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Economic Transformation Capacities and Developmental Countermeasures of Coal-resource-based Counties of China

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Abstract: In China, the economic systems of many small-scale resource-based regions are confronted with realizing sustainable development through economic transformation. This paper, taking 37 coal-resource-based counties in China as objects, evaluates the economic transformation capacities of the counties by principal component analysis (PCA). Based on the comprehensive principal component values of >1, 0–1 and <0, the economic transformation capacities of the counties are classified into strong, common and weak grades. Then, the paper proposes the developmental countermeasures according to different transformation capacities. For the counties with strong transformation capacities, it is crucial to make scientific positioning and rationally exploite resources in view of the developing characteristics and modes of those counties; as for the counties with common transformation capacities, the preparation and perfection of basic transformation conditions are still important aspects; as for the counties with weak transformation capacities, shifting from ″passive transfromation″ to ″active transformation″ in light of resources conditions is necessary.

Keywords: coal-resource-based county; economic transformation capacity; development countermeasure

1 Introduction

Resource-based regional economy is an important regional economic category in the system of regional economy in China. However, because of the constraint of resource structure and the unicity of industrial structure, usually, there are various obstacles in the process of regional economy′s sustainable development.

Foreign research of resource-based regions originated in 1930s, which was marked by the Canadian geographer H A Innis′s research of resource-based towns (Innis, 1940), initial attention was mainly paid to those emerging social problems, and the research scale was restricted to single town or particular regions (Burgess, 1925; Robison, 1962). Later on, relevant researches gradually focused on problems such as resource-based regions′ internal structure such as lifecycle, development stage, industrial structure, labor force structure and so on. Meanwhile, the research scale has been shifting from the empirical study which emphasizes on individual to the empirical and normative study (Bradbury, 1979; Hayter and Barnes, 1992; Randall and Ironside, 1996).

In China, researches on resource-based regions began after the foundation of People′s Republic of China in 1949. Before the 1990s, relevant researches were mainly exploitation-directed for the sake of national large-scale economic construction, and involved resources exploitation, settlement establishement, planning, regional development strategies and so on (Li, 1978; Ma and Sun, 1981; Wei, 1981; Liang, 1985; Ma, 1985). After the 1990s, with the advancement of sustainable development view, researchers paid more and more attention to various problems that appeared in the process of resource-based regional development. Particularly, in the process of the operation of the revitalizing northeast old industrial base, the issues of resource-based regional sustainable development and economic transformation were gradually emphasized. For instance, Fan (1993), Cheng (1994) and Liu (2000) made further research into the industrial structure adjustment of some resource-based regions. And other researchers studied the issues of the sustainable development of resource-based regions and the relevant problems in the process of economic

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transformation (Shen, 1998; Shen and Cheng, 1999; Zhao, 1999; Zhou, 2000; Wang, 2003; Zang *et al*., 2006; Zhang *et al*., 2008).

However, in previous researches the objects were mainly large-scale regions such as provinces and cities. Currently in China, not only medium and large regions, but also a large number of resource-based small-scale regions are faced with the problem of resource exhausition and the task of ecomomic transformation, particularly counties.

Coal-resource-based counties in China have common economic characteristics of counties on one hand, take coal-resource-based industry as their leading industries or pillar industries on the other hand. They are characterized by unitary industry and product, agglomerated industry distribution and low ecomonic benefit. Viewed from the society, the urbanization in the counties is so fast that the urban-rural dualistic structure is obvious, the problems of economy, society and environment are serious because of unreasonable exploitation of resources, and the regional functions, especially living and culture functions, are not perfect (Zhu, 2005). In addition, the economic development of coal-resource-based counties not only has different periods, i.e., preparatory period, growing period, mature period and recession period, corresponding to the resource exploitation cycle (Ma and Zhang, 2004), but also has instability due to technology progress, which can accelerate or decelerate the evolution of the economic development.

Generally, due to the relatively small population scale, the economic and social problems brought about by resources exhausition and irrational industrial structure in coal-resource-based counties are not as serious as those in large-scale resource-based regions such as coal-resource-based cities. However, the degree of the dependence on resources is usually higher, and economic system is more vulnerable in coal-resource-based counties than in large-scale resource-based regions.

