Advances in Economics, Business and Management Research, volume 33
Second International Conference on Economic and Business Management (FEBM 2017)

Research on the impact of implementing performance of China's innovation - driven development strategy on technology innovation index

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Abstract
In this paper, the principal component analysis is used to analyze the performance of China's innovation strategy. We build a scientific and technological innovation evaluation system, The research shows that most provinces have lower technological innovation capability in our country. The regression analysis of the implementation of the performance-driven performance score and the innovation index shows that the regression coefficient begins to decrease after the peak in 2011.
Key words: *innovation-driven development; technological innovation; index; innovation*

1 Introduction

In recent years, domestic and foreign scholars have made a corresponding research on the national innovation strategy of developed countries in the world. Driven development strategy on the impact of technological innovation research is still in the blank. Based on the previous research, this paper makes an empirical analysis on the implementation performance of China's innovation driven development strategy by using principal component analysis, and analyzes the regional science and technology innovation index by using variance weighting method. Finally, we analyze the relationship between the innovation-driven development strategy performance and the scientific and technological innovation index.

2 Literature review

Innovation-driven development strategy focuses on scientific and technological innovation, The domestic and foreign researchers further defined the concept of national innovation capacity on the basis of innovation ability, national competitive advantage theory and national innovation system theory (*Furman et al.*[1]).The Western countries take science and technology development as an important response to actively adjust the science and technology policy(*Gebhard et al.*[2]). They proposed that the American has been able to guide the world's innovation, from its efficient operation of the national innovation system(*Lundvall et al.*[3]).

Based on the previous studies, this paper constructs the performance evaluation system of China's innovation-driven development strategy and uses the principal component analysis and variance weighting method to implement the performance and technology of innovation and development strategy of 30 provinces and cities in mainland China from 2009 to 2015 Innovation index to calculate and analyze the relationship between of them.

3 Construction of index system and data selection

3.1 Construction of China's innovation strategy implementation performance index system

Table 1 - China's innovation-driven development strategy implementation performance evaluation index system

Target	Level 1 Indicators	secondary indicators
Performance Evaluation of Innovation Strategy Implementation	Innovation input	R & D expenses Internal expenses (ten thousand yuan)
		High-tech industry investment (ten thousand yuan)
		Research & Development Agency R & D Person (person)
	Innovation output	Number of patent applications in China（Pieces）
		High-tech industry new production and sales income (million)

This paper divides the innovation-driven development strategy evaluation system into 2 first-level indexes, 5 secondary indicators.

3.2 Construction of scientific and technological innovation index system

According to the innovation elements, this paper constructs 2 first-level indexes and 6 second-level indicators. The specific index system is shown in Table 2.

Table 2 - Science and technology innovation index system

Technological innovation conditions	Every man R & D staff full-time equivalent (million person years)
	R & D accounts for the proportion of GDP
	Technical market turnover contract amount growth rate
Technological innovation effect	The proportion of high - tech products exports to the total exports of all products
	The proportion of total output value of high - tech industry to industrial output value
	The proportion of the main business income of the high - tech industry to the GDP of the region

3.3 Data selection

This paper chooses the "China Statistical Yearbook" and "China Statistical Yearbook of Science and Technology" from 30 provinces of China in 2009 to 2015.

4 Experimental

4.1 Empirical analysis of innovation-driven development strategy

4.1.1 Data selection and effectiveness analysis

The validity of the 5 indicators is validated before the principal component analysis. The KMO value is 0.780, and the data can be Principal component analysis, Bartlett's spherical degree test is 1020.272, the significance level P is 0.000, indicating that the correlation matrix is not a unit matrix, it can be factor analysis.

4.1.2 Factor extraction

According to the eigenvalues of more than 1 extraction of common factors, the variance cumulative contribution rate of 86.045%, the total variance of the explanation in Table 3.

Table 3 - explains the total variance

Ingredients	Initial eigenvalue			Extract squares and load		
	total	Variance%	Accumulated%	total	Variance %	Accumulated%
1	10.28	64.267	64.267	10.283	64.267	64.267
2	3.485	21.779	86.045	3.485	21.779	86.045
3	0.904	5.652	91.697			

4.1.3 innovation-driven development strategy implementation performance static analysis

The principal component factor weighting coefficient is obtained by dividing the load factor of the two principal components by the square root of the eigenvalue. and then weighted weights of 5 normalized variables are used to obtain the principal components of F_1、F_2, two principal component factors of F_1、F_2 are obtained by weighting the normalized variables.

$$F_1 = 0.306X_1 + 0.265X_2 + 0.243X_3 + 0.300X_4 + 0.162X_5 \quad (2)$$

$$F_2 = 0.007X_1 - 0.191X_2 + 0.314X_3 - 0.100X_4 + 0.413X_5 \quad (3)$$

The normalized data into F_1、F_2get the total score of each factor, and then into the following formula (3), get the total score.

$$F = 0.747F_1 + 0.253F_2 \quad (4)$$

The total score calculated according to the above equation (3) is sorted by standardizing the total score to be analyzed and compared. The scores and rankings after treatment are shown in Table 4.

Table 4 - Innovation-driven development strategy implementation performance and ranking

area	Score	Ranking	area	Score	Ranking
Guangdong	1.000	1	Chongqing	0.156	16
Beijing	0.964	2	Hebei	0.152	17
Jiangsu	0.957	3	Inner Mongolia	0.120	18
Shanghai	0.614	4	Heilongjiang	0.098	19
Zhejiang	0.568	5	Jilin	0.097	20
Shandong	0.517	6	Jiangxi	0.093	21
Tianjin	0.389	7	Guangxi	0.049	22
Hubei	0.321	8	Shanxi	0.047	23
Sichuan	0.276	9	Yunnan	0.039	24
Shanxi	0.254	10	Xinjiang	0.027	25
Liaoning	0.246	11	Guizhou	0.016	26
Fujian	0.245	12	Gansu	0.011	27
Henan	0.231	13	Ningxia	0.007	28
Anhui	0.202	14	Hainan	0.005	29
Hunan	0.191	15	Qinghai	0.000	30

According to the results of the standardized treatment in Table 4, it found that the top three Guangdong, Beijing and Jiangsu scores were above 0.9, and then the scores of Shanghai, Zhejiang and Shandong provinces were above 0.5, Guizhou, Gansu and Ningxia the standardization of the region ranked in the last three.

