



Study on the Measurement and Evaluation of Rural-Urban Integration in Lanxi Urban Agglomeration

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Abstract. Since the reform and opening up, with the development of rapid urbanization, the urbanization rate and the built-up area of cities have increased rapidly, and the dual structure of urban and rural areas has gradually appeared, revealing huge barriers in many fields of economy, society, ecology, and space, especially the “Lanzhou-Xining City Cluster” located in the northwestern part of China, is facing serious challenges in the process of urban-rural integration. This paper focuses on the measurement of urban-rural integration level in Lanzhou-Xining City Cluster by combining the characteristics of social development, economic development and environmental resources in this region to construct an evaluation index system. Using the entropy method and the weighted synthesis method to calculate the comprehensive scores of the five core cities within the urban agglomeration during the decade 2010-2019, it is found that there are differences in the level of urban-rural integration in the Lanxi Urban Agglomeration. Finally, based on the calculation results, the research conclusions and countermeasures are drawn for the real problems of the research object.

Keywords: Lanxi urban agglomeration; urban-rural integration; the measurement and evaluation.

1 Introduction

The 18th National Congress of the Communist Party of China (CPC) put forward for the first time the policy of integrating urban and rural development, pointing out that it is the fundamental way to solve China's "three rural issues". The Nineteenth National Congress further proposed the establishment of a sound institutional mechanism and policy system for the integrated development of urban and rural areas, making the integrated development of urban and rural areas an important means and path to achieving urban-rural integration. It can be seen that China is continuously establishing and improving institutions and mechanisms to promote the integration of urban and rural development, and to guide urban and rural development towards a balanced approach.

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Regarding the term urban-rural integration, the existing related research theories in China focus on the theoretical meaning ^[1], the exploration of the driving mechanism ^[2], measurement and evaluation ^[3]. Guan Shu ^[4] constructed an evaluation system of urban-rural integration indicators from four dimensions, and used the entropy method to determine the level of urban-rural integration of 27 cities in the Yangtze River Delta region from 2011 to 2020, and to explore the geographical differences. Lv Lianju and Kan Daxue ^[5] used the EBM model to overcome the shortcomings of the DEA method and the SBM super-efficiency model to measure the efficiency of urban-rural integration development in the central region, and to provide policy suggestions for the central region to promote the construction of urban-rural integration and realise urban-rural integration development. Wang Shuao ^[6] constructed an evaluation index system of urban-rural integration from four dimensions, and used principal component analysis to measure and evaluate the level of urban-rural development integration in Shanxi Province both vertically and horizontally. On the contrary, the empirical research work carried out in foreign countries focuses on micro, with urban and rural agricultural development ^[7], residents' health ^[8] and so on as the key content.

As an economic centre, transportation hub and key area of ecological environment protection in Northwest China, Lanxi City Cluster has an important strategic position, and it is of great significance to measure and evaluate its urban-rural integration level. At the same time, it faces the problems of big gap between urban and rural medical level, big gap between urban and rural income, big gap between urban and rural education and cultural conditions, etc., and the development of urban-rural integration shows a lot of resistance, how to alleviate the contradictions and conflicts of interests between cities and villages in the process of development has become the main problem to overcome in the process of development of urban-rural integration in the Lanxi Urban Agglomeration.

The main purpose of this paper is to build a theoretical framework for the comprehensive measurement of urban agglomeration integration, and to further clarify the methodology for the comprehensive measurement of urban-rural integration in urban agglomerations in Northwest China. After the comprehensive measurement index system is made, the quantitative measurement of the level of urban-rural integration in Lanxi urban agglomeration can help us to achieve a comprehensive understanding of the integration development process, and clearly understand the deficiencies and strengths of the region in the process of integration development, so as to provide guidance for the local government to formulate the policy of coordinated integration and development and to provide the basis for the local government to develop the policy of coordinated integration.

2 Overview of the study area

The research scope of this thesis is the core area of Lanxi City Cluster, including the whole territory of Xining City and Haidong City in Qinghai Province, as well as the whole territory of the municipal administrative divisions of Lanzhou City, Baiyin City and Dingxi City in Gansu Province.

3 Evaluation index system construction

After comprehensively understanding the development of urban-rural integration in Lanxi Urban Agglomeration, this paper proceeds to establish an evaluation system for the level of urban-rural integration development. In the construction process, the principles of representativeness, scientificity and accessibility are always adhered to. The indicators of urban-rural integration are subdivided into a target layer and a criterion layer, in which the target layer is used to evaluate the comprehensive measurement of urban-rural integration, while the criterion layer focuses on economic integration, ecological integration, urban-rural spatial integration, social integration, and financial investment to promote integration to achieve the purpose of evaluating the development of urban-rural integration.

3.1 Data sources

The data within the indicators for prefecture-level cities covering urban municipal districts and built-up areas in this study are all from the 2010-2019 China Urban Statistical Yearbook, with data for individual indicators extracted from the Qinghai Provincial Statistical Yearbook and Gansu Provincial Statistical Yearbook, and also partly from the Statistical Bulletin of National Economic and Social Development. Individual missing data are calculated by trend extrapolation method and arithmetic average method.

