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Land Urbanization Level of Core Cities in the Silk Road Economic Belt

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Abstract: With the construction and development of the Silk Road Economic Belt, it is of great significance to analyze the land urbanization level of cities along the route. This paper established a new evaluation system, consisting of 11 indexes from 6 aspects, to measure the land urbanization level of 71 core cities in the Silk Road Economic Belt in 2014.The Principal component analysis (PCA) method was used to determine weight of indexes and get calculation results. In the course of these studies, it is visually apparent that spatial differentiation phenomena and unbalanced development exist both in provincial scale and urban scale. To promote sustainable development of Silk Road Economic Belt, enhancing the top design, improving the evaluation system, strengthening the cooperation and handling the relationship between exploitation and protection of resources are considered effective methods.

1. Introduction

The concept of Silk Road Economic Belt was firstly proposed by the president Xi Jinping in 2013, which was based on the well-known Old Silk Road in history and expected to make great contribution to deeper cooperation between Eurasian countries in future. It is of great significance to construct Silk Road Economic Belt, regarded as one of the important ways to strengthen regional economic cooperation, accelerate world economic development and optimize China's layout of city and population [1]. Undoubtedly, Intensive urbanization process is happening in China, promoting the urban land expansion, transition of economic structure and population migration, which has become a hot research area. Under the background of rapid urbanization, the concept of land urbanization has been proposed as a new object of study and considered as a main component section of urbanization process. In recent years, the accelerated speed of land urbanization has been much faster than population urbanization in China [2], leading to a range of issues such as land finance, chaotic urban layout, land devaluation, and land wastage [3].In order to monitor the change of land urbanization, a lot of researches concentrated on the analyses of land urbanization, including measurement, evaluation, spatial-temporal differences and driving forces. Studies, which revealed that land urbanization level in the coastal areas of eastern China is much higher than that in center and western China [4], showed the imbalance of urban development, and urban population agglomeration, industrial growth and investment were believed three drivers [5]. Even through attention has been paid to the sustainable development ability, competitive capacity and urbanization development of cities along the Silk Road Economic Belt, few studies attempted to combine the Silk Road Economic Belt research with land urbanization of cities.

In this paper, we first selected 71 core cities from 9 provinces and municipalities in the Silk Road Economic Belt as representatives to measure the land urbanization level in 2014 on the basis of establishing the evaluation system, and analyzed the influencing factors. Finally, the policy countermeasures and proposals were provided in the rest of the paper. The aim of this paper is attempting to establish a new evaluation system of land urbanization, grasp the situation of urban land use in the Silk Road Economic Belt and develop the Silk Road Economic Belt research, which is of theoretical and practical importance.

2. Data and methods

2.1 Data sources. There are 9 provinces and municipalities contained in the Silk Road Economic Belt (Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Chongqing, Sichuan, Yunnan and Guangxi), thus we chose all the 8 vice-provincial cities, 62 prefecture-level cities and 1 municipality for the research respectively, except Hechi because of data incompleteness. The data were gathered from the following sources: China City Statistical Yearbook 2015 and Provincial Statistical Yearbook 2015.

2.2 Evaluation system. After the summarization of present literatures, the evaluation index system of land urbanization level mainly included land structure, landscape, capital input and economic benefit [6].On the basis of existing research and experience, a new evaluation system was established from 6 perspectives. Land use structure shows the development degree of urban land. Economic input and output are used to estimate the economic value that urban land plays. Population-supporting capacity indicates the relation between urban land and urban population. Social service represents the capacity of basic services that urban land provides. And ecological environment is used to evaluate the quality of human settlement.

The evaluation system of land urbanization level is shown in Table 1.