4.2 Analysis of technological innovation measures

4.2.1 Determination of the weight of scientific and technological innovation indicators

In this paper, the variance weighting method is adopted to avoid the interference of the weight value due to subjective randomness.

$$\sigma_i = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_{ij} - \overline{x_j}\right)^2},\quad x_j = \frac{1}{n}\sum_{i=1}^{n} x_{ij} \tag{5}$$

Where i is a province and its value is 1 to 30; j is a column index item with a value of 1 to 17; x_{ij} is the normalized data of the i province j indicator.

$$w_j = \sigma_j \Big/ \sum_{j=1}^{m} \sigma_j \tag{6}$$

4.2.2 Calculation of technological innovation index

$$Y_i = \sum_{j=1}^{m} w_j x_{ij} \tag{7}$$

Where w_j is the weight of the j index and Y_i is the comprehensive technological innovation index of region i.

4.2.3 Analysis of technological innovation

Table 5 - China's provinces and cities in 2015 scientific and technological innovation index

area	ITII	TIC	ISTI	TIE	area	ITII	TIC	ISTI	TIE
Guangdong	0.535	0.505	0.359	0.746	Ningxia	0.301	0.388	0.328	0.170
Jiangsu	0.498	0.541	0.288	0.654	Jiangxi	0.284	0.160	0.426	0.291
Beijing	0.470	0.695	0.240	0.429	Hebei	0.275	0.269	0.383	0.174
Zhejiang	0.446	0.524	0.301	0.499	Jilin	0.271	0.376	0.229	0.188
Tianjin	0.414	0.387	0.260	0.599	Yunnan	0.262	0.314	0.374	0.090
Shanghai	0.398	0.425	0.228	0.535	Guizhou	0.257	0.254	0.349	0.168
Anhui	0.391	0.396	0.388	0.387	Liaoning	0.251	0.347	0.195	0.193
Hubei	0.380	0.430	0.353	0.346	Heilongjiang	0.251	0.358	0.280	0.095
Chongqing	0.375	0.223	0.354	0.577	Hainan	0.232	0.254	0.328	0.112
Fujian	0.370	0.359	0.441	0.311	Qinghai	0.225	0.171	0.436	0.080
Shanxi	0.360	0.394	0.316	0.365	Inner Mongolia	0.224	0.186	0.430	0.064
Henan	0.358	0.206	0.364	0.534	Gansu	0.222	0.277	0.235	0.144
Shandong	0.350	0.374	0.342	0.330	Guangxi	0.184	0.107	0.310	0.153
Xinjiang	0.330	0.301	0.541	0.154	Shanxi	0.174	0.130	0.172	0.229
Hunan	0.325	0.328	0.276	0.372					
Sichuan	0.320	0.260	0.334	0.378	average value	0.324	0.331	0.329	0.312

According to the established index system and the standardized data of 2015, the comprehensive technology innovation index and ranking of 30 provinces and cities in mainland China were obtained by variance weighting method. The value of scientific and technological innovation are shown in Table 5.

In a word, most provinces have a lower technological innovation capability, and there is large room for improvement. The value of technological innovation and technological innovation are high, and these provinces are mainly concentrated in economically developed areas.

4.3 innovation-driven development strategy to implement performance and scientific and technological innovation empirical analysis

In order to further analyze the linear relationship between the implementation of innovation-driven development strategy and the scientific and technological innovation index, the relevant model is constructed to measure the causal relationship between them. The model as shown in equation (8):

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \tag{8}$$

Where Y_t denotes the technological innovation index of the year t, X_t is the innovation performance of the innovation-driven development strategy for the year t, β_1 is the regression coefficient between the two, β_0 is the intercept term, ε_t is the random error term The Using Eviews9.0 statistical software for regression analysis, the results shown in Table 6.

Table 6 - The relationship between innovation-driven development strategy implementation and technological innovation index

years	Regression coefficients	intercept
2009	0.137156***	0.243600
2010	0.040401**	0.267981
2011	0.150125***	0.230438
2012	0.147214***	0.258839
2013	0.123511***	0.241985
2014	0.121070***	0.254732
2015	0.139228***	0.242367
2009-2015	0.247146***	0.125283

Note: * is 10% significant, ** is 5% significant, *** is 1% significant.

From 2009 to 2015, the correlation coefficient between innovation-driven development strategy implementation performance and S & T innovation index is positive. In addition to the 2010 regression coefficient less than 0.1, the regression coefficients of other years are greater than 0.1, among which 2011 and 2012 The regression coefficient is about 0.15, but after the maximum value in 2011, the regression coefficient begins to decrease year by year, and signs of recovery begin in 2015.

5 Conclusions

The results show that the correlation coefficient between innovation-driven development strategy and scientific and technological innovation index is positive in 2009 and 2015, and the regression coefficient starts at the maximum value in 2011 Year-on-year decline, signs of recovery began in 2015. Before the innovation-driven development strategy in 2012 has yet to be formally put forward, the technology innovation index may be an incremental process, and in 2011 it may have reached the peak of the stage. In order to keep science and technology progress and promote economic development, the state in 2012 put forward the innovation-driven development strategy.

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