3.2 Data processing

3.2.1. Entropy method. In This paper evaluates the measurements of urban-rural integration in the Lancashire urban agglomeration, dominated by the entropy method. For the original indicator index matrix data set: m cities, h years, n items of measurement indicators. $\{x_{\lambda ij}\} h * m * h (1 \leq \lambda \leq h, 1 \leq i \leq m, 1 \leq j \leq n) = X$ is the original indicator matrix. The indicator value of the j indicator for the i city in the λ year is expressed through $x_{\lambda ij}$ [9].

Positive indicators:

$$(x_{\lambda ij} - x_{\min}) / (x_{\max} - x_{\min}) = Z_{\lambda ij} \quad (1)$$

Contrarian indicator:

$$(x_{\max} - x_{\lambda ij}) / (x_{\max} - x_{\min}) = Z_{\lambda ij} \quad (2)$$

Normalisation of indicators:

$$Q_{\lambda ij} = Z_{\lambda ij} / \sum_{\lambda=1}^h \times \sum_{i=1}^m \times Z_{\lambda ij} \quad (3)$$

Entropy calculation for each indicator:

$$B_j = 1 - E_j \tag{4}$$

Redundancy calculation of entropy values for indicators:

$$W_j = B_j / \sum_{j=1}^n \times B_j \tag{5}$$

Weighting of indicators:

$$C_{\lambda i} = Q_{\lambda ij} \times W_j \tag{6}$$

Weighted composite methodology for the calculation of the city impact index for each year:

$$E_j = -k \sum_{\lambda=1}^h \times \sum_{i=1}^m \times Q_{\lambda ij} \ln Q_{\lambda ij}, k = 1 / \ln(h \times m) \tag{7}$$

3.2.2. *Indicator weights.* Using the entropy value method as well as the weighted synthesis method, after the data standardization process, the 16 indicators selected from the five guideline layers were processed and calculated to obtain the weights occupied by each evaluation factor.

Table 1 reveals that the vast majority of the indicators in this indicator system are positive, with only the ratio of urban and rural GDP per capita as a negative indicator, i.e., the larger the value of GDP per capita of the municipal districts / GDP per capita of the city as a whole, the higher the GDP per capita of the urban population is compared with that of the rural areas, and the more unfavourable it is for the integrated development of the urban and rural areas. Science and technology expenditures account for the largest share of all indicators, while the coverage rate of basic pension insurance for urban workers, the proportion of urban construction land in the urban area, the amount of end-of-year deposits per capita for urban and rural residents, and urban and rural education expenditures are four indicators that have relatively large weights and have a more pronounced impact on the level of urban-rural integration.

Table 1. Weights of urban and rural economic indicator system of Lanxi urban agglomeration.

Target level	Standardized level	Indicator level	Calculation method	Number	Indicator properties	Weights
		urbanization rate	Urban population/total population	X1	+	0.0523
Integr	Urban-rural		Urban road area/total population			
ation	spatial	Urban road space per capita	(square metres/person)	X2	+	0.0397
of	integration	Proportion of urban built-up land to	Built-up land area/area of municipal			
urban		urban area	districts (%)	X3	+	0.0973
and	Urban-rural	Ratio of urban to rural GDP per capita	GDP per capita in municipal			
rural	economic		districts/GDP per capita in the city	X4	-	0.0343
areas	integration	Amount of year-end deposits per capita	Yearbook statistics (\$million)			
		for urban and rural residents		X5	+	0.0902

		Average wage of the city's inhabitants			
	Ratio of rural to urban per capita income	/ average wage of the inhabitants of the municipal districts	X6	+	0.0458
	Share of output value of secondary and tertiary industries	Output value of secondary and tertiary industries/total output value (%)	X7	+	0.0443
	Share of non-farm employment	Share of employees in the secondary sector + share of employees in the tertiary sector (%)	X8	+	0.0359
Urban-rural social integration	Coverage rate of urban workers' basic pension insurance participants	Number of employees' basic pension insurance participants/population (%)	X9	+	0.0855
	Number of health facilities per 10,000 population in urban and rural areas	Number of hospitals/population in urban and rural areas	X10	+	0.0526
	Number of secondary schools per 10,000 population in urban and rural areas	Number of secondary schools/population in urban and rural areas	X11	+	0.0576
Urban-rural ecological integration	Greening coverage rate of urban built-up areas	Yearbook statistics (%)	X12	+	0.0509
	Centralised treatment rate of sewage treatment plants	Yearbook statistics (%)	X13	+	0.0510
	Non-hazardous domestic waste disposal rate	Yearbook statistics (%)	X14	+	0.0382
Promoting financial inputs for integrated urban and rural development	Expenditure on urban and rural education	Yearbook statistics (\$ million)	X15	+	0.0875
	Expenditure on science and technology	Yearbook statistics (\$ million)	X16	+	0.1369

4 Analysis of results

Using the entropy value method and the weighted synthesis method, the results of the comprehensive measurement of the level of urban-rural integration of the five major cities in the Lanxi Urban Agglomeration from 2010 to 2019 were obtained.

