Analysis of regional competitiveness in the high-tech industry

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The high-tech industry has resulted in economic development and international competition among countries. High output and large exports cannot conceal development imbalances of the high-tech industry. This study is an empirical research to analyse regional competitiveness differences using China as a case study. Based on factor analysis, it compared the competitiveness of the high-tech industry in 31 provinces, autonomous regions and municipalities, analysed the competitiveness differences among four economic regions, and discussed spatial distribution features of the high tech industry. The results showed that large differences existed in regional competitiveness of the high-tech industry. Guangdong had the strongest high-tech industry competitiveness, while Shanxi ranked at the bottom. Among the four economic regions, the eastern region had the strongest competitiveness, followed by middle, western and north-eastern regions. In addition, differences and imbalances of development of the high-tech industry also existed within the same economic region.

Keywords: Factor analysis, high-tech industry, regional competitiveness.

THE word high-tech was first used in *Technology and International Trade*, a book published by the US National Academy of Sciences in 1977. It refers to cutting-edge technologies based on theories of modern natural science and new techniques that can bring significant economic, social and environmental benefits. With economic globalization and rapid development of science and technology, competition among countries has intensified. As a technology-intensive and knowledge-intensive industry, the high-tech industry is a key venue for international competition and a main driver of economic development in many countries. However, development imbalances and regional differences of the high-tech industry still exist within a country. Since undergoing reforms and opening up, China's high-tech industry has made remarkable progress and has played a significant role in international markets. In 2014, it achieved 826.42 billion USD of exports, and was the largest exporter of high-tech products in the world. However, regional development of the high-tech industry in China presents an imbalanced situation, because of differences in geography, levels of economic development, policies and measures of the high-tech industry and other aspects. Thus choosing China's high-tech industry as a case study and conducting empirical research to discuss differences in regional competitiveness could be representative. This article compares the high-tech industry's competitiveness across different provinces, autonomous regions and municipalities in China, and analyses differences in competitiveness among four economic regions to study its spatial distribution features.

Several studies are available on industry competitiveness and on competitiveness evaluation models. The World Economic Forum (WEF) and the International Institute for Management Development (IMD) together developed the competitiveness equation, which considered both the competitiveness process and competitiveness assets. Porter[1] proposed the national competitive advantage diamond model, which was a comprehensive competitiveness analytical framework. It analysed international competitive advantages from four vantage points: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry. Given the trend towards economic globalization, Dunning added the business behaviour of transnational corporations into Porter's diamond model[2]. Subsequently, Rui added knowledge absorption and innovation ability into the diamond model, emphasizing the effects of knowledge research and development on competitiveness[3]. Several studies adopted typical and representative indicators, such as revealed comparative advantage index (RCA) and trade competitiveness index (TC) and so on, or established indicator systems to assess the high-tech industry competitiveness and conduct comparative studies[4–9]. Braddorn and Hartley chose labour productivity, output, firm size, development time-scales, labour hoarding, exports and profitability to evaluate the competitiveness of UK's aerospace industry and drew comparisons with the US and the EU. They found that competitiveness of the aerospace industry in UK improved between 1980

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and 2000 compared to that in the US and the EU[10]. Wang and Wang[11] built an evaluation system consisting of six categories of input and output indicators and adopted the improved technique for order preference by similarity to ideal solution (TOPSIS) to evaluate the competitiveness of the high-tech industry. Some studies focused on factors influencing the competitiveness of high-tech industry. Aye[12] explored the relationship between technological infrastructure and the high-tech industry's competitiveness, and found that large R&D investment and number of R&D researchers can foster the high-tech industry's competitiveness. Sun *et al.*[13] studied the relationship between outward foreign direct investment (OFDI) and high-tech industry competitiveness. They found that OFDI had a significant negative influence on the high-tech industry competitiveness through its effects on innovation activities. Feng *et al.*[14] argued that technology development capability, more than technology transfer capacity, affected the international competitiveness of the high-tech industry. Morris and Einhorn[15] studied the relationship between economic globalization and industry competitiveness. They found that economic globalization had competitive and complementary impacts on the competitiveness of the domestic industry. Merchant[16] studied the role that governments played in the development of high-tech industry and found that industrial policies and measures contributed to increasing the high-tech industry competitiveness. The foregoing literature review shows that existing studies primarily focus on comparing the high-tech industry competitiveness of several countries and explore factors affecting it. Very few studies assessed the high-tech industry regional competitiveness and its spatial distribution features within a country. This article attempts such a study by choosing China's high-tech industry as a case study and mainly answers the following questions: (i) how does regional competitiveness of the high-tech industry vary in different provinces, autonomous regions, municipalities and economic regions? (ii) what are its spatial distribution features? (iii) why do some areas show strong regional competitiveness, while others do not?