Table 1. Evaluation system of land urbanization level

Layer of target	Layer of factors	Code	Layer of indexes
Land urbanization level	Land use structure	X_1	Urban construction land ratio
	Economic input	X_2	Fixed-asset investment per unit area
		X_3	Public finance expenditure per unit area
	Economic output	X_4	GDP per unit area
		X_5	Public finance income per unit area
	Population-supporting capacity	X_6	Population density
		X_7	Employment figures per unit area
	Social service	X_8	Educational institutions per unit area
		X_9	Medical institutions per unit area
	Ecological environment	X_{10}	Green coverage ratio
		X_{11}	Industrial solid wastes comprehensively utilized ratio

Note: Educational institutions include regular institutions of higher education, vocational secondary schools, regular secondary schools and primary schools. Medical institutions include hospitals and health centers.

2.3 Index weight setting and measurement. Principal component analysis (PCA) was used for measure the land urbanization level, which demanded data normalization with the purpose of eliminating the differences caused by magnitude and measurement units. The method of data normalization is z-score, making sure each column of data with zero mean and unit variance, of which formula is expressed as

$$Z_{ij} = \frac{X_{ij} - \overline{X_j}}{S_j} \tag{1}$$

where Z_{ij} represents each normalization data, X_{ij} is each original data, $\overline{X}_j$ is mean value of indexes, S_j represents standard deviation of each index,i is the number of evaluation objects and j is the number of indexes. In this paper, a KMO inspection and Bartlett test of sphericity were conducted to test the correlation of the data, and the analysis results are shown in Table 2.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.845
Bartlett's Test of Sphericity	Approx.Chi-Square	1023.927
	df	55
	Sig.	0.000

The KMO is greater than 0.8, and Bartlett's inspection gives the probability of the sphere as 0.000, less than the significance level 0.05, which indicates that the data is suitable for such an analysis. Based on the above analysis, PCA results are shown below.

Table 3. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
X_1	6.820	62.002	62.002	6.820	62.002	62.002	6.219	56.536	56.536
X_2	1.355	12.321	74.323	1.355	12.321	74.323	1.638	14.894	71.430
X_3	1.021	9.286	83.608	1.021	9.286	83.608	1.340	12.179	83.608
X_4	0.688	6.254	89.862						
X_5	0.613	5.571	95.433						
X_6	0.186	1.687	97.120						
X_7	0.162	1.476	98.596						
X_8	0.057	0.516	99.113						
X_9	0.053	0.479	99.592						
X_{10}	0.030	0.269	99.861						
X_{11}	0.015	0.139	100.000						

The results show that the 11 traits are consolidated into 3 principal components which account for 83.608% of total variation. On the basis of calculation of eigenvector, standardized data and formula, land urbanization level of 71 core cities was measured and sequenced (Table 4).The positive value indicates that land urbanization level of the city is higher than the average level, while a negative one represents a lower level.

Table 4. Land urbanization level of 71 core cities

Ranking	City	Level	Ranking	City	Level	Ranking	City	Level
1	Chengdu	3.833	25	Guigang	0.031	49	Kelamayi	-0.366
2	Xi'an	3.003	26	Tongchuan	-0.048	50	Haidong	-0.367
3	Zigong	0.822	27	Leshan	-0.066	51	Guangyuan	-0.378
4	Beihai	0.768	28	Qinzhou	-0.099	52	Hezhou	-0.380
5	Chongqing	0.749	29	Liuzhou	-0.106	53	Shangluo	-0.384
6	Deyang	0.731	30	Panzhihua	-0.109	54	Dingxi	-0.391
7	Xianyang	0.711	31	Longnan	-0.140	55	Ya'an	-0.409
8	Neijiang	0.634	32	Baoji	-0.151	56	Laibin	-0.410
9	Suining	0.565	33	Fangcheng-gang	-0.168	57	Baoshan	-0.429
10	Kunming	0.534	34	Mianyang	-0.172	58	Yulin	-0.454
11	Wulumuqi	0.463	35	Wuzhou	-0.174	59	Chongzuo	-0.464
12	Weinan	0.409	36	Bazhong	-0.182	60	Baise	-0.500
13	Guan'gan	0.393	37	Wuwei	-0.209	61	Qingyang	-0.508
14	Yinchuan	0.370	38	Tianshui	-0.213	62	Ankang	-0.516
15	Nanchong	0.368	39	Shizuishan	-0.214	63	Jinchang	-0.525
16	Ziyang	0.304	40	Jiayuguan	-0.227	64	Baiyin	-0.531
17	Xining	0.237	41	Pingliang	-0.251	65	Yan'an	-0.548
18	Lanzhou	0.235	42	Hanzhong	-0.259	66	Lincang	-0.552
19	Meishan	0.233	73	Zhaotong	-0.268	67	Zhongwei	-0.618
20	Nanning	0.170	44	Wuzhong	-0.273	68	Zhangye	-0.628
21	Yulin	0.154	45	Qujing	-0.284	69	Lijiang	-0.638
22	Dazhou	0.116	46	Guyuan	-0.302	70	Pu'er	-0.660
23	Luzhou	0.091	47	Yuxi	-0.308	71	Jiuquan	-0.761
24	Yibin	0.063	48	Guilin	-0.344			

