An Empirical Research on Industrial Structure Optimization of Provincial Area Based on Two-oriented Society*

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Abstract: The article sets up an indicator system of industrial structure optimization with resource-conserving and environment-friendly indexes. Then the industrial structure optimization level of 30 provinces' in China is evaluated. The result shows that the level of industrial structure has a high coefficient with the development of economics, and it declined along the eastern, the middle, the western area gradually. The level also depends on the coordinate development of resources & environment production efficiency, relevant supporting industries, industrial innovation ability, and industrial correlation degree.
Keywords: Two-oriented society; Level of industrial structure optimization; Provincial; SPSS

1 Introduction

Since *Silent Spring* reveals the damage power of pollution which produced by human, Many economists criticized the model of economic growth in nowadays, and prompted the importance of the environment and resources. After the general assembly of United Nations in 1980, China's government tried to transform its model of economic development, many new thoughts have been cleared out, 'two-oriented society' is an important one. The idea emphasize resource-conserving and environment-friendly, hope all departments can enhance the utilization of resources and reduce environment cost by measures of technique ,management and others. It is no doubt that this idea will lead China's socioeconomic development nowadays.

Traditional industrial structure theory takes the economic growth as the only goal to achieve, and neglects the importance of environment and resources. This isn't fit for the economic development of China. (Zhang Changrong, 2006) points out the importance of environment and resources in industrial structure, and the industrial structure theory should include these two factors[1]. (Ji Xiaoyan, 2006) finds that the recycle economic theory gives the new meaning of industrial structure[2]. (Jiang Xianxiao,2007) stands at the recycle sight, reveals the pollution produced by industrial structure in China[3]. (He Dexu, 2008) thinks the optimization of industrial structure should under the restriction of environment and resources[4]. (Dong Kun,2008) constructs a dynamic model which makes the industrial structure change has multiplex goal including economic, environment and society[5]. Many researchers stand at a province sight to research the industrial structure and resources& environment, like (Zheng Airong,2001) [6], (Ma Xiaoming,2003) [7], (Zhang Yan,2003) [8], (Zhao Haixia,2003) [9] etc.

So as few researchers analyze the optimal level of industrial structure restricted by resources & environment, and this is the article trying to do. Set up the indicator system of industrial structure optimal level which bringing resource-conserving and environment-friendly indexes, and compare the provinces' optimal level in China by primary component analysis.

2 Indicator System of Industrial Structure Optimal Level Restricted by Resources & Environment

2.1 Indexes selection

The article uses 10 indexes from 3 aspects including resources & environment, rationalization of industrial structure and upgrading of industrial structure (Figure 1).

Resources & environment aspect includes 2 parts. One part is utilization ratio of resources & environment, here using comprehensive energy consumption per total output value (CETV) characterize the dependence of energy consumption in area development, water consumption per total output value (WCTV) and land using per total output value (LUTV) characterize the dependence of water and land in area development. Another part is the pollution of industries, here using three waste per total output value (TWTV) characterize the environment pressure of pollution, the three wastes

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output(ton)=chemical oxygen demand(COD) of trade waste(ton) + soot emissions and dust emissions of process gas(ton)+outputs of industrial solid wastes(ton). SPSS software requests for positive indexes, so we take the reciprocal of these four indexes characterize the effectiveness of the resources & environment production efficiency.

The rationalization of industrial structure aspect shows the correlative and coordinative ability among industries. As advantages and professional industries are different between provinces, the correlative ability between industries is more important than the coordinative ability in provincial industrial structure. The article using the sum of sensitive coefficient (SC) and influence coefficient (IC) to characterize the correlative ability between industries, and the index mark as (SCIC). It is to be noted here that we use an improved method to calculate the index in order to have more accurate economic significance. Liu Qiyun(2002)suggests make column analysis of the $\overline{B}$ matrix (full demand coefficients), make transverse analysis of $\overline{D}$ matrix (full supply coefficient), and change the calculation method of denominator[10]. And then we use 42 department's input-output table of 2002 to calculate the influence coefficient and sensitivity coefficient.