Establishment of the indicator system

Referring to existing studies and considering the features of the high-tech industry, this study establishes an evaluation indicator system of regional competitiveness of the high-tech industry as shown in Table 1. The indicator system is composed of 4 first-level indicators namely input level, output level, innovation ability, and development circumstances, and 15 second-level indicators.

The input production factors are the foundation for industry development. Advanced production factors are the key to strong and lasting competitiveness. Therefore, we chose advanced production factors, R&D personnel input (B_1), R&D expenditure (B_2) and assets input (B_3) to describe the input level. The output level represents the production ability and market control. We chose exports volume (B_4), sales profit margins (B_5), domestic market share (B_6) and labour productivity (B_7) to describe output level. B_5, B_6 and B_7 can be obtained using eqs (1)–(3), in which *SPM*, *DMS* and *LP* are sales profit margins, domestic market share and labour productivity respectively. *TP* is the total profit of the high-tech industry, and *P* is the profit of the high-tech industry of one province, autonomous region, municipality or economic region. *TR* is the total revenue from principal business of the high-tech industry. *AEP* is the annual average number of employed personnel of the high-tech industry.

$$SPM = TP/TR, \quad (1)$$

$$DMS = P/TP, \quad (2)$$

$$LP = TR/AEP. \quad (3)$$

In the diamond model improved by Rui, knowledge absorption and innovation ability was an important component. We referred to his research and added innovation ability into our indicator system. We chose patents application quantity (B_8), sales revenue of new products (B_9), the number of R&D institutions (B_{10}) and R&D personnel full-time equivalent (B_{11}) as second-level indicators. Stable and promising development circumstances contribute to the regional competitiveness of high-tech industry. We chose indicators from enterprises, government, and economic operation state to represent development circumstances. The number of high-tech enterprises (B_{12}), per capita regional gross product (B_{13}), the growth rate of regional gross product (B_{14}) and government funds

Table 1. The indicator system of the high-tech industry regional competitiveness

First-level indicator	Second-level indicator
Input level (A_1)	R&D personnel input (B_1)
	R&D expenditure input (B_2)
	Assets input (B_3)
Output level (A_2)	Exports volume (B_4)
	Sales profit margins (B_5)
	Domestic market share (B_6)
	Labour productivity (B_7)
Innovation ability (A_3)	Patents application quantity (B_8)
	Sales revenue of new products (B_9)
	The number of R&D institutions (B_{10})
	R&D personnel full-time equivalent (B_{11})
Development circumstances (A_4)	The number of enterprises (B_{12})
	Per capita regional gross product (B_{13})
	The growth rate of regional gross product (B_{14})
	Government funds support (B_{15})

support (B_{15}) were the second-level indicators of development circumstances. To avoid the influence of different dimensions and enhance data comparability, we adopted the Z-score method to standardize the data, as shown in eq. (4), where Z and X are the standardized data value and the original data value of a province, autonomous region, municipality or economic region on an indicator, and μ and σ are the mean value and the standard deviation of the whole industry on an indicator.

$$Z = (X - \mu)/\sigma. \quad (4)$$

Methodology

The factor analysis method was used to compare regional competitiveness of the high-tech industry in this study. The factor analysis method was introduced by Pearson and Spearman in the early 20th century. By analysing correlations among variables and identifying basic data structures, this method can extract abstract factors to reveal most information of the original data. It is a useful solution for dimension reduction when variables are correlated. The factor analysis was undertaken by SPSS version 21 in this study. The specific steps are as follows:

First, the Kaiser–Mayer–Olkin (KMO) test and Bartlett's test of sphericity were performed to check whether the data were suitable for factor analysis. The value of KMO statistics falls into the interval of [0, 1]. The original variables have strong correlation if the value of KMO statistics approaches 1. The original variables here refer to standardized data of each second-level indicator. In conducting factor analysis, the value of KMO statistics is required to be higher than 0.70. It is inadequate for factor analysis if the value is less than 0.50. The null hypothesis of Bartlett's test of sphericity is that the correlation coefficient matrix of original variables is a unit matrix, which means that every two original variables are uncorrelated. Then the factors extracted by the principal components method were rotated by the maximum variance method with Kaiser standardization. Eigenvalue of each extracted factor should be more than 1. The cumulative percentage of variance of extracted factors should be greater than 85%, which ensures that the extracted factors reflect most information of the original data. Factor rotation facilitates identification of factors and makes the extracted factors practically meaningful. The factor score was then calculated using the factor score coefficient and standardized data value. Finally, the comprehensive evaluation results were obtained by taking the variance contribution percentage of each factor as the weight.

Table 2. The Kaiser–Mayer–Olkin test and Bartlett's test of sphericity

Test		Value
KMO test of sampling adequacy		0.748
Bartlett's test of sphericity	Approximated Chi-square	909.497
	Degree of freedom	105.000
	Significance	0.000

Results and discussion

Competitiveness of provinces, autonomous regions and municipalities

China was the largest exporter of high-tech products in the world in 2014, and its high-tech industry is witnessing rapid development. Thus assessing the regional competitiveness of China's high-tech industry as a case study could be a representative study. All original data came from the *2015 China Statistics Yearbook on High Technology Industry* and the *2015 China Statistics Yearbook*.

Table 2 shows the results of KMO and Bartlett's test of sphericity. P value of Bartlett's test of sphericity was 0.000 and much less than the significance level, which indicates that the null hypothesis should be rejected and that original variables are correlated. The value of KMO statistics was 0.748, which means it is suitable for factor analysis.

Table 3 presents the eigenvalue, percentage of variance, and cumulative percentage of variance of factors. Four factors were extracted, and because they account for 87.032% of variance, they well describe most of the information of the original data and represent four main aspects of the high-tech industry's regional competitiveness. After factor rotation, the eigenvalue of the first factor was 8.14; it accounts for 54.27% of variance, which means that the first factor contains 54.27% of the information within the original data. Table 4 shows the factor loadings of every variable after rotation. The eight variables that have a large loading on factor 1 are mainly about the production input. The three variables that have a large loading on factor 2 are mainly about the output level. The two variables that have a large loading on factor 3 are mainly about innovation and R&D input. The two variables that have a large loading on factor 4 are mainly about economic circumstances and industrial profit level.

Table 5 presents the factor score coefficient. The detailed calculation of factor scores is shown in eqs (5)–(8). Using variance contribution percentage of each factor as the weight, we can obtain the final comprehensive evaluation results, as shown in eq. (9). The evaluation results and rankings are presented in Table 6.

$$F_1 = 0.150B_1 + 0.173B_2 - 0.101B_3 + \cdots + 0.115B_{15}, \quad (5)$$

$$F_2 = -0.044B_1 - 0.028B_2 + 0.013B_3 + \cdots + 0.240B_{15}, \quad (6)$$

$$F_3 = -0.080B_1 - 0.178B_2 + 0.572B_3 + \cdots -0.432B_{15}, \quad (7)$$

$$F_4 = 0.019B_1 + 0.024B_2 - 0.076B_3 + \cdots -0.124B_{15}, \quad (8)$$

Table 3. Eigenvalue and variance contribution

	Initial eigenvalue			Extraction			Rotation		
Component	Total	Variance (%)	Cumulative variance (%)	Total	Variance (%)	Cumulative variance (%)	Total	Variance (%)	Cumulative variance (%)
1	9.158	61.052	61.052	9.158	61.052	61.052	8.140	54.270	54.270
2	1.635	10.898	71.950	1.635	10.898	71.950	1.921	12.809	67.079
3	1.196	7.975	79.926	1.196	7.975	79.926	1.731	11.541	78.620
4	1.066	7.106	87.032	1.066	7.106	87.032	1.262	8.412	87.032
5	0.862	5.747	92.778						
6	0.519	3.461	96.239						
7	0.338	2.256	98.495						
8	0.098	0.656	99.151						
9	0.077	0.514	99.665						
10	0.020	0.133	99.798						
11	0.016	0.106	99.905						
12	0.009	0.060	99.964						
13	0.004	0.025	99.989						
14	0.002	0.010	99.999						
15	0.000	0.001	100.000						

The extraction method is the principal components method.