3. Results

It can be concluded that only 25 cities of the total take a higher land urbanization level than the average level, which shows obvious characteristics of spatial differentiation. Vice-provincial cities, the provincial capital cities, have the highest land urbanization level in each province, except

Nanning. It's not surprising to find this result, because funds, population, resources and technologies, attracted by the provincial capital cities, effectively promote the land urbanization process. Meanwhile, the land urbanization level of Chongqing municipality is higher than any other provinces' average level, and cities with a high level of land urbanization are centrally distributed in such provinces as Sichuan, Shaanxi and Xinjiang, while other backward regions mainly locate in Qinghai, Ningxia, Yunnan and Gansu. Through analysis, a significant spatial differentiation of land urbanization level is found both in provincial scale and in urban scale in 2014, reflecting regional development distinctions in economy, finance, industry, urbanization and land use.

4. Conclusions

To sum up, land urbanization is a significant aspect of urbanization and land use, playing an essential role in the development of Silk Road Economic Belt. On the basis of existing research and experience, land use structure, economic input, economic output, population-supporting capacity, social service and ecological environment were considered the factors to evaluate land urbanization, and 11 specific indexes were selected to measure the land urbanization level. Through establishing the evaluation system, this paper evaluated the land urbanization level of core cities in the Silk Road Economic Belt, using the cross-sectional data of 71 cities in 2014, and principal component analysis was employed as the main research method. The results indicated the unbalanced development of land urbanization among selected provinces, which needs further research and policy support.

To promote the function of Silk Road Economic Belt, the government's primary task is to get to grips with the land urbanization. First, the top design of land urbanization should be enhanced. Depending on the diverse development situations, phased and targeted policies would take effect in different regions, therefore, it's an effective method to improve the land urbanization level and eliminate the gap between developed and backward cities by establishing perfect policies and rules. Second, the evaluation system of land urbanization level should be improved. Compared with evaluation system of urbanization, evaluation system of land urbanization has not been paid enough attention, leading to a lack of complete understanding and profound recognition about land urbanization, which makes an objective and scientific evaluation system urgently needed. Third, the cooperation among provinces and cities should be strengthened. Although the financial cooperation has gained an initial scale and scientific cooperation in major projects has scored remarkable achievements [7], achievement of intergovernmental cooperation has not come to arise, which is supposed to maximize efficiency and drive improvements in land urbanization. Forth, the relationship between exploitation and protection of resources should be well handled. Only by reducing the adverse phenomena such as excessive occupation of cultivated land and waste of construction land, can land urbanization in Silk Road Economic Belt achieve sustainable development.

Despite the present results and proposals have been involved in this paper, land urbanization level of core cities in the Silk Road Economic Belt remains to be further studied.

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