Study on Sub-regional Cooperation in the Central Region

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Abstract. The development of the central region plays an important role in the pattern of regional development in China. Taking 8 typical sub-regions in the central region as the research object, this paper studies the sub-regional cooperation conditions in the central region. Through the measurement and comprehensive scoring of sub-regional cooperation conditions, this paper makes an evaluation of sub-regional cooperation conditions in order to contribute to sub-regional cooperation and development in the central region.

Introduction

The central region, including Shanxi, Henan, Anhui, Hubei, Jiangxi and Hunan six provinces, linking the east to the west, connecting the south to the north, is an important part of The Belt and Road economy. It is a key area of strategic implementation in the central region and plays an important role in the pattern of regional development in China.

Through the implementation of Promote the Central Region, the central region has developed rapidly, and has become an important area for China to undertake industrial transfer in the eastern coastal area. With the implementation of the National New-type Urbanization Plan, the new-type urbanization has accelerated the economic development of the central region. However, the social economic resources are too concentrated in the central cities of the central region, and sub-regions often become a forgotten corner. In the development plan of the urban agglomeration of the middle reaches of Yangtze River, the National Development and Reform Commission clearly stated "encourage and support the sub-regional cooperation demonstration area of Tongcheng, Pingjiang and Xiushui" [1]. How can we strengthen the sub-regional cooperation? This paper is to explore the sub-regional cooperation conditions in the central region, in order to promote the development of regional integration in the central region.

Compared with previous researches, the possible contributions are: (1) the study is beneficial to speed up the cooperation of urban agglomeration, which supports the strategy of the rise of the central region [2]; (2) the study will help to speed up the construction of new-type urbanization, which plays an important exemplary role in improving the urban system construction in the central and western regions; (3) the study will help to break the traditional barriers, form an integrated structure model and establish a long-term and effective cooperative mechanism for development and cooperation.

Literature review and theoretical basis

Sub-region and sub-regional cooperation. Sub-region, Li Tieli(2005) thinks that it is a relative concept of the region [3], and Yang Aiping(2007) thinks sub-region is a smaller area under macro scale area [4]. In this paper, sub-region is a region which is formed by geographical location, administrative division, resource conditions, industrial structure and other reasons, and it has a certain homogeneity and common boundary, which is a specific geographical space smaller than the "region".

Sub-regional cooperation, Hu Zhiding (2010) believes that sub-regional cooperation refers to the cooperation between the border provinces of the neighboring countries, which are carefully defined and within a small cross border area, to develop the needs of economic development and social stability [5]. In this paper, sub-regional cooperation is a comprehensive cooperation for the needs of

stability and development in many countries or regions in a small "region" with a certain homogeneity and common boundary, involving economic, political, cultural, environmental and security fields.

Sub-regional Cooperation Model in the Central Region. Sub-regional cooperation can present many different models and types [6]. From the perspective of the subject of cooperation, it can be divided into government led model and enterprise led model. From the perspective of the comparative relationship between the economic development level of the two parties, it can be divided into strong and strong cooperation mode, strong and weak cooperation mode and weak and weak cooperation mode.

The Restrictive Factors of sub-regional Cooperation in the Central Region. Combined with the division of sub-regional cooperation mode in the central region, we can extract the restrictive factors of sub-regional cooperation. (1) Subject factors. Sub-regional administrative division involved in the planning scope is complex [7], which increases its difficulty, while non-governmental organizations fail to provide sufficient support. (2) Dynamic factors. The interest community in the sub-region hasn't really formed yet, and national support level isn't enough. (3) Operating factors. The level of urbanization in the sub-region isn't high, the competitiveness of the core cities isn't strong, the degree of integration isn't enough, the industrial structure is highly converging, and administrative barriers and market segmentations are serious. (4) Security factors. The cooperative security mechanism is imperfect, and there isn't effective incentive and restraint mechanism. Interest sharing and compensation mechanism hasn't been established yet [8].

Data and Methodology

Combining the different sub-regional cooperation modes and the restrictive factors of cooperation in the central region, we study the measure and comprehensive score of sub-regional cooperation conditions from subject mechanism, internal dynamic mechanism, external dynamic mechanism and security mechanism, and evaluate the sub-regional cooperation conditions [9].

In Table 1, the object of this study is 8 typical sub-regions in the central region, including 24 prefecture-level cities, 6 counties and 1 county-level forest area. In order to make the statistics of the panel data consistent, the data of the county level unit are treated as follows: the six counties of Chongqing is considered as a region, assuming it is the East Chongqing area; Shennongjia forest region is a county, and it's close to Yichang, so they are regarded as the area of Yishen. This paper divides the research objects into two spatial dimensions, one is 8 sub-regions, the other is 25 regions.

This paper selects 2011-2015 years as the research time of empirical analysis. Urban data mainly originates from "China's urban statistical yearbook 2012-2015", the statistical yearbook of Shaanxi, Shanxi, Henan, Anhui, Hubei, Hunan, Chongqing and Jiangxi, as well as the annual report and statistical bulletin of the related cities. Sub-regional data is accumulated by regional data. The regional sample data is 1500 and the sub-regional sample data is 140.

