THE STUDY OF EVALUATION OF REGIONAL INNOVATION CAPABILITY OF THE HIGH-TECH INDUSTRY

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Abstract

This paper establishes a comprehensive evaluation index system which can reflect the high-tech industry innovation capability. Factor analysis is carried out using statistical data of high-tech industry innovation ability, constructing the corresponding comprehensive evaluation model. Through 30 provinces (cities and autonomous regions), quantitative analysis of statistical data found that there exists an unbalanced development in the high-tech industry between Eastern and Western parts of China; the eastern parts show obvious advantages and a steadily increasing trend. Finally, according to the method of factor scores by cluster, these 30 provinces are divided into three categories, and then provide constructive suggestions of how to accelerate the developmental level of the high-tech industry.

Introduction

The high technology industry is the strategic industry of our economy, playing an important role in promoting the transformation and upgrading of the industrial structure and economic growth mode. This technological industry's development level is related to the comprehensive competitiveness of country or region. In recent years, China's high technology industry has been rapidly developing, making great contributions to the development of the Chinese economy. Yet, at the same time, the rapid development of the high-tech industry also has many problems, such as the fact that the regional high technology industry development is not balanced and the innovation input and output efficiency still contains many problems. Due to the high technology industry with the characteristics of intensive technology and knowledge, resource consumption, and lower quantity, the factors of technological innovation guide the industry development, also determining the level of development of the high-tech industry in various regions. Therefore, an analysis of the influencing factors of the industry's development put forward the opinions and suggestions to improve the technological innovation capability of it, all of which is greatly significant to promoting the rapid growth of the high technology field.

The key problem of the evaluation of technological innovation capability in this industry is the establishment of a comprehensive and feasible evaluation index system and the choice of scientific and reasonable evaluation methods. In the research for this evaluation system, Yang Qingfeng [1] with fourteen years in the high-tech industry's sub regional panel data, used the stochastic frontier model to analyze the factors of the area's innovation efficiency and effect; Yang Yi, XueHuijuan [2] constructs the index system of independent innovation ability of industrial technology from the input capacity, configuration capability, supporting ability, output ability and so on; Feng Wei Yi [3] used statistical data of fifteen years and empirical research on the influence of competitiveness in the industry through technical innovation and found that the impact on the competitiveness of the high-tech industry effects the ability of technical development far greater than it does the technical transformation ability; Zhou Ming [4] considered the production function of knowledge and research funding, using the high technology industry's relevant statistical data from 1998-2006, using the spatial panel model analysis method, and carrying on the analysis to the regional technological innovation of the high-tech industry from the perspective of industrial agglomeration; Liu Yixin [5],according to the statistics of 2008, applied the catastrophe progression method to analyze the technological innovation capability of five industries of China's high-technology industry; Fang Yi et al. [6] aimed to improve the innovation ability, using two dynamic, efficient methods from different periods of the field, such as the Malmquist index, to study the dynamic efficiency of it; Jia Jun et al. [7] based their research on a duality theory, producing an innovation system design for the state subsystem characterization of innovation performance and innovation resource's cooperative behavior subsystem measurement which consists of two imaging systems and allows for the aerospace manufacturing technology innovation to be analyzed.Views from the existing literature, including domestic and foreign scholars's research on technological innovation ability, is rich at the enterprising level, but the establishment of the evaluation index system of technology innovation capability of the regional high-tech industry is imperfect. Evaluation methods need to be further optimized; differences of the innovation of technology of the provincial high-tech industry is still not deep enough, and the study of the dynamics of regional innovation's capability of high-tech development trend is lessened as many areas of the field's development in planning and decision-making still retain blindness.

On the basis of the studies of domestic and foreign researchers who have established an index system which has a comprehensive reflection of regional technological innovation of high-tech industry evaluation, based on the statistical data in recent years, using the method of factor analysis, objective, scientific, dynamic evaluation, and analysis on the technology innovation capability of our provincial high-tech industry, this paper reveals the advantages and disadvantages of each area as they exist in high technology innovation. Results show that the technology innovation capacity of the high-tech industry in China is not balanced, regional differences are more serious, and the gap is widening; by analyzing the reason for the gap between the regional innovation capability of the high technology industry, and providing a basis for both policy-making related development and the government for the technical innovation capability of the high-tech industry, we are able to determine which is the more important guiding reference value.

