflected in the following aspects: waste treatment, including three indicators; urban environmental governance, including three indicators; urban greening includes three indicators. Among them, the discharge of industrial wastewater in urban environmental treatment is the inverse index. From the comprehensive environmental score of “two oriented cities”, most cities have a better degree of environmental development, and Loudi, Yueyang, Hengyang, Changde and Yiyang have a higher comprehensive environmental score, of which Loudi is the highest, which is related to the higher scores of

three-level indicators in waste treatment rate, urban environmental treatment and urban greening. Among the western cities, Shaoyang, Yongzhou and Huaihua have low comprehensive environmental scores, which is mainly due to their low scores in urban greening, urban environmental treatment and waste treatment rate, which lowers the overall score. As can be seen from **Figure 3**, Changsha ranked first in the comprehensive score of “two oriented cities” in 2014. As the capital of Hunan Province, Changsha is in the forefront in terms of economic development, social progress, resource conservation and utilization and environmental protection followed by zhuzhou’s comprehensive economic strength ranks second among prefecture level cities in Hunan Province, and as the national “pilot area for comprehensive supporting reform of two oriented society”, it has improved in terms of environment and resource conservation in recent years. Yongzhou City ranks last, which is mainly due to the low scores in the “two oriented” economy and “two oriented” environments, resulting in the low overall comprehensive score.

4. Conclusions and discussions

Facing the major issues of the rise of central China, undertaking the industrial transfer in the East and the construction of “two oriented society”, Hunan Province should speed up the transformation of cities into “two oriented cities” to achieve a win-win situation of economic development, energy conservation and emission reduction. At present, the “two oriented cities” in Hunan Province have achieved initial results in the construction of economy, society, resources and environment, but there is still huge room for improvement. In particular, it is necessary to strengthen infrastructure construction, improve the level of science and technology, enhance the utilization rate of “three wastes” and improve the ability of urban environmental governance.

(1) In general, the “two oriented cities” in 13 cities in Hunan Province have shown a good development trend in environmental construction. Individual western cities also need to pay attention

to the control of “three wastes” emission and further improve the per capita green space area.

(2) From the comprehensive score of the overall goal of economic development, social progress, resource conservation and environmental friendliness, Changsha has a higher score than other cities. It can be seen that Changsha has the highest degree of development of “two oriented cities”, followed by Zhuzhou. There is little difference in the overall target comprehensive score of other cities, but relatively speaking, the cities in the West and South still have great room for improvement in the economic and social progress of “two oriented cities”, which need to continue to work hard in these aspects, while the cities in the East and Dongting Lake economic zone should continue to pay more attention to resource conservation and environmental friendliness.

In addition, the index system of “two oriented cities” in this study refers to the index evaluation system constructed by different institutions and scholars for different urban development goals in terms of index selection, standardization and weight assignment, and the author avoids the influence of subjective value judgment and professional factors as much as possible, which is scientific. Therefore, this set of index system is scientific for different provinces on the basis of combining the regional characteristics of the province. The evaluation of the development of “two oriented cities” has certain reference and reference significance. In the future evaluation of urban “two oriented” development, we should further expand the connotation and extension of “two oriented” and clarify the objectives of urban “two oriented” development. Increase the uncertainty and sensitivity analysis of the comprehensive index, and discuss the construction framework, index selection, standardization, weight assignment and other options of the “two oriented cities” index system, so as to reduce the influence of human subjective factors as much as possible.

Conflict of interest

The author declares no conflict of interest.

References

1. Qiu B. Transformation trend of urban development model in China—Low carbon ecological city. *Urban Development Research* 2009; 16(8): 1–6.
2. Gu C, Tan Z, Liu W, et al. Research progress on climate change, carbon emission and low-carbon urban planning. *Journal of Urban Planning* 2009; (3): 38–45.
3. Wang Z, Zhu Y. Study on carbon emission status and emission reduction countermeasures of provinces and regions in China. *Journal of the Chinese Academy of Sciences* 2008; 23(2): 109–115.
4. Sun H. “Two-oriented society” construction and “two-oriented industry” development of China—In view of the empirical research of Changzhutan megalopolis. *China Industrial Economics* 2009; (11): 25–34.
5. Wang W. Chang-Zhu-Tan chengshiqun jianshe “liangxing shehui” shizheng fenxi (Chinese) [Empirical analysis on the construction of “two-oriented society” in Chang-Zhu-Tan urban agglomeration] [Master’s thesis]. Changsha: Central South University; 2009.
6. Kuang Y, Xie H, Yin X. Liangxing shehui” shengtai wenhua tixi goujian—Chang-Zhu-Tan chengshiqun shizheng fenxi (Chinese) [Construction of ecological and cultural system of “two oriented society”—Empirical analysis of Changsha-Zhuzhou-Xiangtan urban agglomeration]. *China Collective Economy* 2010; (6): 179–180.
7. Liu Z, Dai Y, Dong C, et al. Low carbon city concept and international experience. *Urban Development Research* 2009; (6): 1–7, 12.
8. Edward L, Matthew K. The greenness of city. *Rappaport Institute Taubman Center Policy Briefs* 2008; 3: 1–11.
9. Du D, Wang T. Study on comprehensive evaluation of evaluation index system improvement and development of low-carbon cities. *China Environmental Management* 2011; (3): 8–11, 14.
10. Wang Y. The construction of “two oriented cities” and the transformation of production mode and consumption mode. *Reform and Opening Up* 2006; (8): 6–7, 12.
11. Zang M, Zhu D. Research on the framework of “two oriented cities”. *China Population, Resources and Environment* 2011; 21(3): 136–142.
12. Liu J, Wei X, Zhao X. Research on strategic development plans for low-carbon “two-oriented” villages and towns of Chang-Zhu-Tan city cluster based on the SWOT analysis. *Journal of Hunan University of Technology* 2013; 4: 1–6.
13. Liu X, Shen L. Research on comprehensive evaluation index system of resource-saving society. *Journal of Natural Resources* 2006; 21(3): 382–391.
14. Chen F, Zhu D. Theoretical methods of low-carbon city research and empirical analysis of Shanghai. *Urban Development Research* 2009; (10): 71–79.

15. Li P. Measurement and empirical analysis of low carbon cities. *Statistics and Decision Making* 2011; (24): 95–98.