Table 4. Rotated component matrix

	Component			
Variable	1	2	3	4
B_2	0.981	0.124	0.038	–0.059
B_8	0.981	0.091	0.064	–0.039
B_{11}	0.979	0.080	0.130	–0.050
B_1	0.974	0.100	0.153	–0.057
B_9	0.946	0.116	0.235	–0.036
B_4	0.937	0.121	0.202	–0.045
B_{12}	0.916	0.124	0.360	–0.066
B_6	0.858	0.193	0.450	–0.058
B_7	–0.055	0.894	0.193	0.173
B_{13}	0.280	0.830	0.030	–0.262
B_{15}	0.483	0.491	–0.393	–0.249
B_3	0.438	0.129	0.794	–0.102
B_{10}	0.644	0.124	0.657	–0.049
B_{14}	0.105	0.099	–0.042	0.801
B_5	–0.166	–0.169	–0.025	0.652

The extraction method is the principal components method. The rotation method is the maximum variance method with Kaiser standardization. Rotation converges after five iterations.

Table 5. Factor score coefficient

	Component			
Variable	1	2	3	4
B_1	0.150	–0.044	–0.080	0.019
B_2	0.173	–0.028	–0.178	0.024
B_3	–0.101	0.013	0.572	–0.076
B_4	0.130	–0.027	–0.032	0.026
B_5	0.032	–0.033	–0.006	0.526
B_6	0.053	0.020	0.191	0.007
B_7	–0.131	0.565	0.151	0.208
B_8	0.172	–0.047	–0.156	0.037
B_9	0.126	–0.031	–0.007	0.033
B_{10}	–0.026	–0.004	0.411	–0.013
B_{11}	0.158	–0.056	–0.100	0.024
B_{12}	0.091	–0.027	0.106	0.002
B_{13}	–0.051	0.460	–0.040	–0.136
B_{14}	0.073	0.116	–0.089	0.692
B_{15}	0.115	0.240	–0.432	–0.124

The extraction method is the principal method. The rotation method is the maximum variance method with Kaiser standardization.

$$\mathrm{TF} = (54.270F_1 + 12.809F_2 + 11.541F_3 + 8.412F_4)/87.032. \tag{9}$$

Competitiveness of the four economic regions

The results in Table 6 show that provinces, autonomous regions and municipalities in the same region generally have similar high-tech industry competitiveness, because they have similar geographical conditions and economic development levels. However, provinces, autonomous regions and municipalities in different regions show differences in competitiveness. Therefore, in the following section we analyse the high-tech industry competitiveness among different regions.

China consists of four economic regions: the eastern, middle, western and northeastern regions. Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong and Hainan belong to the eastern economic region. Shanxi, Henan, Hubei, Hunan, Anhui and Jiangxi belong to the middle economic region. Chongqing, Sichuan, Guangxi, Guizhou, Yunnan, Shaanxi, Inner Mongolia, Ningxia, Xinjiang, Qinghai and Tibet belong to the western region. Heilongjiang, Jilin and Liaoning belong to the northeastern region. We took the averaged factor scores and evaluation results of the provinces, autonomous regions and municipalities in the same economic region as the factor score and evaluation result of this economic region. Table 7 shows the evaluation results for each economic region.

