

## Development evaluation of New-type urbanization

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**Abstract.** This paper introduces a hybrid combined weight-place value method for evaluating the sustainable of urbanization. The values of development index are calculated by combined weight method. A case study of urbanization in Liaoning demonstrates the process of using the evaluation method. The result indicates that the urbanization in Liaoning is better. The development between economic, environments, social, public service and livelihood is enhancing conspicuously.

**Keywords:** New-type urbanization; combined weight; development evaluation

### 1 Introduction

Urbanization is the movement of people from rural to urban areas with population growth equal to urban migration, which is shown in two forms, the increasing number of cities and the expanding population of cities [1]. Urbanization is the core force of regional economic and social development, the development quality of which determined the regional economic capacity for sustainable development to a large extent. The level of urbanization, the number and size of large cities are unprecedented especially in developing countries [2].

Urbanization is one of the major topics that have been studied focusing on socio-economic and environmental perspectives in urbanization [3], to economic perspectives in peri-urban areas [4], to the loss of vegetation and with respect to urban emissions. Increased urbanization has direct impact on the social and economic condition of the cities [5]. This phenomenon is particularly significant in developing countries, where the rural-urban areas become one of the very important places of urban growth. Meanwhile, urbanization must take into account such factors as development capacity, avoiding mega-city problems experienced by many countries, and balancing urban development and ecological protection [6].

This paper aims to develop such a tool for evaluating the sustainability of urbanization in China and help city decision-makers to select a suitable development strategy. This research constructs a hybrid model using combined weight method and place value method to evaluate the development of new-type urbanization. The hybrid method can not only evaluate the development performance of new-type urbanization, but also provide a method for improving coordination of new-type urbanization.

## 2 The hybrid model for evaluating the development of new-type urbanization

### 2.1 Confirm the new-type urbanization evaluating indicators

In this study, four dimensions of the new-type urbanization indicators are adopted, including environment, economy, social and public service and livelihood. Each dimension is categorized into many sections. After analyzing the above sources and researching from industry, governmental offices, the paper led to the selection of 23 indicators that are further grouped in the four dimensions, as shown in Table 1.

**Table 1.** Indicator system and combined weight for urbanization development

First grade	Second grade	weight
Economic (0.1007)	fixed assets investment of urban	0.0964
	speed of urbanization	0.1229
	per capita GDP of urban residents	0.1097
	Per capita disposable income of urban residents	0.1172
	Engel's Coefficient of urban residents	0.1122
	Energy consumption of per 10,000 output value of urban	0.1093
	Proportion of GDP accounted for by services of urban	0.1025
Public service (0.2916)	Employment ratio of urban residents	0.1658
	Urban road area per capita	0.1337
	penetration rate of water of urban residents	0.1425
	penetration rate of gas of urban residents	0.1454
	per capita Housing space of urban residents	0.1512
Environment (0.3527)	Percentage of good air quality of urban residents	0.1559
	waste water emissions ratio of urban residents	0.1098
	total Disposes of living garbage of urban residents	0.1006
	Green area per capita of urban residents	0.1348
	Total Industrial dust emissions of urban residents	0.1210
	Comprehensive utilization ratio of Industrial solids waste of urban residents	0.1310
Social (0.2550)	Registered urban unemployment ratio	0.1263
	Number of hospital beds per 10,000 population of urban residents	0.1767
	Number of health workers per 10,000 population of urban residents	0.1449
	per capita employment-burden coefficient of urban residents	0.1428
	Social insurance coverage of urban residents	0.1476

### 2.2 Calculate the value of development index

#### Standardize the indicator

$$X_{ij} = \begin{cases} X_{ij} = \frac{a_{ij} - \min a_{ij}}{\max a_{ij} - \min a_{ij}}, & a_{ij} \text{ for positive indicator} \\ X_{ij} = \frac{\max a_{ij} - a_{ij}}{\max a_{ij} - \min a_{ij}}, & a_{ij} \text{ for negative indicator} \end{cases}$$

$a_{ij}$  is the original value of the  $j$  th indicator that is accounted for at the  $i$  th year.

**Determine the combined weight:** Using the principles to calculate the weight of new-type indicators among Entropy method, AHP and Deviation weight method. The combined weight method is as follows:

$$w_j = \frac{w_1^j \cdot w_2^j \cdot w_3^j}{\sum_{i=1}^4 w_1^j \cdot w_2^j \cdot w_3^j}$$

Where  $w_1^j$  is the weight calculated by Entropy Method,  $w_2^j$  is the weight calculated by AHP,  $w_3^j$  is the weight calculated by Deviation Weight Method. Thus the combined weight of new-type indicators is presented.

**Calculate the value of development index:** Using the place value method, the normalized value of index is calculated.

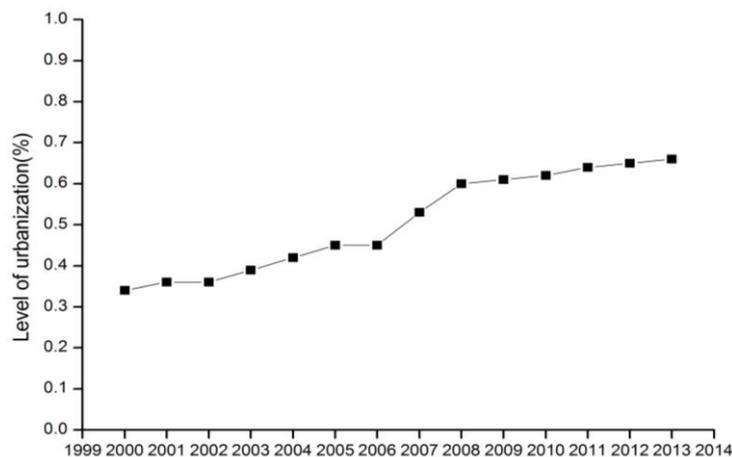
$$p_{ij} = \begin{cases} 0.01 + 0.99 \times \frac{a_{ij} - \min a_{ij}}{\max a_{ij} - \min a_{ij}}, & a_{ij} \in p_{ij}^+ \\ 0.01 + 0.99 \times \frac{\max a_{ij} - a_{ij}}{\max a_{ij} - \min a_{ij}}, & a_{ij} \in p_{ij}^- \end{cases}$$