2 Methods

2.1 Establishment of the high-tech industry innovation capacity index system

The technological innovation capability of the high-tech industry is placing high-tech knowledge into new products and technology, while promoting the ability of industrial development. Evaluating the amount of information technology innovation capability of the relevant industry covers a wide range, so the key is to establish a scientific index system, a reasonable choice of appropriate indicators that selected indicators can more objectively and comprehensively reflect the regional high-tech industry technology levels and trends of innovation capability. From the main elements of the high-tech industry technology innovation system, on the basis of reference for evaluation of technological innovation capability to the relevant scholars, from a technical innovation investment, innovation technical support and the innovation output capacity of three aspects, 19 indicators have been selected to establish a regional high-tech industry innovation capability comprehensive evaluation system (see Table 1).

Table 1: Evaluation index system of regional high-tech industry technological innovation ability

One class index	Two level index	Variable name
Innovation input capacity	High tech Enterprises	X_1
	The number of R&D mechanism	X_2
	R&D staff	X_3
	R&D internal expenditure	X_4
	R&D project funds	X_5
	New product expenditure	X_6
Innovation and technology support	The number of R&D projects	X_7
	New product development projects	X_8
	The number of patent applications	X_9
	Unit personnel, the number of patent applications	X_{10}
	R & D funds patent number	X_{11}
	Effective invention patent number	X_{12}
The output of innovation ability	Output value of new products	X_{13}
	The proportion of the output value of new products	X_{14}
	Sales revenue of new products	X_{15}
	Scientific research personnel unit sales income	X_{16}
	Unit sales of R & D funds	X_{17}
	Total output value	X_{18}
	The main business income	X_{19}

2.2 Data source and research method

2.2.1 Data sources

The evaluation of technical innovation capacity of this high-tech industry is complicated as it should be based on objective, accurate statistical data. This paper selects data from the "Chinese Statistical Yearbook" (2007 -2011), "China Statistical Yearbook on Science and Technology" (2007 -2011) and "Chinese High-tech Industry Statistical Yearbook" (2007 -2011), as well as from 30 of China's provinces and autonomous regions (Tibet is not included due to the lack of data).

2.2.2 Research method

At present, in the technological innovation capability evaluation, the fuzzy evaluation method, artificial neural network method, the grey system theory, data envelopment analysis (DEA), and other evaluation methods are utilized; however, these methods have some drawbacks, such as the difficulty of comparing analyses, subjectivity in determining index weight, evaluation system, and the limited scope of application. In this paper, using the factor analysis method to deal with the data, the basic principle of the factor analysis method is based on grouping index correlation, the high correlation index points in the same group, each group of targets with a suitable public factor to represent and reflect the common factor; calculation of scores in each index, and a comprehensive score. The method of factor analysis, to a certain extent, overcomes the human supervisor to determine weight problems. Results of the application of the multi-index evaluation system is good and can reduce the loss index information as far as possible without loss or circumstances, common factors extracting a few can effectively reflect the original information. The core of factor analysis is to achieve dimension reduction for the purpose so that it not only reduces the number of variables, but also can reflect the real relationship between original variables.

2.2.3 The core idea of the method of factor analysis

The factor analysis method is adopted to build a linear map from high to lower dimension space. Relevant indicators can effectively reflect both the comprehensive and multi-index, namely the public factor. By grouping the primitive variables, the high correlation index points towards the same group. An evaluation function is constructed using the variance contribution rate of public factor extraction and can effectively process the repeated relationship between the multi-index, so that the original number of variables is simplified in order to analyze it conveniently.

2.2.4 Factor analysis model

Let X be the dimensional random vector of P, with mean μ; the covariance matrix as Σ, X expressed:

$$X = \mu + AF + S \qquad (1)$$

Among them, $X = \left(X_1, X_2, \cdots X_p\right)'$, $F = \left(f_1, f_2, \cdots, f_q\right)'$ is q Dimensional vector（$q \le p$）.As the public factor which can effectively reflect the relationship between the dependent variable, $S = \left(s_1, s_2, \cdots, s_p\right)$ is p Dimensional random vector. As the special factor, it cannot be common factors to explain, a factor representing the unique observation variables: $A = \left(a_{ij}\right)_{p\times q}$, $q \le p$, $j = 1, 2, \cdots, p$, $k = 1, 2, \cdots, q$. Then, A is the factor loading matrix, a_{ij} is the load of the I index on the J public factors. Model (1) is the factor analysis model.