On account of the long time for coal exploitation and regional development, most of the coal-resource-based counties in China have been in the middle-age period of resource exploitation, and some have already been in the agedness because of resources exhaustion (Guo, 1999). Data from Chinese Mining Website show that there are 86.5% of couties being in middle-age and agedness periods. Therefore, it is urgent to pay more attention to those small-scale resource-based counties, seeking and exploring a scientific way of sustainable development, which will be politically, economically as well as socially meaningful. For that reason, this paper will probe into the economic development countermeasures for coal-resource-based counties in China through evaluating economic transformation capacity.

2 Data Sources and Methods

2.1 Data sources

The data used in this study were taken from *China Country Statistical Yearbook 2006* (Department of Rural Serveys, National Bureau of Statistics, 2006), *China Statistical Yearbook for Regional Economy 2006* (Department of Comprehensive Statistics of National Bureau of Staistics, 2007), *China City Statistical Yearbook 2006* (Department of City Serveys, National Bureau of Statistics, 2007), *China Mining Yearbook 2006* (Editorial Board of China Mining Yearbook, 2007), *Tabulation on the 2000 Population Census for Each County of China* (Popolation Census Office under the State Council; Department of Population Statistics, State Statistical Bureau, People′s Republic of China, 2001), http://www.chinamining.com.cn, *etc*.

2.2 Methods

According to *China Mining Yearbook 2006* (Editorial Board of China Mining Yearbook, 2007) and Chinese Mining Website (http://www.chinamining.com.cn), this paper selected 37 coal-resource-based counties in China as research objects.

In the evaluation, the principles for index selection were as follows: first, the index should reflect the economic characteristics; second, it should consider social, economic, resources and environmental system conditions comprehensively; third, it should avoid the regional scale differences; fourth, the index should be available. Based on the above principles, 14 indexes, which relate to aspects of economy, finance, infrastructure, industry, social foundation, resources, *etc*., were selected (Table 1) (Zhang, 2007; Li and Zhang, 2008). Then, the principal component analysis (PCA) was adopted in the evaluation of economic transformation capacity (Yu and Ren, 1999; Xu, 2002). According to the scree plot, we chose five principal components as new factors for economic transformation capacity, whose eigenvalues are greater than one (Table 2).

Table 1 Index system for economic transformation capacity of coal-resource-based county

	Index	Some index's calculation method	Role of the index
x_1	Per-capita GDP (yuan/person)		Basic economic level
x_2	Ratio of GDP growth (%)		Economic growth level
x_3	Ratio of financeself-support (%)	$\frac{\text{financial revenue}}{\text{financial expenditure}} \times 100\%$	Financial self-supply ability
x_4	Density of fixed assets investment ($\times 10^4$ yuan/km^2)	$\frac{\text{total investment in fixed assets}}{\text{land area of administrative region}} \times 100\%$	Infrastructure development ability
x_5	Comprehensive development index of industry	$\delta = \frac{1}{\sum \lvert X_m - X_n \rvert}$ (X_m: proportion of output value of industrial department m, X_n: proportion of output value of industrial department n)	Comprehensive development ability of industry
x_6	Proportion of industry output value of non-mining industry (%)		Non-mining industry development ability
x_7	Proportion of employee of non-mining industry (%)		Employment structure of labor force
x_8	Proportion of actual utilization of foreign capital (%)	$\frac{\text{actual foreign capital}}{\text{total investment in fixed assets}} \times 100\%$	Economic openness ability
x_9	Balanc of urban and rural residents' savings ($\times 10^4$ yuan)		Capital accumulation ability
x_{10}	Proportion of registered unemployment in towns (%)	$\frac{\text{registered unemployment}}{\text{town population}} \times 100\%$	Social stability
x_{11}	Urbanizaion (%)	$\frac{\text{town population}}{\text{total population}} \times 100\%$	Social development level
x_{12}	People of education background over junior college per thousand (person)	According to *Tabulation on the 2000 Population Census for Each County of China*	Labor force quality
x_{13}	People in scientific research and comprehensive technical service (person)		Regional innovation level
x_{14}	Intensity of resources exhausition	According to evaluation of resources exploration period (infancy=0.3; middle-age=0.6; agedness=0.9)	Resource support ability

