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Systematic Evaluation of Sustainable Development of Coal District Based upon Principal Component Analysis and Research on Countermeasures

Zhu Jing and Shi Jiazhuang
School of Management and Economics of Hebei University of Science and Technology,
050000, Hebei, China

Abstract: Through comprehensive evaluation and classification of sustainable development capacity of coal districts, it has been found that districts rich in coal resource achieves no prosperity owing to rich resources but experience degradation of ecological environment, the so called "resource curse". The research has confirmed this phenomenon and proposed advices and countermeasures.

Key words: Coal district, sustainable development capacity, resource curse, comprehensive evaluation, countermeasure

INTRODUCTION

Coal has been formed in different times and distributed in large area; whereas, the distribution of coal resource is typically uneven which is mainly represented by apparent regional characteristics and richer existence in the western and northern regions than in the eastern and southern regions. The regional characteristics of coal resource are closed related with regional characteristics and geological distributions of ecological environment and with degree of richness of environmental resources such as coal and water resources (Song, 2004).Economic development in China's southern and eastern areas is not in balance with that in the northern and western areas(Chen, 2008). On one hand, economic development in the northern region is different from that in the south, the former more developed than the latter (Zhu, 1999). On the other hand, economic development in the western region is not in balance with that in the eastern region, the former far more lagged behind the latter. Hence, it could be seen that storage of coal resource in a region is not in pace and balance with regional economic development. In the research, demarcation of administrative regions is utilized as research angle, the methods for principle component analysis and cluster analysis are employed and quantitative method used to classify the basic data of State Statistics Bureau for the year 2010 in order to find out the problems through comparison and contrast.

ESTABLISHMENT OF INDEX SYSTEM

Soundness of environment is an important symbol to evaluate sustainable development and demonstrate coordination degree of resource, environment, social and

Table 1: Index of environment sustainable development

Environment system A1	Discharge of industrial sewage, waste gas and solid waste, compliance rate of industrial sewage discharge, treatment capacity of sewage treatment facilities, total amount of water resource, amount of water resource per capita, compliance rate of discharge of SO_2, industrial fume dust and ash, comprehensive utilization of industrial solid waste, wetland area, forest coverage rate, funds for rehabilitation and treatment of mine environment, percentage of investment into environmental pollution treatment in GDP, percentages of areas for rehabilitated and damaged mine environment.
Resource system A2	Possession of coal resource per capita, yield of raw coal, storage, total consnmption and consumption per capita of coal resource
Economic system A3	GDP per capita, investment into fixed asset per capita, all persounel labor productivity, financial revenue per capita, percentage of yield of tertiary industry in GDP, social retail goods per capita, social consnmption expenditure per capita, percentage of total revenue in GDP, growth rate of GDP
Social system A4	Urbanization rate, quantity of medical technical staff, residential area per capita, percentage of education expenditure in fiscal expenditure, unemployment rate, coverage rate of social insurance network, density of transportation network
Population system A5	Population density, natural growth rate of population, dependency ratio of employed population, percentage of illiterate population in total population aged no less than 15, percentage of populated received education higher than secondary technical education

Corresponding Author: Zhu Jing, School of Management and Economics of Hebei University of Science and Technology, 050000, Hebei, China

economic development. Taking into consideration of impossibility to obtain some data among all the provinces, the following indexes have been employed for calculation.

OVERALL EVALUAYION OF SUSTAINABLE DEVELOPMENT SYSTEM FOR COAL RESOURCE DEVELOPMENT

Overall evaluation of sustainable development level concerning coal resource development based upon principal component analysis: With help of SAS economic statistical software and model for principle component analysis, total scores and rankings of sustainable development systems of ecological environment in 26 provinces, municipalities and autonomous regions have been calculated in combination with percentages of influencing factors for environment sustainable development. The results are listed in the Table 2.

Based on the total scores of environment sustainable developments here above, it could be learnt that environment sustainable development levels for 11 provinces among 26 provinces in China for the year 2010 are above the average levels and the 11 places are Beijing, Zhejiang, Jiangsu, Shanxi, Guangdong, Inner Mongolia, Fujian, Liaoning, Hebei, Anhui and Hunan. The first three provinces in terms of ranking have achieved total scores of 1.152502, 0.831684 and 0.811565, respectively. The places whose environment sustainable development levels are below the average level are 15 in total, including Chongqing, Hubei, Shaanxi, Henan, Heilongjiang, Jiling, Guangxi, Xinjiang, Jiangxi, Ningxia, Yunnan, Sichuan, Guizhou, Qinghai and Gansu.

Cluster analysis of sustainable development level of coal district: After standardized treatment of raw data of 42 indexes, K-average cluster method is employed for cluster analysis of 26 provinces.