The sum of Load matrix of A column j factors of the square is the common factor f_j variance contribution rate of X. That is:

$$V_j = \sum_{i=1}^{p} a_{ij}^2, \ j = 1, 2, \cdots, q \qquad (2)$$

The variance contribution rate is the sum of common factor f_j; the variance contribution to the X of each part and the comparison and description are the relative important index factors; the higher the value, the more important factor.

Therefore, the cumulative variance contribution rate can be defined as the public factor:

$$V = \sum_{j=1}^{q} V_j \qquad (3)$$

The canonical variables, which can be rotated, can be divided into orthogonal and oblique factors. The orthogonal rotation satisfies the orthogonality condition at the expense of simple partial factors, and if the oblique rotation angle between each factor is not fixed, the structure is more of a simple factor. Therefore, the oblique rotation method is the choice for the analysis.

3 Results

With the high technology industry in different regions in statistical data of 2011 as an example in this paper, we use the factor analysis method to evaluate the innovation capability of the high technology industry.

3.1 Factor analysis to test the applicability

The factor analysis method requires a strong correlation between the original variables. Therefore, in the factor analysis, the first step of the original variables is related to the need for inspection; if the correlation between variables is relatively low, it is not suitable for using factor analysis. The commonly used methods are the KMO test and the Bartlett test of sphericity; if there is significant probability, and the Bartlett statistics are less than or equal to 0.05, it is suitable for factor analysis. For the KMO value between 0-1, the values closer to 1 are more suitable for factor analysis. Kaiser provides a standard KMO measurement: 0.9 and above is very suitable; 0.8-0.9 is very suitable; 0.7-0.8 and 0.6-0.7 are generally suitable; less than 0.5 is generally not suitable for factor analysis. Upon examination, this paper selects variables suitable for factor analysis, the results of which are in Table 2

Table 2: KMO and Bartlett Test

Test method		Test value	Inspection criteria	Test results
KMO test		0.732	Kaiser Inspection standard	Suitable for factor analysis
Bartlett test	Approximate chi square value	1748.302	The significance level is less than 0.05	Suitable for factor analysis
	Freedom	171		
	Significant level	0.000		

3.2 Determine the eigenvalue and principal factor

In accordance with the principle of eigenvalue greater than 1, the paper selected 3 public factors. The accumulative variance contribution rate of 91.752% can represent most information, more fully reflecting the 30 provinces (cities and autonomous regions), along with the comprehensive high-tech industry innovation ability, which corresponds to each public factor value and variance contribution rate (Table 3).

Table 3: Features corresponding to each public factor value and variance contribution rate

	Initial eigenvalue			Extraction of square and load	
Ingredients	Total	Variance %	Cumulative %	Total	Variance %
1	13.380	70.420	70.420	13.162	69.272
2	3.023	15.910	86.330	2.198	11.570
3	1.030	5.422	91.752	2.073	10.910
4	.618	3.251	95.003		
5	.385	2.028	97.031		
6	.364	1.916	98.947		
7	.103	.544	99.491		
…	…	…	…		
18	9.727E-5	.001	100.000		
19	3.392E-5	.000	100.000		

3.3 Factor rotation

To facilitate the naming and explanation of the public factor, using an oblique rotation method to cycle through the load matrix, the oblique rotation after the public factor loading matrix, is shown in Table 4.