Sources: *China County Statistical Yearbook 2006* (Department of Rural Serveys, National Bureau of Statistics, 2006), *China Statistical Yearbook for Regional Economy 2006* (Department of Comprehensive Statistics of National Bureau of Staistics, 2007), *China City Statistical Yearbook 2006* (Department of City Serveys, National Bureau of Statistics, 2007), *Tabulation on the 2000 Population Census for Each County of China* (Popolation Census Office under the State Council; Department of Population, Social, Science and Technology Statistics, National Bureau of Statistics of China, 2002), http://www.chinamining.com.cn, *etc*.

3 Evaluation on Economic Transformation Capacity

After the component matrix rotation (Table 3), we can see that the first principal component (Z_1) has greater load in x_1, x_3, x_4, x_6 and x_7, reflecting the general economic development level; the second principal component (Z_2) has greater load in x_{11} and x_{12}, reflecting the social development level; the third principal component (Z_3) has greater load in x_9 and x_{13}, reflecting the self-accumulation capacity and innovation capacity, that is, the developmental potentiality; the fourth principal component (Z_4) has greater load in x_2, x_5 and x_{14}, reflecting the economic development capacity under re-

Table 2 Eigenvalue and total variance explained

Component	Eigenvalue	Variance (%)	Cumulative variance (%)
Z_1	4.0933	29.2382	29.2382
Z_2	2.3390	16.7069	45.9451
Z_3	1.5183	10.8451	56.7902
Z_4	1.2141	8.6723	65.4626
Z_5	1.1764	8.4029	73.8655
Z_6	0.9003	6.4307	80.2962
Z_7	0.7706	5.5044	85.8005
Z_8	0.6655	4.7536	90.5542
Z_9	0.5058	3.6130	94.1671
Z_{10}	0.3045	2.1753	96.3424
Z_{11}	0.2050	1.4646	97.8070
Z_{12}	0.1842	1.3160	99.1230
Z_{13}	0.0822	0.5874	99.7104
Z_{14}	0.0405	0.2896	100.0000

Table 3 Principal component load

Component	First (Z_1)	Second (Z_2)	Third (Z_3)	Fourth (Z_4)	Fifth (Z_5)
x_1	0.711	0.201	0.403	–0.207	0.278
x_2	0.481	0.227	0.109	0.638	–0.074
x_3	0.630	–0.109	0.552	–0.020	0.343
x_4	0.807	0.117	0.142	–0.184	–0.056
x_5	–0.375	–0.127	–0.035	0.661	–0.270
x_6	–0.719	–0.185	0.105	–0.209	–0.092
x_7	–0.785	0.198	0.287	0.080	0.098
x_8	–0.096	–0.103	0.094	0.061	0.735
x_9	0.274	–0.419	0.658	–0.208	0.255
x_{10}	–0.163	–0.129	0.024	0.064	–0.792
x_{11}	0.230	0.914	–0.104	–0.065	0.025
x_{12}	0.224	0.938	0.090	–0.089	0.013
x_{13}	–0.161	0.118	0.831	0.088	–0.083
x_{14}	–0.046	–0.132	–0.038	0.730	0.162

source-constrained conditions; the fifth principal component (Z_5) has greater load in x_8 and x_{10}, reflecting the social stability and open conditions, that is, the social developmental environment. By analyzing eigenvalues, results of the first principal component are the best with the value of 4, which is obviously different from other principal components. By analyzing indexes, there is a negative correlation between indexes of non-resource-based industry (x_6 and x_7) and comprehensive indexes (x_1, x_3 and x_4). This indicates that the comprehensive strength of coal-resource-based counties is low, the capacity of economic diversification is weak and the economic structure especially the industrial structure tends to be unitary. Therefore, the secondary industry which takes coal industry as the main always makes more contribution to regional economy, and the non-resource-based industry makes less contribution.

By calculating the values of each principal component based on the load (Table 4), we got the comprehensive value according to the contribution rate of each principal component (Table 5). And then we used these comprehensive principal component values to reflect the economic transformation capacity.