Table 6. Evaluation results of each province, autonomous region and municipality

Province, autonomous region and municipality	FAC1_1	FAC2_1	FAC3_1	FAC4_1	Evaluation result	Rank
Guangdong	4.748	–0.656	–1.379	0.002	2.681	1
Jiangsu	1.797	0.551	3.948	–0.077	1.718	2
Shandong	0.219	1.105	1.211	0.093	0.469	3
Zhejiang	0.662	–0.263	0.363	–0.370	0.386	4
Shanghai	0.355	2.254	–1.712	–0.893	0.240	5
Beijing	–0.004	2.461	–0.994	–0.258	0.203	6
Fujian	0.028	0.322	–0.122	0.204	0.069	7
Tianjin	–0.447	2.121	0.059	0.158	0.057	8
Sichuan	–0.086	0.010	0.339	0.170	0.009	9
Tibet	–0.282	–0.371	–0.455	3.035	0.003	10
Hubei	–0.091	0.102	0.238	0.063	–0.004	11
Henan	–0.122	–0.692	1.169	–0.205	–0.043	12
Shaanxi	0.258	0.142	–1.415	–0.390	–0.044	13
Guizhou	–0.095	–0.548	–0.610	1.729	–0.054	14
Chongqing	–0.552	1.012	0.407	0.621	–0.081	15
Hunan	–0.191	–0.073	0.223	0.082	–0.093	16
Anhui	–0.271	–0.208	0.655	0.156	–0.098	17
Jiangxi	–0.309	–0.443	0.516	0.099	–0.180	18
Hainan	–0.325	–0.523	–0.415	1.545	–0.186	19
Liaoning	–0.329	0.863	–0.345	–0.806	–0.202	20
Guangxi	–0.501	–0.197	0.144	0.549	–0.269	21
Gansu	–0.267	–1.292	–0.363	0.843	–0.323	22
Yunnan	–0.351	–0.843	–0.314	0.592	–0.327	23
Qinghai	–0.427	–0.558	–0.361	0.599	–0.338	24
Jilin	–0.653	0.194	0.346	–0.386	–0.370	25
Inner Mongolia	–0.796	0.658	0.198	–0.375	–0.410	26
Hebei	–0.418	–0.796	0.362	–1.101	–0.436	27
Heilongjiang	–0.329	–0.511	–0.610	–1.091	–0.467	28
Xinjiang	–0.267	–1.278	–0.607	–0.577	–0.491	29
Ningxia	–0.416	–1.118	–0.490	–1.654	–0.649	30
Shanxi	–0.539	–1.426	0.017	–2.355	–0.771	31

FAC1_1, FAC2_1, FAC3_1 and FAC4_1 are extracted factors, factor 1, factor 2, factor 3 and factor 4 respectively.

Table 7. Evaluation results of the economic regions

Region	FAC1_1	FAC2_1	FAC3_1	FAC4_1	Evaluation result
The eastern region	0.662	0.658	0.132	–0.070	0.520
The middle region	–0.254	–0.457	0.470	–0.360	–0.198
The western region	–0.315	–0.365	–0.294	0.429	–0.248
The northeastern region	–0.437	0.182	–0.203	–0.761	–0.346

FAC1_1, FAC2_1, FAC3_1 and FAC4_1 are extracted factors, factor 1, factor 2, factor 3 and factor 4 respectively.

Discussion

Through comparison of the high-tech industry competitiveness of 31 provinces, autonomous regions and municipalities, we see that Guangdong, Jiangsu, Shandong, Zhejiang and Shanghai are the top five competitive provinces and municipalities in the high-tech industry. Shanxi, Ningxia, Xinjiang, Heilongjiang and Hebei are weak competitive provinces. Guangdong has the strongest high-tech competitiveness among the 31 provinces, autonomous regions and municipalities. It has the best performance in factor 1 which is mainly about industrial input. In 2014, Guangdong put in the most R&D personnel and R&D expenditure, achieved the highest export volume of high-tech products and filed the largest number of patent applications among the 31 provinces, autonomous regions and municipalities. It is also the province where most high-tech enterprises are located. Shanxi has the weakest competitiveness in the high-tech industry. It gets negative scores in factors other than factor 3. Provinces with good evaluation results are mostly located in the eastern region, which is the most developed area of China; provinces with bad evaluation results are spread across all economic regions, including the eastern region.

The evaluation results of the high-tech industry's competitiveness of four economic regions are listed in

Table 7. Eastern region ranks first, with an evaluation score of 0.520, and has good performance in factors 1, 2 and 3, which means that the eastern region has adequate high-tech industry input, satisfactory output and good innovation ability. However, its score of factor 4 is –0.070, which implies that sales profit margins of the high-tech industry and the growth rate of regional gross product in the eastern region need to be improved. The middle region ranks second with a score of –0.198. But it merely behaves well in factor 3, having abundant input assets as well as research institutions. The western region ranks third with a score of –0.248, and it receives negative scores in factors other than factor 4. This reflects a lack of adequate industry input, output, and innovation ability. Generally, the provinces, autonomous regions and municipalities in the western region are in relatively backward areas. However, they develop rapidly and show promising economic circumstances, which is the reason for western region receiving positive scores in factor 4. The northeastern region has the weakest competitiveness among the four regions and lags behind the eastern region. The northeastern region traditionally is an industrial base and has competitive and developed heavy industries and good industrial infrastructure. Heavy industry, rather than the high-tech industry, is the main driving force for its development.