Table 4: The rotated factor loading matrix

Variable name	Index	Common factor 1	Common factor 2	Common factor 3
X_1	High-tech Enterprises	0.960	-0.029	0.092
X_2	The number of R&D mechanism	0.969	0.006	0.087
X_3	R&D staff	0.967	0.006	0.094

X_4	R&D internal expenditure	0.879	-0.048	0.138
X_5	R&D project funds	0.988	-0.021	0.047
X_6	New product expenditure	0.987	-0.025	0.071
X_7	The number of R&D projects	0.974	-0.038	0.160
X_8	New product development projects	0.987	-0.011	0.051
X_9	The number of patent applications	0.967	-0.030	0.162
X_{10}	The number of patent applications of unit personnel	0.993	-0.012	0.077
X_{11}	R&D funds patent number	0.982	0.003	0.146
X_{12}	The number of effective invention patents	0.980	0.005	0.146
X_{13}	Output value of new products	0.984	0.021	0.068
X_{14}	The proportion of the output value of new products	0.924	0.034	0.000
X_{15}	Sales revenue of new products	0.159	-0.020	0.860
X_{16}	Scientific research personnel unit sales income	0.117	0.561	0.717
X_{17}	Unit sales of R&D funds	-0.034	0.930	0.212
X_{18}	Total output value	0.090	0.382	0.774
X_{19}	The main business income	-0.065	0.930	0.125

The common factor 1 in the high technology enterprise number (a) is X_1. The number of R&D mechanism (a) is X_2, R&D staff (a) X_3, R&D internal expenditure (millionyuan) X_4, and R&D project funds (million yuan) X_5.New product expenditure (million yuan)is X_6. Project number of R&D (a) is X_7.The number of new product development project (a) is X_8.The number of patent applications (pieces) is X_9, while the number of patent applications of unit personnel (A / person) is X_{10}, R&D funds patent number (a) is X_{11}, and the number of effective invention patents (a) is X_{12}.New product output value (million yuan) is X_{13}, The new product output value accounted for the proportion of total output value (%) X_{14} and had greater load solution release capacity. Index reflects mainly the basic conditions of the high technology industry in each area, so the factor-named activity is based on input and output factors.

The common factor 2 in R&D funds sales income (million yuan) is X_{17}.The main business income (million yuan) X_{19} has a large load ability to explain and reflects the innovative business income level, so it is named factor productivity.

Meanwhile, the common factor 3 in new product sales revenue (million yuan) is X_{15}.Scientific research personnel unit sales revenue (million yuan / person) is X_{16}.The total output value (million yuan) is X_{18} and has a large load explanation ability, reflecting the level of output of the high technology industry, so it is the factor-named output capacity factor.

3.4 The evaluation model

According to the factor score coefficient matrix, we obtain the factor score model as follows:

$$\begin{cases} f_1 = 0.072X_1 + 0.073X_2 + 0.073X_3 + 0.066X_4 + 0.074X_5 + \cdots - 0.004X_{19} \\ f_2 = -0.016X_1 - 0.009X_2 + 0.007X_3 + 0.009X_4 - 0.024X_5 \cdots + 0.264X_{19} \\ f_3 = 0.012X_1 + 0.038X_2 + 0.033X_3 - 0.042X_4 + 0.053X_5 \cdots + 0.482X_{19} \end{cases} \quad (4)$$

Then, standardized data values $\left(X_1, X_2, \cdots, X_{19}\right)$ of the 30 provinces (cities and autonomous regions)are placed into the formula, allowing for the score in the common factor f_1, f_2, f_3 to be obtained.

In order to better express their contribution public factor on the high-tech industry innovation ability, weight analysis can be utilized according to the variance contribution rate of public factors' contribution rate to the cumulative variance proportion. The provinces (cities and autonomous region) comprehensively evaluate the high-tech industry innovation capability model as follows:

$$f = \frac{\left(w_1 f_1 + w_2 f_2 + w_3 f_3\right)}{\left(w_1 + w_2 + w_3\right)}$$

Among them, f is the comprehensive score while w_i is the i of common factor variance contribution rate.

Higher scores indicate that the comprehensive high-tech industry innovation capability is strong. Among them, the positive value indicates that the innovation ability has the advantage, being higher than the average level, and that the negative number indicates that the innovation ability is at a disadvantage, below average. The ability of high-tech industry innovation is in different areas of China and achieve a ranking score in Table 5.