We take zero as the basic critical value of the comprehensive values, that is to say, zero is the average level in economic transformation capacity for the 37 counties. The value that is lower than zero means that the economic transformation capacity is lower than the average level, the value that is higher than zero means that the capacity is higher than the average level, and the value that is higher than one means that the capacity is relatively strong. Based on the comprehensive principal component values of >1, 0–1 and <0, economic transformation capacities of 37 counties can be classified into strong, common and weak grades, respectively (Table 6).

There are only four counties with strong capacity, which account for 10.8% of the studied counties; 12 counties with common capacity, which account for 32.4%; and 21 counties with weak capacity, which takes up 56.8%.

According to the spatial distribution, counties with strong or common capacities are mainly distributed in the eastern and central regions of China (Fig. 1). Especially, for the 16 counties whose comprehensive value larger than zero, 68.8% of them are distributed in Shandong, Shanxi and Henan provinces. For example, in these three provinces, Yima and Longkou′s grades are strong; Zoucheng, Yanzhou, Xinmi and Dengfeng′s degrees are common. These reflect the obvious location directivity of the economic transformation capacity. On one hand, these three provinces′ coal resources are relatively richer and their mining conditions are better. On the other hand, regional coal resources demand of the provinces is relatively large because they are close to Beijing-Tianjin-Tangshan industrial base in the north and Shanghai- Ningbo-Hangzhou energy consumption center in the south, and are distributed in the industrial

Table 4 Principal component value and order

Order	County	First (Z_1)	County	Second (Z_2)	County	Third (Z_3)	County	Fourth (Z_4)	County	Fifth (Z_5)
1	Yima	5.726	Manzhouli	4.072	Zoucheng	4.868	Beipiao	5.573	Zixing	3.543
2	Huolinguole	3.421	Huolinguole	3.904	Longkou	4.634	Heshan	2.956	Longkou	3.372
3	Longkou	2.850	Yima	3.803	Xinmi	1.695	Fengcheng	1.984	Xintai	2.590
4	Manzhouli	2.545	Hetianshi	2.555	Xintai	1.629	Xuanwei	1.822	Feicheng	2.020
5	Yanzhou	1.670	Diaobingshan	2.428	Yanzhou	1.600	Bijie	1.372	Dengfeng	1.666
6	Xinmi	1.574	Huichun	1.802	Feicheng	1.301	Leiyang	0.838	Huolinguole	1.491
7	Dengfeng	1.201	Gujiao	0.857	Xingyang	1.006	Lingwu	0.462	Yanzhou	1.333
8	Zoucheng	0.948	Lingwu	0.733	Tengzhou	0.891	Hetianxian	0.387	Gaoping	1.197
9	Xingyang	0.765	Duyun	0.517	Xuanwei	0.761	Leping	0.355	Xinmi	1.055
10	Diaobingshan	0.653	Heshan	0.408	Manzhouli	0.675	Huolinguole	0.306	Leiyang	0.840
11	Xintai	0.633	Yanzhou	0.127	Dengfeng	0.390	Hetianshi	0.245	Gujiao	0.816
12	Gujiao	0.476	Hancheng	0.054	Hetianshi	0.386	Hancheng	0.043	Zoucheng	0.725
13	Heshan	0.449	Jiexiu	–0.092	Yuzhou	0.246	Gaoping	0.039	Xingyang	0.657
14	Jiexiu	0.418	Zixing	–0.125	Zixing	0.148	Duyun	0.027	Huozhou	0.540
15	Yongcheng	0.286	Huozhou	–0.183	Gaoping	0.075	Zixing	0.006	Heshan	0.535
16	Gaoping	0.229	Longkou	–0.229	Jiexiu	–0.250	Dengfeng	–0.031	Yuzhou	0.459
17	Tengzhou	0.143	Zoucheng	–0.401	Leiyang	–0.280	Ruzhou	–0.223	Hancheng	0.060
18	Feicheng	0.109	Huaying	–0.490	Huolinguole	–0.283	Huichun	–0.276	Jiexiu	0.055
19	Yuzhou	0.100	Xinmi	–0.568	Duyun	–0.383	Huozhou	–0.282	Yongcheng	0.008
20	Hancheng	0.008	Beipiao	–0.674	Huozhou	–0.412	Feicheng	–0.366	Lianyuan	–0.108
21	Lingwu	–0.233	Feicheng	–0.679	Lianyuan	–0.453	Xingyang	–0.381	Manzhouli	–0.388
22	Zixing	–0.680	Xingyang	–0.702	Hancheng	–0.454	Xinmi	–0.404	Diaobingshan	–0.504
23	Huozhou	–0.748	Dengfeng	–0.758	Fengcheng	–0.467	Xintai	–0.461	Huichun	–0.544
24	Huichun	–0.880	Xintai	–0.886	Ruzhou	–0.526	Zoucheng	–0.511	Tengzhou	–0.671
25	Leiyang	–0.983	Tengzhou	–0.904	Gujiao	–0.580	Yuzhou	–0.595	Lingwu	–0.755
26	Fengcheng	–1.131	Shulan	–0.965	Yongcheng	–0.653	Jiexiu	–0.598	Yima	–0.809
27	Ruzhou	–1.284	Yongcheng	–1.028	Bijie	–0.668	Lianyuan	–0.717	Shulan	–0.875
28	Duyun	–1.360	Lianyuan	–1.054	Diaobingshan	–0.787	Yima	–0.733	Bijie	–0.883
29	Hetianshi	–1.449	Gaoping	–1.109	Leping	–0.985	Yongcheng	–0.816	Ruzhou	–0.926
30	Xuanwei	–1.475	Yuzhou	–1.122	Yima	–1.149	Manzhouli	–0.903	Duyun	–1.056
31	Lianyuan	–1.526	Bijie	–1.124	Lingwu	–1.301	Gujiao	–1.110	Hetianshi	–1.140
32	Huaying	–1.575	Fengcheng	–1.252	Beipiao	–1.333	Yanzhou	–1.171	Fengcheng	–1.335
33	Leping	–1.745	Ruzhou	–1.296	Heshan	–1.336	Longkou	–1.618	Huaying	–1.477
34	Beipiao	–1.769	Leiyang	–1.325	Huaying	–1.439	Shulan	–1.817	Hetianxian	–2.594
35	Bijie	–2.244	Xuanwei	–1.336	Huichun	–1.759	Tengzhou	–1.948	Beipiao	–2.597
36	Hetianxian	–2.550	Leping	–1.450	Shulan	–2.094	Diaobingshan	–2.082	Xuanwei	–2.667
37	Shulan	–2.571	Hetianxian	–1.509	Hetianxian	–2.710	Huaying	2.082	Leping	–3.632