$a_{ij}$  is the original value of index,  $p_{ij}$  is the place value of  $a_{ij}$  calculated by the place value method,  $p_{ij}^+$  indicates forward index,  $p_{ij}^-$  indicates backward index. Then the value of development index for each year is calculated by the following method:

$$f_j = \sum_{i=1}^n w_j p_{ij}, i = 1, 2, \dots, m$$

### 3 A case study

In recent years, the urbanization trance in Liaoning is faster due to the growing population, rapid industrial development and exploitation of mineral resources. The urbanization level in Liaoning increased from 34% in 2000 to 66% in 2013 (Figure 1). According to Northam urbanization curve [7], urbanization in Liaoning entered the stage of acceleration stage.

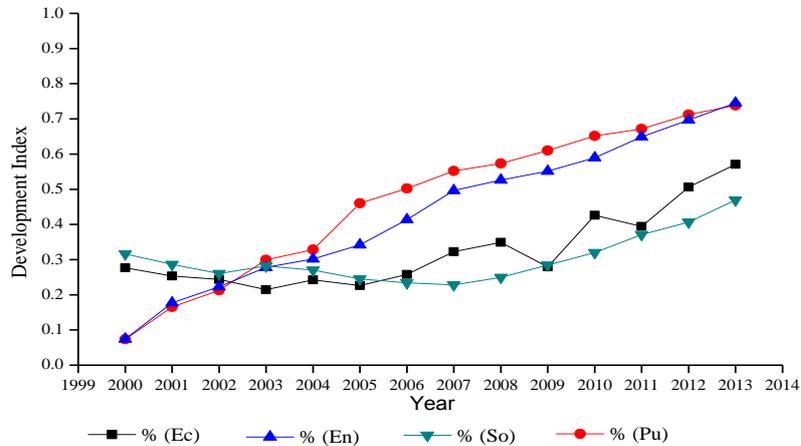


**Fig. 1.** Urbanization level curve in Liaoning from the year 2000 to 2013

The indicator weight is calculated using the combined weighted method and shown in Table 1. The values of development index calculated by using the combined weight method and place value method are shown in Table 2. Based on the four sets of data shown in Table 2, the changing trends of development index for each dimension during the period from 2000 to 2013 are simulated, as shown in Figure 2.

**Table 2.** Analysis results on development index

Year	Ec	Pu	En	So
2000	0.2764	0.0738	0.0745	0.3160
2001	0.2537	0.1655	0.1768	0.2861
2002	0.2440	0.2125	0.2233	0.2604
2003	0.2146	0.2991	0.2779	0.2817
2004	0.2424	0.3284	0.3016	0.2701
2005	0.2263	0.4601	0.3420	0.2451
2006	0.2580	0.5025	0.4134	0.2339
2007	0.3225	0.5519	0.4964	0.2283
2008	0.3493	0.5734	0.5265	0.2496
2009	0.2795	0.6105	0.5516	0.2841
2010	0.4262	0.6518	0.5898	0.3198
2011	0.3944	0.6717	0.6491	0.3710
2012	0.5062	0.7123	0.6967	0.4069
2013	0.5709	0.7384	0.7451	0.4692



**Fig. 2.** The variation trend of development index in economic, public service and livelihood, environment and social

The changing trends of development index illustrate that the improvement on the social performance of Liaoning Province is comparatively small during the year 2000-2013. The trend of development index of economy is unsteady but improved overall. On the contrary, the development of environment and public service and livelihood dimensions has improved greatly. As a result, the coordination index demonstrates up-ward trend in recent years. Therefore, government should strive to improve its social and economy performance in the urbanization process. First, the government should establish modern industrial system and promote comprehensive development to dealing with the unsteady of economy development. Also the structure of economy should be adjusted such as optimize industrial layout and greatly develop ecological industry by industry combination and transition, improve the social security system and promote urbanization of rural areas. Meanwhile, government should promote urbanization of rural areas and realize transition from spillover-echo model to leap-type model, also strengthen innovation development and realize leap-type urbanization model for urban and rural integrity.

## 4 Conclusions

In order to evaluate the performance of urbanization sustainability, a comprehensive indicator system and an effective method are necessary. This present research proposes a hybrid combined weight-place value method to calculate the development index for such purpose. The case study presented in this study shows that the hybrid method model is an effective tool to evaluate the changing trace and the performance of urbanization sustainability. The combined weight method assisting in determining the weights of indicators can help reduce subjectivity. The hybrid methods can display the overall status of urbanization sustainability based on both development

indexes, which allows managers to determine the level of urban development and develop suitable strategies for improving the performance of sustainable urbanization. The results of this research add value to the development of methodology for further studies on the sustainability of urbanization.

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