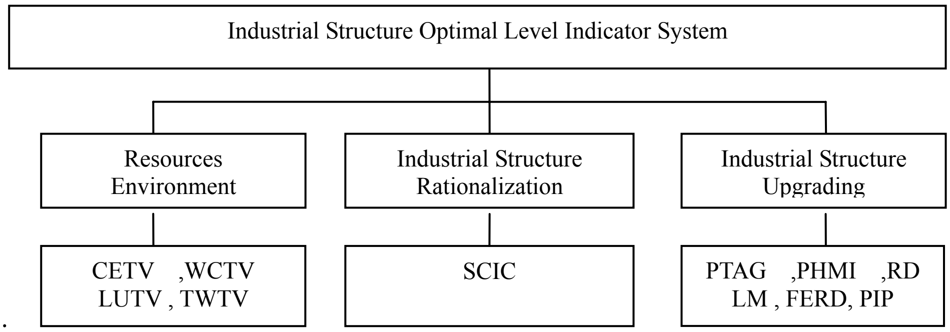

Figure 1 Industrial Structure Optimal Level Indicator System

The upgrading of industrial structure aspect shows the innovation ability which can make the industrial structure upgrade to a higher level. The advantages of industry between three industries from primary industry to secondary industry and to tertiary industry at last with the development of industrial structure. So here using the percent of tertiary industrial added value in GDP (PTAG) characterizes the development of industrial structure. The development of science & technology is the first dynamic of industrial structure upgrading. Here using the percentage of high-tech industries in manufacturing industry (PHMI), the R&D input of large and medium enterprises (RDLM), full-time equivalent of R&D workers (FERD), the possession of invention patents (PIP) these four indexes characterize the innovation ability of industries.

2.2 Sources and analysis of data

As so many data, the article use the principal component analysis method by SPSS analyses 30 provinces of China (except Tibet, some indexes of Tibet isn't in the yearbooks). The data set and collected from <China Statistics Yearbook 2009>, <China Input-output Table of 2002>, < China Statistics Yearbook of High-tech Industry 2009>. The detail data are in Table 1.

Table 1 Primary Data of Areas in China

Provence	*CETV (10000 RMB/ton standard coal)*	*WCTV (1000 RMB / m^3)*	*LUTV (10000RMB/ hectare)*	*TWTV (10000 RMB/ ton)*	*PHMI (%)*	*PTAG (%)*	*RDLM (100 million RMB)*	*FERD (10000 people year)*	*PIP*	*SCI C*
Peking	1.51	298.97	73.15	1035.71	28.36	73.20	70.97	2.69	3848	5.34
Tianjin	1.06	284.57	59.90	477.35	15.55	37.90	89.79	2.18	2439	6.32
Hebei	0.58	83.01	10.88	267.67	2.42	33.20	72.87	2.54	823	4.99
Shanxi	0.39	121.90	6.30	193.36	1.88	34.20	46.97	2.99	443	5.45
I Mongolia	0.46	44.16	0.80	277.08	2.15	33.30	26.84	1.13	251	5.08
Liaoning	0.62	94.28	10.66	230.52	4.75	34.50	128.98	4.00	900	5.80