belts along the eastern coastal line and Longhai-Lanxin railway line. These provinces are the coal-resource-based regions in China with good transportation conditions and comprehensive location advantages. In addition, Huolinguole and Manzhouli in Inner Mongolia Autonomous Region are comparatively special. As for their economic transformation capacities, Huolinguole ranks the second and Manzhouli ranks the fourth in the overall order. But the mechanism for their strong capacity is different. According to the basic data and the result of

Table 5 Comprehensive value and order of counties

Order	County	Province (region)	Value
1	Yima	Henan	2.053
2	Huolinguole	Inner Mongolia	1.774
3	Longkou	Shandong	1.441
4	Manzhouli	Inner Mongolia	1.387
5	Zoucheng	Shandong	0.755
6	Yanzhou	Shandong	0.693
7	Xinmi	Henan	0.603
8	Dengfeng	Henan	0.404
9	Xintai	Shandong	0.391
10	Heshan	Guangxi	0.356
11	Diaobingshan	Liaoning	0.288
12	Xingyang	Henan	0.238
13	Feicheng	Shandong	0.198
14	Gujiao	Shanxi	0.192
15	Zixing	Hunan	0.095
16	Jiexiu	Shanxi	0.032
17	Gaoping	Shanxi	–0.006
18	Hancheng	Shanxi	–0.029
19	Hetianshi	Xinjiang	–0.030
20	Lingwu	Ningxia	–0.110
21	Yuzhou	Henan	–0.144
22	Huichun	Jilin	–0.217
23	Yongcheng	Henan	–0.229
24	Tengzhou	Shandong	–0.238
25	Huozhou	Shanxi	–0.273
26	Leiyang	Hunan	–0.396
27	Duyun	Guizhou	–0.439
28	Beipiao	Liaoning	–0.509
29	Fengcheng	Jiangxi	–0.531
30	Xuanwei	Yunnan	–0.638
31	Lianyuan	Hunan	–0.743
32	Ruzhou	Henan	–0.746
33	Bijie	Guizhou	–0.872
34	Huaying	Sichuan	–1.003
35	Leping	Jiangxi	–1.134
36	Shulan	Jilin	–1.371
37	Hetianxian	Xinjiang	–1.476