Table 5: Scores of Chinese provinces (cities and autonomous regions) with high-tech industry innovation ability and ranking

Area	Common factor 1	Ranking	Common factor 2	Ranking	Common factor 3	Ranking	Comprehensive score	Ranking
Beijing	0.07965	6	-0.20429	15	2.24082	2	0.276012257	5
Tianjin	-0.19724	12	0.15458	10	1.20039	4	0.012215362	8
Hebei	-0.28008	16	-0.53415	24	-0.85803	26	-0.34942925	21
Shanxi	-0.4177	25	0.03853	14	-0.75967	23	-0.36777122	24
Inner Mongolia	-0.4057	24	0.23078	9	-1.12007	27	-0.3765349	25
Liaoning	-0.18088	11	-0.51524	23	-0.0461	13	-0.18994197	15
Jilin	-0.35026	20	-0.29472	18	-0.69848	22	-0.35293538	22
Heilongjiang	-0.32287	18	-0.73045	26	-0.80671	24	-0.39618363	28
Shanghai	0.37247	5	0.25119	7	-0.18248	16	0.267171533	6
Jiangsu	2.27442	2	0.04386	13	0.40697	9	1.625011251	2
Zhejiang	0.63296	3	-0.44861	21	0.49743	7	0.440829487	3
Anhui	-0.23197	14	0.24453	8	0.10445	11	-0.12100264	12
Fujian	-0.13036	9	-0.94489	29	1.44059	3	-0.04245838	9
Jiangxi	-0.28136	17	-0.67056	25	-0.57398	21	-0.33510871	19
Shandong	0.46995	4	-0.28098	17	0.42323	8	0.339208771	4
Henan	-0.13656	10	0.48857	4	-1.17451	28	-0.16620934	13
Hubei	-0.09772	8	-0.76099	27	-0.30002	17	-0.18847132	14
Hunan	-0.2545	15	0.60217	3	0.05422	12	-0.10071077	11
Guangdong	4.54089	1	0.30633	6	-0.40305	19	3.137034947	1
Guangxi	-0.35734	21	-0.43977	20	-0.81521	25	-0.38735736	26
Hainan	-0.34604	19	1.07627	1	-1.55403	30	-0.28472906	17
Chongqing	-0.61303	29	0.38624	5	2.70522	1	-0.08483067	10
Sichuan	-0.05346	7	0.13724	11	0.74279	6	0.059884246	7
Guizhou	-0.39166	23	-0.26951	16	-0.41769	20	-0.348063	20
Yunnan	-0.47998	26	-0.47765	22	-0.0533	14	-0.39357088	27

Shaanxi	-0.19878	13	-0.88445	28	-0.35967	18	-0.27926974	16
Gansu	-0.50165	27	-0.43665	19	-0.13051	15	-0.41226203	29
Qinghai	-0.38676	22	0.64713	2	-1.5039	29	-0.35711894	23
Ningxia	-0.63849	30	0.0511	12	1.13465	5	-0.31259221	18
Xinjiang	-0.5774	28	-1.31889	30	0.35142	10	-0.51423218	30

3.5 The evaluation results

Based on factor explanation, according to Table 4 and related data sources, we have ranked the innovation capacity of the high-tech industry in various regions based on common factors.

(1) In the activities of the foundation and input and output factor, the top six were Jiangsu, Guangdong, Zhejiang, Shandong, Shanghai, and Beijing. These areas are in the Yangtze River Delta, Pearl River Delta and Bohai Rim regions and are the development of China's high technology industry's most densely populated region. Among them, the most developed, Guangdong, has the highest technology industry based on the best and most rapid development. The six lowest scores followed as Shanxi, Yunnan, Gansu, Xinjiang, Chongqing, and Ningxia, and are in the western region where the high technology industry is in a relatively backward state, the foundation is weak, but also reflective of the difference of the industry layout.

(2) In factor output efficiency, the top six were Hainan, Qinghai, Hunan, Henan, Chongqing, and Guangdong. With the exception of Guangdong, Chongqing’s high-tech industrial base is relatively better than other provinces and cities; though the foundation is comparatively weak, its main business income and R&D funds by selling at a higher income, suggesting that these areas of research and development funds utilization ratio and output rate higher than that of other good regions; at the same time, it also shows that R&D input-output efficiency is not complete with R&D activities and consistent investment. The factor scores of the front area can appropriately increase investment and ensure the production efficiency, effectively improving the output level and, as a result, the coordinated development of the regional economy. Meanwhile, the six lowest scores are Jiangxi, Heilongjiang, in Hubei, Shaanxi, Fujian, and Xinjiang. In the northwest, the high-tech industrial base is weak, lagging behind the development and utilization of resources to the point of unreasonably low efficiency. The area should change its mode of development and increase the allocation of high investment in technology innovation and scientific resources.