Jilin	0.69	61.72	3.68	171.63	5.07	38.00	25.31	0.83	283	3.16
Heilongjiang	0.78	27.98	2.11	174.49	3.74	34.40	48.08	2.66	772	4.59
Shanghai	1.25	114.37	220.60	513.60	23.49	53.70	181.11	3.67	2127	5.66
Jiangsu	1.25	54.29	35.04	356.00	17.57	38.10	409.02	11.96	6471	5.27
Zhejiang	1.28	99.19	22.10	398.94	6.61	41.00	193.51	7.94	4756	4.36
Anhui	0.93	33.32	6.90	205.02	3.05	37.40	61.23	2.77	2453	5.29
Fujian	1.19	54.65	9.51	286.19	13.02	39.30	64.72	3.22	779	5.78
Jiangsu	1.08	27.67	4.29	145.54	6.89	30.90	44.86	1.44	300	4.92
Shandong	0.91	141.31	22.07	457.89	6.23	33.40	345.40	10.75	4209	6.57
Henan	0.82	80.90	12.72	282.85	3.11	28.60	90.18	4.64	1523	5.43
Hubei	0.76	41.85	7.06	193.46	6.30	40.50	77.23	3.56	1190	5.13
Hunan	0.82	34.47	5.78	126.13	4.53	37.80	63.33	2.55	1489	4.84
Guangdong	1.40	77.34	21.40	370.43	25.60	42.90	410.96	17.75	15958	5.45
Guangxi	0.90	23.13	3.81	70.82	4.00	37.40	19.61	0.71	332	4.24
Hainan	1.14	31.12	4.68	144.97	4.35	40.20	0.63	0.04	8	3.86
Chongqing	0.79	61.58	6.78	210.86	4.92	41.00	43.95	2.09	774	3.95
Sichuan	0.72	60.23	2.84	166.96	9.51	34.80	61.31	3.83	1272	4.65
Guizhou	0.35	32.72	2.11	150.28	7.07	41.30	14.10	0.57	583	4.86
Yunnan	0.64	37.22	1.75	203.20	2.41	39.10	11.18	0.69	416	4.42
Shanxi	0.78	80.17	3.55	206.30	8.69	32.90	42.01	2.49	578	4.50
Gansu	0.50	26.00	1.28	186.24	1.64	39.10	16.86	0.95	255	5.41
Qinghai	0.34	27.98	0.22	128.95	1.36	34.00	2.51	0.08	262	3.69
Ningxia	0.27	14.81	2.50	83.32	1.83	36.20	6.00	0.28	87	5.17
Xinjiang	0.51	7.96	0.65	146.39	0.47	33.90	11.82	0.43	142	4.52

3 Tests and Analysis of the Results of Primary Components Model

3.1 The evaluation process

The article using KMO and Bartlett test the results of the primary components model. The KMO test result is 0.752>0.6 and Bartlett test result is 0.000<0.05, it means the model is fit for primary components analysis (Figure 2).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.752
Bartlett's Test of Sphericity	Approx. Chi-Square	300.547
	df	45
	Sig.	.000

Figure 2 KMO and Bartlett's Test

Then the article calculates the eigenvalue and contribution of correlative matrix. And making the cumulative contribution ratio above 80%, so can explain the full information of the data (Fig 3). After the tests, the article rotated the factor loading matrix and standardizes it (Fig 3), so can get the eigenvalue of every primary component (Figure 3).

component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.432	54.316	54.316	5.432	54.316	54.316	3.786	37.864	37.864
2	2.056	20.559	74.874	2.056	20.559	74.874	3.334	33.339	71.203
3	1.010	10.102	84.977	1.010	10.102	84.977	1.377	13.774	84.977
4	.595	5.947	90.924						
5	.334	3.340	94.264						
6	.266	2.662	96.926						
7	.168	1.676	98.602						
8	.077	.768	99.369						
9	.048	.480	99.849						
10	.015	.151	100.00						

Figure 3 Total Variance Explained

	Component		
	1	2	3
CETV	.658	.562	-.077
WCTV	.717	.037	.517
LUTV	.727	.085	.224
TWTV	.855	.218	.332
PHMI	.796	.503	.092
PTAG	.924	.022	-.116
RDLM	.131	.919	.263
FERD	.057	.970	.188
PIP	.224	.925	.033
SCIC	.148	.261	.904

Figure 4 Rotated Component Matrix

According to Fig 3, the three main primary components cumulative contribution ratio is 84.799%, nearly 85%. It shows that these three main components can characterize the information of 10 indexes. According to Fig 4, the first main component includes CETV, WCTV, LUTV, TWTV, PHMI, PTAG which characterize the comprehensive level of the production efficiency of resources & environment, the development of high-tech industry and tertiary industry. The secondary component includes RDLM, FERD, PIP which characterize the ability of industrial innovation. The third component includes SCIC which means the correlation among industries.

3.2 The evaluation results

On the basis of the tests of the model, the article calculates the weight of every index and the score of every primary component in different provinces (table 2).