principal component analysis, the mechanism for Huolinguole is endogenous driving, that is, the region gets self-increasing by transforming resources capital into regional development energy inside, while the mechanism for Manzhouli is external driving, that is, the high transformation capacity of this region is driven mainly by non-resource economy depending on perfect port conditions.

Table 6 Grades of economic transformation capacity

Capacity	Grade	Region
>1	Strong	Yima, Huolinguole, Longlou, Manzhouli
0–1	Common	Zoucheng, Yanzhou, Xinmi, Dengfeng, Xintai, Heshan, Diaobingshan, Xingyang, Feicheng, Gujiao, Zixing, Jiexiu
<0	Weak	Gaoping, Hancheng, Hetianshi, Lingwu, Yuzhou, Huichun, Yongcheng, Tengzhou, Huozhou, Leiyang, Duyun, Beipiao, Fengcheng, Xuanwei, Lianyuan, Ruzhou, Bijie, Huaying, Leping, Shulan, Hetianxian

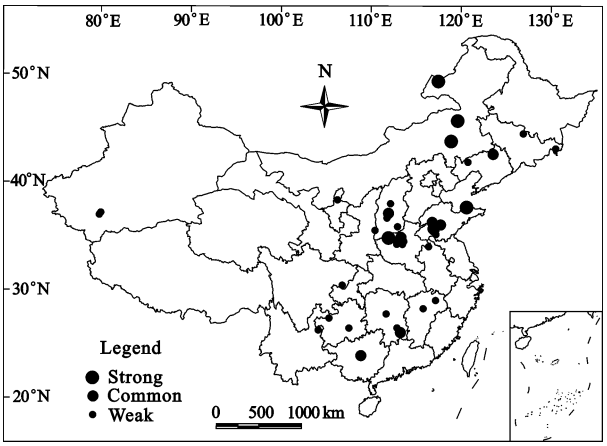

Fig. 1 Distribution of coal-resource-based counties with different economic transformation capacities in China

4 Developmental Countermeasures

According to the principal component structure, the first and the second principal components can be viewed as basic factors due to their good manifestations, whose cumulative percentage is about 45.9%; the third, the fourth and the fifth principal components can be viewed as promotive factors due to the total 27.9% of the cumulative percentage. From the principal component presentation, basic factors have greater effects on the transformation capacity of the coal-resource-based counties. The higher the economic and the social development level, the better the economic strength and the social infrastructure, and this will be a better supporting capacity for the realization of resource-based counties′ active transformation.

4.1 Counties with strong transformation capacity

According to the analysis of principal component proportion (Table 7), the counties with strong transformation capacity have higher economic development level and the social development level. Definitely speaking,

Table 7 Principal component proportion (%)

Principal component value	First			Second			Third			Fourth			Fifth		
	Strong	Common	Weak	Strong	Common	Weak	Strong	Common	Weak	Strong	Common	Weak	Strong	Common	Weak
>1	57	43	0	50	17	33	14	86	0	0	20	80	22	67	11
0–1	0	62	38	0	50	50	13	25	62	10	10	80	0	50	50
<0	0	6	94	4	32	64	9	18	73	14	45	41	11	6	83

the basic factors for economic transformation are superior. For the promotive factors, the developmental potentiality and the social developmental environment are also good, but the economic development capacity under resource-constrained conditions is comparatively weak. Viewed from the developmental period (http://www.chinamining.com.cn), these counties are in the period of middle-age or infancy and rich in resources. Viewed from the way of development, these counties follow two different modes. One including Yima and Huolinguole is characterized by rich resources. The resources capital can be effictively transformed into the capital for economic development, and accumulated in the local. So the counties′ development can get powerful motivity, but strongly depends on resources. The other one including Longkou and Manzhouli is characterized by external-driving economy. As the prosperity of non-resource-based economy, these counties weakly depend on resources in their development.