In the ten provinces and municipalities of the eastern region, Guangdong definitely has the strongest competitiveness. Jiangsu, Shandong, Zhejiang, Shanghai, Beijing, Fujian and Tianjin rank from second to eighth respectively. However, Hainan and Hebei rank 19th and 27th respectively. Although the eastern region has the best competitiveness performance among the four regions, differences and imbalances in the development of the high-tech industry in this region are still serious.

In the six provinces of the middle region, Hubei has the highest competitiveness ranking and ranks 11th. Apart from Shanxi, the competitiveness rankings of the rest of the provinces in the middle region are all clustered around the middle level. Therefore, the overall competitiveness level of this region falls in the middle level.

In the twelve provinces, autonomous regions and municipalities of the western region, Sichuan has the highest competitiveness ranking – 9. Ningxia has the lowest ranking – 30. Therefore, there are large internal differences in this region. Tibet ranks 10th among 31 provinces, autonomous regions and municipalities, and it has the second highest competitiveness in the western region, which stands in sharp contrast to its formidable natural conditions and overall backward economic development level. To determine the reason, we examined the industry segment within its high-tech industry. The statistical range of China's high-tech industry includes five manufacturing categories: aircraft, spacecraft and related equipment; electronics and communication equipment; computer and office equipment; medical equipment and measuring instruments; and medical and pharmaceutical products. We found that Tibet only had the medical and pharmaceutical products manufacturing industry. Traditional Tibetan medicine is the focus of Tibet's medical and pharmaceutical products manufacturing industry. It has a long history and a large number of regular consumers. Its traditional processing techniques have low requirement for advanced production factors and R&D input. The sales profit margin of the high-tech industry in Tibet was 18.88% in 2014, which was the highest sales profit margin among all the 31 provinces, autonomous regions and municipalities. Thus high sales profit margin of its high-tech industry helps Tibet obtain a good competitiveness ranking.

In the three provinces of the northeastern region, the rankings of Liaoning, Jilin and Heilongjiang are 20th, 25th and 28th respectively. They are all in the low level, which explains why the competitiveness of the northeastern region is the lowest among the four regions. What is worse, the northeastern region, among the four economic regions, has the lowest scores in factor 4, mainly related to economic development circumstances and potential. This suggests that its disadvantage in high-tech industry will endure because of the overall unsatisfactory state of economic operation, inadequate number of enterprises, and lack of government funding.

Conclusion

The high-tech industry has already become a significant part of the national and regional economy. Because of differences in natural conditions, economic development levels, high-tech industry policies and measures, and other aspects, imbalances and differences exist in the high-tech industry's regional competitiveness within a country. This study has made a case study of regional competitiveness of China's high-tech industry and gathered 2014 data for 31 provinces, autonomous regions and municipalities falling in four major regions (west, middle, east and northeast). Based on factor analysis, we compared the high-tech industry competitiveness and obtained the following results. (i) Among the 31 provinces, autonomous regions and municipalities, Guangdong has the strongest high-tech industry competitiveness, while Shanxi ranks at the bottom of the competitiveness. (ii) Among the four economic regions, the eastern region has the strongest high-tech industry competitiveness, followed by the middle, western and north-eastern regions. (iii) Differences and imbalances in the high-tech industry competitiveness and development also exist within the same region. The eastern, middle and western regions all have large internal competitiveness differences and serious development imbalances. Analysis of regional competitiveness in the high-tech industry offers policy suggestions for further improving China's high-tech industry, which can also be adopted by other emerging countries. First, each province, autonomous region and municipality should identify its own advantage segment industries and focus on strengthening them. For example, Tibet focuses on developing the medical and pharmaceutical products manufacturing industry according to its natural sources and traditional culture, and the high sales profit margin of this industry segment helps Tibet obtain a high competitiveness ranking. Secondly, development of high-tech industry clusters should be promoted. Industry clusters have positive externality, learning effects, and knowledge spillover effects and help increase industrial innovation capacity and improve competitiveness. Thirdly, technology innovation and introduction should be strengthened. The development of the high-tech industry relies on advanced technologies. Thus domestic independent research and development, and introduction and absorption of foreign technologies are both important.

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