Table 1 Division of Sub-regional Cooperation in the Central Region

Typical sub-region in central region(8)	Region(25)	County
"Yuncheng-Linfen-Sanmenxia-Weinan" Golden Triangle Sub-region of the Yellow River	Yuncheng	-
	Linfen	-
	Sanmenxia	-
	Weinan	-
"Xinyang-Fuyang-Huainan-Bengbu" Sub-region of the Middle Reaches of Huaihe	Xinyang(Intersecting area)	-
	Fuyang	-
	Huainan	-
	Bengbu	-
"Xinyang-Huanggang-Anqing-Lu'an" Sub-region of the Ring Dabie Mountains	Xinyang(Intersecting area)	-
	Huanggang(Intersecting area)	-
	Anqing(Intersecting area)	-
	Lu'an	-
Sub-region of Ecological Economic Cooperation of the Three Gorges	the East Chongqing area	Wanzhou Kaixian Yunyang Fengjie Wushan Wuxi
	the area of Yishen	Shennongjia forest region
	Jingzhou(Intersecting area)	-
	Jingmen Enshi Zhangjiajie	- - -
"Xianning-Yueyang-Jiujiang" Small Triangle Sub-region	Xianning	-
	Yueyang(Intersecting area)	-
	Jiujiang(Intersecting area)	-
"Jiujiang-Huanggang-Huangshi" Cross River Sub-region	Jiujiang(Intersecting area)	-
	Huanggang(Intersecting area)	-
	Huangshi	-
"Jingzhou-Yueyang-Changde-Yiyang" Ecological Economic Sub-region of Dongting Lake	Jingzhou(Intersecting area)	-
	Yueyang(Intersecting area)	-
	Changde	-
	Yiyang	-
"Jiujiang-Anqing-Chizhou-Jingdezhen" Sub-region	Jiujiang(Intersecting area)	-
	Anqing(Intersecting area)	-
	Chizhou	-
	Jingdezhen	-

The variables selected in this article are shown in Table 2. The sub-regional cooperation conditions in the central region include subject mechanism(*Sub*), internal dynamic mechanism(*Int*), external dynamic mechanism(*Ext*) and security mechanism(*Sec*) 4 two level indexes and 15 three grade indexes, and the comprehensive scores are

$$Z_{i,t}=f(\text{Sub}_{i,t}, \text{Int}_{i,t}, \text{Ext}_{i,t}, \text{Sec}_{i,t})(1)$$

In order to avoid multicollinearity, this paper uses the SPSS17 statistical analysis software to measure the level of cooperation conditions in different years by using the time series global principal component analysis method. Based on the original observation data, the global variables are processed dimensionless, and then the validity analysis is carried out. It can be tested by KMO test and Bartlett sphere test, 3 principal components are extracted, and variance accounts for 88.593% of the total variance, which is suitable for factor analysis.

Table 2 The Variables of Sub-regional Cooperation Conditions in the Central Region

Variable	Symbol	Variable measure	Unit
Subject mechanism	Sub	Financial Expenditure /GDP	%
		Value added for industrial enterprises above scale	Hundreds of millions Yuan
		R&D personnel	person
Internal dynamic mechanism	Int	Total industrial output value for domestic enterprises above scale	Hundreds of millions Yuan
		Total retail sales of consumer goods	Hundreds of millions Yuan
		Total import	Hundreds of millions dollars
External dynamic mechanism	Ext	Actually utilized foreign capital	Hundreds of millions dollars
		Total export	Hundreds of millions dollars
Security mechanism	Sec	Broadband Internet access number of 100 people	Households / 100 people
		The number of students in Colleges and Universities	Person
		Accepting an application for a patent for invention	Piece
		Domestic tourist reception income	Hundreds of millions Yuan
		Energy consumption in unit industry	Tons of standard coal / 10000 yuan
		Every 10000 people have green space	Hectare / 10000 people
		Road mileage / Area	Km / sq km

Results

The detailed results are shown in Table 3 and Table 4, it can be seen that the sub regional cooperation conditions in the central region have shown an obvious upward trend in the two levels of sub-region and region, but the annual and spatial differences are obvious.

From table 3, at the sub-region level, the mean value of sub-regional cooperation in the central region increases year by year in 2011-2015, from 1.00 in 2011 to 1.44 in 2015, with an increase of 0.44. The sub-regional cooperation conditions show a polarization trend. The Sub-region of the Three Gorges Ecological Economic Cooperation and the Ecological Economic Sub-region of the Dongting Lake belong to the first echelon, the other 6 sub-regions belong to the second echelon, and the spatial differences of the two echelons increase year by year. This shows that the gap in the development level of the sub-region is mainly manifested in the gap between the two echelons.