(3) In the output ability factor, the top six were Chongqing, Beijing, Fujian, Tianjin, Ningxia, and Sichuan. These six areas are in the high technology industry as mentioned in three intensive areas. Chongqing and Beijing scored higher because of their total output value; sales income of new product levels are also higher and the sales are at a high level with greater output efficiency. The six lowest score were Guangxi, Hebei, Inner Mongolia, Henan, Qinghai, and Hainan, all of which are in the northwest and considered to be underdeveloped areas where output capacity is limited and the efficiency is low. These regions should reasonably use the resource of innovation to further improve the development and use of funds output efficiency.

3.6 Cluster analysis

In order to make the evaluation results more intuitive and convenient for analysis it can be classified according to the regional comprehensive factor score. According to the analysis result of clustering, the region is divided into three categories, as shown in Table 6:

Table 6:The classification ability of high-tech industry innovation in various regions of China

Category	Area
First class	Guangdong, Jiangsu, Zhejiang, Shandong, Beijing, Shanghai
Second class	Sichuan, Tianjin, Fujian, Chongqing, Hunan, Anhui, Henan, Hubei, Liaoning, Shaanxi, Hainan, Ningxia, Jiangxi
Third class	Guizhou, Hebei, Jilin, Qinghai, Shanxi, Inner Mongolia, Guangxi, Yunnan, Heilongjiang, Gansu, Xinjiang

The first class consists of Guangdong, Jiangsu, Zhejiang, Shandong, Beijing, and Shanghai. In the first class major provinces and cities is a coastal city in the east where the high technology industry foundation is better with a greater level of investment and output ability. The first factor in other areas is at the forefront but the second and third factor rankings are not high. Further adjustments to improve the output capability of R&D resources allocation are necessary.

The second class is for Sichuan, Tianjin, Fujian, Chongqing, Hunan, Anhui, Henan, Hubei, Liaoning, Shaanxi, Hainan, Ningxia, and Jiangxi. This area belongs to the medium level of high tech industry innovation ability; although the innovation output capacity in some areas is strong, it also has the advantages in the industrial foundation and the input and output quantity, but the unit of output capacity and the main business income level is low. The area should seize the weak links in classification management and intensify efforts to meet the first class area or at least narrow the gap.

The third category is Guizhou, Hebei, Jilin, Qinghai, Shanxi, Inner Mongolia, Guangxi, Yunnan, Heilongjiang, Gansu, and Xinjiang. This kind of area is mostly in the western provinces, and is characteristic of the level of differences between larger area factors or where those with high level area factor score disparity are obvious, which occupy the lower position in the comprehensive evaluation. For this type of region, the overall situation of the high-tech industry innovation capability is not ideal; therefore, it should seize the opportunity of western development, to further strengthen the basic conditions for innovation in the high technology industry and continuously improve the level of output.

The above is the 2011 China's provinces' (cities and autonomous regions) comprehensive evaluation of the high-tech industry's innovation ability and analysis. Similarly, 2007-2010 showed that the innovation ability of the high-tech industry's score and ranking includes limited space, though the evaluation process is omitted in this. According to 2007-2011, the five years of high-tech industry innovation ability score and ranking enable the technical innovation ability of the high-tech industry development trend that are in China's 30 provinces, autonomous regions, as shown in Figure 1.