Composite score for urban-rural integration

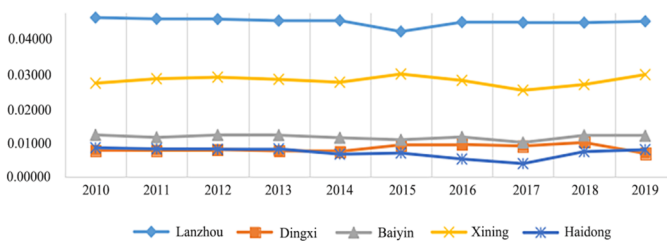


Fig. 1. Comprehensive measure of the level of urban-rural integration in the Lancashire urban agglomeration, 2010-2019.

Figure 1 reveals that in terms of the growth of the composite urban-rural integration score, in the last three years, i.e., 2017-2019, there is a more pronounced growth trend in Xining City and Haidong City in Qinghai Province, and some growth in Baiyin City within the Gansu Area. In other time periods, Lanzhou City had a more pronounced bottoming out growth in 2015-2016, restoring its pre-2014 level, and Xining City had a period of rapid growth in 2014-2015.

Lanzhou city has the highest comprehensive score of urban-rural integration, implying that it has the highest level of urban-rural integration construction, while Haidong city has the lowest level of urban-rural integration construction. Dingxi, Baiyin and Haidong, as the general prefecture-level cities in the Lanxi City Cluster, do not have a large gap in their comprehensive scores, indicating that their levels of urban-rural integration development are relatively close. The levels of urban-rural integration of the five major cities in the Lanxi City Cluster generally showed a smooth fluctuating trend and did not show any significant changes from 2010 to 2019, but the levels of urban-rural integration development and construction of these five cities showed a significantly unbalanced development phenomenon. The reasons are mainly as follows: (1) Differences in geographical conditions: Lanzhou is located in the Yellow River Valley, with flat terrain and better conditions for agricultural production; Xining is located on the Tibetan Plateau, with hilly terrain plateau and limited agricultural development. These differences in geographical conditions lead to differences in agricultural development and farmers' incomes, which in turn affects the development level of urban-rural integration. (2) Differences in economic development: Lanzhou and Xining, as the capitals of provinces, have more complete industrial systems and higher levels of economic development; while the economic development of the remaining prefectural cities of Dingxi, Baiyin, and Haidong is relatively lagging behind. These differences in economic development have led to the income gap between urban and rural areas, which in turn affects the development level of urban-rural integration. (3) Differences in policy orientation: the five major cities in the Lanxi urban area give different policy support and resource inputs to urban and rural development, leading to uneven urban-rural development.

5 Conclusions

By measuring and evaluating the data on the current development status of urban-rural integration in Lanxi City Cluster, it can be found that the overall urban-rural integration construction level of Lanxi City Cluster has shown a stable trend between 2010 and 2019, but there are up and down fluctuations between the ten years, especially the fluctuating trend is more obvious after 2016, and there is a very strong imbalance between the provincial capital city and the general prefectural cities. In order to promote the sustainable development of urban-rural integration in the Lanxi City Cluster, as well as to promote the relatively balanced development of each prefecture-level city and the provincial capital, so that urban-rural integration can be maintained in a steady state, this paper puts forward corresponding countermeasures and suggestions.

Focusing on urban-rural economic co-development to address urban-rural economic integration. Firstly, the central Government should always practice the transfer of payments to achieve balanced development between the central and eastern regions and the Gansu and Qinghai regions. Secondly, it can make full use of the "national unified market" policy, as well as its own advantages in energy, minerals and land, to co-operate with developed regions in the east in the areas of energy trading, land trading, and carbon emission trading, so as to enhance the level of economic development.

Equalisation of public services in urban and rural areas promotes social integration between urban and rural areas. With urban-rural integration as the guiding principle in the construction of the public finance system, public expenditure in rural areas has been appropriately adjusted upwards, and all efforts have been made to build up social services such as medical care, education and social welfare protection in rural areas, in order to promote the equalisation of public services between urban and rural areas.

Integration of rural and urban infrastructure strengthens the spatial integration of rural and urban areas. The promotion of urban-rural infrastructure integration should focus on the improvement of agricultural and rural infrastructure, such as rural water conservancy construction and the reconstruction of rural roads, in order to promote the significant enhancement of comprehensive production capacity.

Green modernised agriculture to promote rural-urban ecological integration. The path to achieving urban-rural ecological integration can be green agricultural modernisation. By vigorously developing agricultural mechanization, to ensure that agricultural technical equipment in place; Cleverly inject the regional characteristics of Gansu and Qinghai to create a modern agricultural park; Government will give priority to supporting leading agricultural enterprises.

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