Table 3 Comprehensive Scores of the Cooperation Conditions at the Sub-region level

Sub-region	2011	2012	2013	2014	2015
Golden Triangle Sub-region of the Yellow River	0.989	1.083	1.146	1.192	1.180
Sub-region of the Middle Reaches of Huaihe	0.843	0.942	1.042	1.119	1.204
Sub-region of the Ring Dabie Mountains	1.016	1.137	1.245	1.367	1.450
Sub-region of Ecological Economic Cooperation of Three Gorges	1.405	1.611	1.795	1.989	2.145
"Xianning-Yueyang-Jiujiang" Small Triangle Sub-region	0.887	1.021	1.143	1.261	1.356
"Jiujiang-Huanggang-Huangshi" Cross River Sub-region	0.752	0.851	0.950	1.043	1.100
"Jiujiang-Anqing-Chizhou-Jingdezhen" Sub-region	0.794	0.891	0.970	1.064	1.126
Ecological Economic Sub-region of Dongting Lake	1.314	1.504	1.667	1.845	1.990

From Table 4, at the region level, the gradient pattern of sub-regional cooperation conditions is basically stable in the central region in 2011-2015. The highest comprehensive score was the area of "Yishen", the lowest was Zhangjiajie; The top three of the increase were "Yishen" (1.24), Yueyang (0.97) and Changde (0.89), and the last two were Huainan (0.06) and Linfen (0.03).

The comprehensive score threshold of cooperative conditions is defined as 1.2. The area with a comprehensive score greater than 1.2 is defined as strong cooperative condition (S), the area with a comprehensive score less than or equal to 1.2 is defined as weak cooperative condition (W). From Table 4, at the region level, the timing and spatial differences of the cooperation conditions are

more significant in 2011-2015. Yuncheng, Huainan, Lu'an, Enshi, Zhangjiajie, Xianning, Chizhou and Jingdezhen are always weak cooperative condition, while Xinyang, the area of "Yishen", Yueyang, Jiujiang and Changde are strong cooperative condition. There are 12 areas of strong and weak type change, of which 11 areas from weak to strong, only Linfen from strong to weak.

Table 4 Comprehensive Scores and Types of the Cooperation Conditions at the Region level

Region	2011		2012		2013		2014		2015	
Yuncheng	1.003	W	1.054	W	1.125	W	1.186	W	1.158	W
Linfen	1.120	W	1.204	S	1.207	S	1.197	W	1.146	W
Sanmenxia	1.049	W	1.133	W	1.189	W	1.224	S	1.244	S
Weinan	1.015	W	1.196	W	1.331	S	1.441	S	1.449	S
Xinyang	1.260	S	1.390	S	1.560	S	1.734	S	1.853	S
Fuyang	0.842	W	0.950	W	1.048	W	1.131	W	1.250	S
Huainan	0.700	W	0.771	W	0.808	W	0.779	W	0.760	W
Bengbu	0.770	W	0.878	W	0.994	W	1.094	W	1.236	S
Huanggang	1.031	W	1.177	W	1.315	S	1.457	S	1.568	S
Anqing	1.199	W	1.341	S	1.399	S	1.524	S	1.592	S
Lu'an	0.810	W	0.906	W	0.997	W	1.072	W	1.128	W
the East Chongqing area	1.155	W	1.270	S	1.394	S	1.550	S	1.680	S
the area of Yishen	2.126	S	2.492	S	2.797	S	3.111	S	3.362	S
Jingzhou	1.029	W	1.180	W	1.317	S	1.461	S	1.569	S
Jingmen	0.930	W	1.071	W	1.187	W	1.293	S	1.370	S
Enshi	0.413	W	0.476	W	0.545	W	0.604	W	0.662	W
Zhangjiajie	0.294	W	0.334	W	0.361	W	0.405	W	0.442	W
Yueyang	1.874	W	2.170	W	2.398	W	2.634	W	2.848	W
Jiujiang	1.240	S	1.401	S	1.580	S	1.756	S	1.877	S
Huangshi	0.914	S	1.026	S	1.129	S	1.202	S	1.212	S
Chizhou	0.368	W	0.412	W	0.456	W	0.497	S	0.537	S
Jingdezhen	0.557	W	0.620	W	0.671	W	0.728	W	0.762	W
Xianning	0.643	W	0.751	W	0.860	W	0.951	W	1.016	W
Changde	1.787	S	2.011	S	2.235	S	2.481	S	2.673	S
Yiyang	0.872	W	1.007	W	1.108	W	1.236	S	1.336	S

Conclusions

Through the measurement and comprehensive scoring of sub-regional cooperation conditions, this paper studies the sub-regional cooperation conditions in the central region. In order to contribute to sub-regional cooperation in the central region, firstly, the government can set up specialized agencies to coordinate sub-regional development [10], and play the main role of non-governmental organizations. Secondly, the government should uphold top-level design, plan ahead and institutional innovation, and support and create sub-regional cooperation zones [11]. Thirdly, the government should promote the new urbanization, strengthen the industrial integration and promote the coordinated development of sub-regions. Finally, we should perfect the cooperation security mechanism, establish an effective incentive and restraint mechanism, and establish the benefit sharing and compensation mechanism.

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