Table 2 Ranking of Provinces in China

Provence	First component		Second component		Third component		Co-component	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Peking	7.544	1	2.309	4	2.892	3	4.736	1
Guangdong	3.027	3	7.076	1	1.864	5	4.427	2
Shanghai	4.984	2	2.036	5	2.418	4	3.411	3
Jiangsu	1.692	5	4.246	2	1.415	6	2.649	4
Shandong	1.040	7	3.010	3	3.272	2	2.175	5
Tianjin	2.820	4	0.952	7	3.316	1	2.168	6
Zhejiang	1.206	6	1.936	6	0.026	12	1.301	7
Fujian	0.626	8	0.386	8	0.653	10	0.536	8
Liaoning	-0.548	11	-0.060	10	1.098	7	-0.090	9
Henan	-0.744	16	0.036	9	0.685	8	-0.207	10
Hubei	-0.456	9	-0.274	12	-0.221	14	-0.347	11
Anhui	-0.619	12	-0.179	11	-0.197	13	-0.378	12
Sichuan	-0.709	15	-0.327	13	-0.570	17	-0.537	13
Shanxi	-0.664	14	-0.686	16	-0.608	18	-0.663	14

Hebei	-0.894	17	-0.779	17	0.072	11	-0.692	15
Hunan	-0.902	18	-0.545	14	-0.749	21	-0.737	16
Shanxi	-1.042	21	-1.043	20	0.657	9	-0.767	17
Jiangxi	-0.974	19	-0.629	15	-0.701	19	-0.795	18
ChongQing	-0.494	10	-0.922	19	-1.436	26	-0.814	19
Heilongjiang	-1.203	24	-0.810	18	-0.970	23	-1.011	20
Hainan	-0.631	13	-1.285	22	-2.076	28	-1.122	21
Gansu	-1.282	26	-1.436	24	-0.278	16	-1.180	22
I Mongolia	-1.349	27	-1.387	23	-0.249	15	-1.185	23
Guizhou	-1.093	23	-1.503	26	-0.820	22	-1.210	24
Yunnan	-1.088	22	-1.480	25	-1.243	24	-1.267	25
Guangxi	-1.219	25	-1.274	21	-1.714	27	-1.321	26
Jilin	-1.000	20	-1.523	27	-2.356	30	-1.425	27
Ningxia	-2.007	29	-1.920	29	-0.712	20	-1.763	28
Xinjiang	-1.939	28	-1.785	28	-1.357	25	-1.784	29
Qinghai	-2.081	30	-2.141	30	-2.110	29	-2.109	30

3.3 Analysis of the results

According to table 2, Peking has the highest score of the first primary component, means it has stronger ability to promote the environment and upgrade industrial structure. Guangdong, Jiangsu and Shandong are the first three provinces in the secondary primary component, shows they have stronger ability of innovation than other provinces. Tianjin and Shandong are the first two provinces in the third provinces, so they have a better correlation between industries than other province. From the co-component's score, the article divide all the provinces to three groups: there are eight provinces are above 0, in the high level group; eleven provinces are between 0 to -1, in the middle level group; the other eleven provinces are under -1, in the low level group.

From the area sight, all of the provinces in the high level group are in the eastern region, six provinces in the central region are in the middle level group, eight western regional provinces are in the low level group, and Sichuan has a better performance which rank is 13. Provinces in the northeast region have a larger gap between themselves, Liaoning's rank is 9 nearly the high level group, Heilongjiang's rank is 20, in a lower part of the middle level group; Jilin's rank is 27, in the low level group.

The level of industrial structure has a high coefficient with the development of economics. According the gdp per capita in 2008, except Inner Mongolia for its less people, the high level groups here are still higher than other provinces in GDP per capita. And the low level group is in the same way. The three primary components are impact on each other, the former six provinces in the co-components ranks have a higher score in every primary component, if one primary component's score isn't high enough, there will be a large gap (i.e. Zhejiang compare to Tianjin; Shanxi's third primary component's rank compare to its co-component's rank). So, it's important for every province to develop these three aspects coordinatively.

4 Conclusion

Along with the problems loom large in the shortage of resources, energy and environmental pollution, the aim of the economic development should no longer pursue economic return only, but has to pay more attention to resources, energy conservation and environmental protection. This article set up the evaluation indicator system according to the present aim of economic development, and then evaluates the industrial structure optimization level of 30 provinces' in China. The result shows that the level of industrial structure has a high coefficient with the development of economics, and it declined along the eastern area, the middle, the western area gradually. The level also depends on the coordinate development of resources& environment efficiency, proportion of service industry, industrial innovation ability, and industrial correlation degree.

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