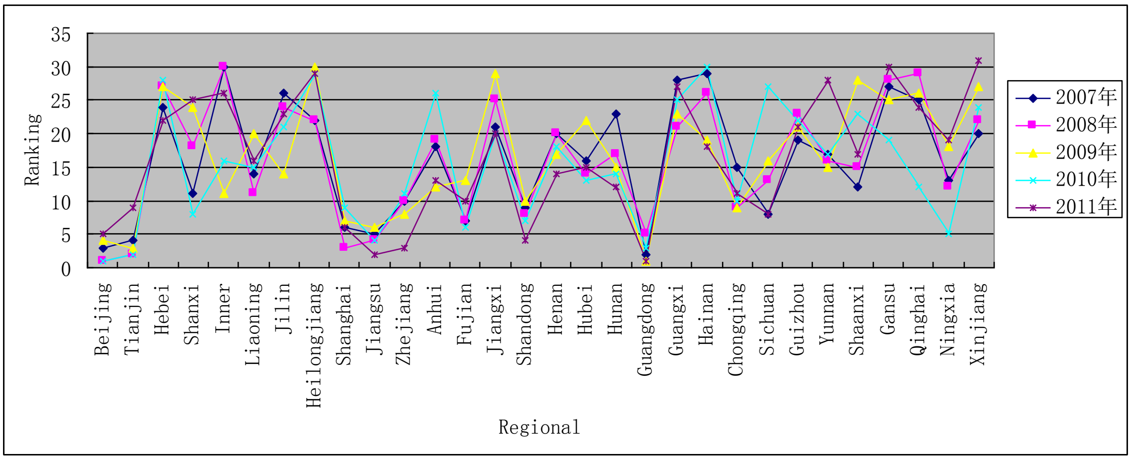

Figure. 1: Provinces' (cities and autonomous regions) changes during 2007-2011, innovation ability of high-tech industry trends

It can be seen from Figure 1 that Guangdong, Jiangsu, Zhejiang, Shandong, Beijing, and Shanghai are six provinces of the high-tech industry where the innovation capacity is higher. Each shows a steadily increasing trend with innovation as the foundation, and the high technology industry in these areas with better stability of the investment of a larger relationship. Inner Mongolia, Guangxi, Yunnan, Heilongjiang, Gansu, and Xinjiang provinces contain weaker, more volatile capabilities in the high-tech industry's innovation, indicating that, in the area of the high technology industry, the innovation input and output annual differences is not stable. These areas need increasingly high technology industry innovation investment levels, improving the output ability, and pay attention to maintaining the stability of the high-tech industry innovation.

4 Conclusion

In this paper, by using the factor analysis method, the 30 provinces of China (cities and autonomous regions) have been analyzed for the comprehensive evaluation of the high-tech industry's technological innovation ability and the clustering analysis. The main conclusions are as follows:

(1) Overall innovation capacity of the high-tech industry in China's regional development is not balanced, more so in terms of the general innovation ability and weaker area, and less so in the stronger areas. Among them, there is the most innovative ability of the eastern coastal areas, followed by the central region, with the weakest in the northwest. The gap between the eastern coastal area and central area is larger, but the gap between the central and northwest areas is not evident.

(2) The innovation capability of high tech industries in the eastern region is strong, and the very high relations with the high technology industry innovation's aggregate level is higher, however, relative to the scale of industrial development, it is not high. The eastern region, as a result, holds national policy and its location advantage, along with the high technology industry development speed; however, attention should also be paid to the eastern area where the innovation efficiency is not high. Local governments and enterprises need to pay enough attention to the lack of innovation in the high tech industry, in order to guarantee the dominant position of the eastern region in the development of field and turn it into a strong support, driving the development of the national high technology industry. For this to occur, the eastern region needs to be further strengthened in the R&D capability and innovation environment.

(3) There is a big gap between the central and western regions and the eastern region in the total factor of high technology innovation ability but, compared to the eastern area, higher efficiency of technological innovation in the high-tech industry exists in some areas of the mid-west, but it is smaller; only the industry's overall size reaches a certain degree. It may be on account of more manpower

and funds for technological innovation. Therefore, for the central and western regions, how to improve the overall development of the high technology industry is now the main problem being faced and, especially the need to further optimize the investment environment in the western region, there must be efforts to attract more high-tech industrial investment in order to solve the insufficiency problem.

In a word, to improve our high-tech industry's technological innovation ability, first the investment must be increased, followed by an improvement of the efficiency of input and output and a provided material basis for the technical innovation. To strengthen policies' support to create a good environment for industrial innovation, too, this must be done. Finally, improving the understanding of government in the importance of the high-tech industry's innovation and striving to cultivate enterprise technology innovation consciousness is all very vital.

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