In general, for the counties with strong transformation capacity, it is crucial to make scientific positioning as well as rational exploitation of resources in view of the developing characteristics and mode of those counties. For example, Yima and Huolinguole should actively adjust the structure of coal-resource-based industries, improve the technological capability, and prolong the lifecycle of resources to break away from the dependence on resources and realize sustainable development. And Longkou and Manzhouli should take coal-resource-based industries as their regional characteristic industries, and follow the way of ecological protection based on the principle of ecological harmony.

4.2 Counties with common transformation capacity

According to Table 7, for the basic factors of the counties with common transformation capacity, the general economic development level is higher than the social development level; for the promotive factors, the developmental potentiality and the developmental environment are better. Regard to the economic transformation of the counties, the preparation and perfection of social infrastructure conditions are still important, such as the accumulation of financial capital and human capital, the construction of infrastructure, the promotion of urbanization, etc. However, to achieve the rapid development in economy and the capital accumulation for transformation, it is still necessary to depend on the coal resources for a period of time. Therefore, extending coal industry chain and developing coal-related industries and upstream and downstream industries are pragmatic ways for decreasing dependence on coal resources and achieving economic transformation stage by stage. For instance，for Diaobingshan, more attention should be paid to three promotive factors, especially to the decrease in the dependence on coal resources. As a result, problems that need to be solved urgently are to improve the capacity of the diversification for economic development, and to decrease the dependence on coal resources by adjusting the structure of industries and resources, developing continuous industries, and the rationally positioning industries. At the same time, it is also necessary to improve its development potentiality and perfect development environment.

4.3 Counties with weak transformation capacity

From Table 7, it can be seen that the the counties with weak transformation capacity are comparatively poor in all basic factors and promotive factors, especially in general economic development level and development potentiality. Due to the relatively lower general economic development level, the economic development capacity under resource-constrained conditions is comparatively stronger than others from the statistic data. The reasons are as follows: firstly, the loss of resources capital leads to the decrease of benefit from coal resources; secondly, inefficient utilization and exhaustion of resources make the counties non-resources-constrained. For example, for Beipiao and Heshan which are in the agedness period of resources exploration, resources exhaustion makes them non-resource-constrained. For

these counties, countermeasures for economic transformation are mainly in two aspects: first, developing new resources to replace coal rsources, we call this ″passive transformation″; second, accumulating resources capital in the local, that is to say, keeping the benefit from coal exploration and primary processing in the local so as to promote the counties′ development effectively, we call this ″active transformation″.

5 Conclusions

This paper, taking 37 coal-resource-based counties in China as objects, evaluates the economic transformation capacities of the counties. Based on the principal component analysis, the paper assorts the economic transformation capacity and proposes the developmental countermeasures.

(1) Based on the comprehensive principal component values of >1, 0–1 and <0, the economic transformation capacities of the counties are classified into strong, common and weak grades. For one thing, the counties with weak tansformation capacity account for high proportion of the studied counties, then the counties with common transformation capacity follow, and the counties with strong transfoamation capacity take the least proportion. For another, counties with strong or common capacities are mainly distributed in the eastern and central regions of China, which reflectes the obvious location directivity of the economic transformation capacity..

(2) According to each principal component value, the paper analyses the characteristics of each grade of the coal-resource-based county, and then discusses the general developmental countermeasures in the future. For those counties with strong transformation capacities, it is crucial to make scientific positioning as well as rational exploitation of resources in view of the developing characteristics and mode of those counties; as for counties with common capacities, the preparation and perfection of basic transformation conditions are still important aspects; as for counties with weak capacities, shifting from ″passive transfromation″ to ″active transformation″ in light of resources conditions is necessary.

(3) It should be pointed out that since economic transformation is a complicated economic process, there may be a lot of factors that are intertwined and the relationships among them may be complicated. This paper only choses indexes from economy , society and resources and environment aspects for the evaluation on economic transformation capacity, therefore, it is inevitable to draw the conclusion that this paper still have some limitations, and futher exploration should be made.

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