Table 2: Total score of environment sustainable development

	Environment subsystem A1	Resource subsystem A2	Economic subsystem A3	Social subsystem A4	Population subsystem A5	Total score A	Ranking
1 Beijing	0.015686	-0.705	6.747175	1.825584	2.741906	1.152502	1
2 Hebei	0.747045	-0.55321	-0.24589	0.050106	-0.07348	0.138223	9
3 Shanxi	0.332102	2.312418	-0.50661	0.018637	-0.43917	0.651662	4
4 Inner Mongolia	-0.25379	2.53981	1.102636	-0.48255	-0.8469	0.628541	6
5 Liaoning	-0.00372	-0.37124	1.613335	0.410211	0.383065	0.166205	8
6 Jiliing	-0.13168	-0.31127	0.288023	-0.08981	-0.4959	-0.1545	17
7 Heilongjiang	0.377964	-0.2091	-0.50795	-0.09055	-0.66445	-0.06167	16
8 Jiangsu	1.039003	-0.47388	2.633185	1.7325	0.919097	0.811565	3
9 Zhejiang	0.958758	-0.53643	2.83529	1.483907	1.128322	0.831684	2
10 Anhui	0.403399	-0.21768	-1.04218	-0.18464	0.163188	0.06077	10
11 Fujian	0.769865	-0.49884	0.975547	0.541262	-0.00873	0.29886	7
12 Jiangxi	0.178939	-0.42526	-1.16607	0.143026	-0.32397	-0.27654	20
13 Shandong	1.16772	-0.16817	1.239765	0.867105	0.471019	0.650133	5
14 Henan	0.77591	-0.00992	-0.99537	-0.44075	0.616235	-0.04992	15
15 Hubei	0.492545	-0.60576	-0.52746	0.445693	-0.07556	-0.02927	13
16 Hunan	0.439966	-0.47411	-0.88565	0.243979	0.187622	0.010288	11
17 Guangxi	0.169711	-0.54122	-1.45278	-0.36217	-0.08067	-0.21117	18
18 Chongqing	0.131113	-0.42262	-0.34414	0.048243	0.397613	-0.01365	12
19 Sichuan	-0.46795	-0.30364	-1.00611	-0.50751	-0.02396	-0.45523	23
20 Guizhou	-1.01808	0.146321	-2.03413	-1.14962	-0.12861	-0.87333	24
21 Yunnan	-0.44024	-0.04824	-1.36477	-0.60739	-0.35179	-0.42323	22
22 Shaanxi	-0.20833	0.361058	-0.78094	-0.31554	-0.27107	-0.03192	14
23 Gansu	-1.79481	-0.34446	-1.64011	-1.00908	-0.69172	-1.11986	26
24 Qinghai	-1.91672	0.171187	-1.48462	-1.03076	-0.80015	-0.92334	25
25 Ningxia	-1.15624	0.193435	-0.85865	-0.83693	-0.62563	-0.36336	21
26 Xinjiang	-0.89102	1.164736	-0.59154	-0.70292	-1.10631	-0.26179	19

Table 3: Assort of environment sustainable development per province in 2010

Category	Region
I	Beijing
II	Hebei, Liaoning, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan and Guangxi
III	Chongqing, Sichuan, Ynnnan, Guizhou, Gansu, Qinghai and Ningxia
IV	Shanxi, Inner Mongolia, Jiling, Heilongjiang, Shaanxi and Xinjiang

CONCLUSION

Establishment of green accounting system: Conventional national economic accounting system has a great many defects; it is established upon pure analysis of economic system, failing to take into consideration resource environment system that is closely related with economic activities. It fails to demonstrate the value of natural resources and include loss due to environmental pollution. GDP shall be "greenized" and green accounting system set up to reflect true value of resource environment; hence, effective mechanism for sustainable development could be established(Dai, 1998).

Establishment of standard orderly central finance transfer payment system: Central government shall reinforce finance transfer payment to the western regions, specifying the proportion of transfer payment to the western regions in central finance in a specific period and the increasing ratio hereof to ensure the portion of central finance transferred to the western regions. In this way, stable financial source could be formed in the long term. Moreover, prevailing international practice shall be referred to from a great many countries to work out specific legislations and rules for government transfer payment so that transfer payment is highly feasible in practice and highly authoritative, being standardized and regulated by law.

Compensations among regions: Environmental benefits in middle and lower reaches shall be calculated in currency so that the beneficiary could pay for actual benefits. Certain proportion of GDP in eastern regions shall be allotted to help development of the western regions. Communities of interests could be formed between the upper and the lower reaches through government coordination and financial support. With compensations of the upper reaches to the lower reaches, economic activities that are resulted from poverty and life pressure and have destructive effects to the environment could be reduced, financial support and guarantee to the western regions could be realized to realize transformation of economic structure and production manner in the western regions and residents in the western regions could be provided with more living and development opportunities. Meanwhile, the masses shall be encouraged in principle of just and fairness to protect ecological environment collectively and make contributions to environmental protection.

Establishment of environmental protection funds: Environmental protection funds could be sourced from pollution charge (for air and sewage pollution), charges for using natural resources (mineral resources, water and other resources) and charges paid for specific products (fuels and packaged products). In addition, through foreign cooperations and exchanges, preferential loans shall be sought with efforts from international financial institutions and developed countries and forest mortgage loans and donations from domestic and foreign civil groups and individuals shall be sought as well. The central government shall seize good opportunity to ease financial credit policies and give local government certain power to issue local bonds. Environmental protection bonds shall be issued as well to widen new funds raising channels.

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