



# Journal of Applied Sciences

ISSN 1812-5654

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Construction of Evaluation System of Innovative City and Empirical Research

<sup>1</sup>Guo Ping, <sup>2</sup>Chen Jianwei and <sup>3</sup>Song Zhihui

<sup>1</sup>School of Economy and Management, Shijiazhuang Tiedao University, Hebei, China

<sup>2</sup>Hebei Academy of Social Sciences, Hebei, China

<sup>3</sup>University of Sydney, Sydney, Australia

---

**Abstract:** Since 2006, the strategic decision of building some innovative country was put forward in China, many cities one after another have been building innovative cities on the agenda and to accelerate the construction of innovative city. In the past few years, a uniform standard for evaluation of the construction and development of innovative city was needed. Based on the systematicness, orientation, operability, comparability principle to establish the innovative city evaluation index system, we select 15 key indicators which were divided into five categories. By factor analysis method, consulting the “China City Statistical Yearbook”, “China Science and Technology Statistical Yearbook”, “National Economic and Social development Statistics Bulletin” of the cities, R andD resources inventory key data bulletin of each city, the study evaluated 15 major innovative cities pilot in Chinese eastern, central and western regions and finally summarized six different types of innovative cities development and analyzed each classification.

**Key words:** Innovative city, evaluation, indicators, factor analysis

---

### INTRODUCTION

The objectives evaluated of innovative city refers to the cities which are based on the realistic foundation of economy in our country and develop into the innovative city, this is the problem of the city development with Chinese history and realistic particularity. (National Innovation System Construction Strategy Research Group, 2011) So, we should not only need to keep the direction of the construction of innovative city but also need to research the evaluation techniques of innovative city construction.

### CONSTRUCTION PRINCIPLES OF THE INNOVATION CITY EVALUATION INDEX SYSTEM

To design a scientific, effective and easy to operate evaluation index system of innovative city, we should consider the general principles of designing evaluation index system and the specific requirements and characteristics of the innovative city evaluation. Therefore, the design of the evaluation index system of innovative city should be guided by the following principles:

- **Systematicness:** Innovative city is a complex social economic system with innovation input, innovation process, innovation environment and innovation output subsystem (Gao *et al.*, 2013) and including a series of indexes

- **Orientation:** The evaluation index system of innovative city should play the leading function, which guide the governments at all levels and relevant departments pay attention to those easily overlooked aspects and to those constituted a bottleneck effect aspects and to those advantage aspects in the construction of innovative city
- **Operability:** The index should not be too much, by cutting out the superfluous and be easy to understand, to obtain, analyze, evaluate and monitor. At the same time, different index should be as far as possible reduced the degree of correlation, avoiding duplication and overlapping
- **Comparability:** In the index system, the parameters of the statistical range must remain consistent and the index should facilitate the staff know about status, trend of constructing innovative city and compare information in different period of time

### EVALUATION INDEX SYSTEM OF INNOVATIVE CITY

According to the above principles 15 indexes are divided into 5 categories are as followed Table 1.

### EMPIRICAL STUDY OF INNOVATIVE CITY

This study, based on the comprehensive evaluation of the innovative city system, is using factor analysis method to evaluate innovative city (Gan and Huang,

**Table 1: Innovative city evaluation index system list**

| First-class indexes                     | Second-class indexes   | Third-class indexes  | Unit    | Serial No. |
|---|------------------------|--|---------|------------|
| Innovative city Evaluation index system | Innovation input       | X1: Personal quantity engaged in R and D per million labor forces                                | Person  | 1          |
|   |                        | X2: The proportion of R and D fund to GDP  | %       | 2          |
|   |                        | X3: The Proportion of local financial science and technology funding to local fiscal expenditure | %       | 3          |
|   | Enterprises Innovation | X4: The No. of high-tech enterprises   | a       | 4          |
|   |                        | X5: The number of industrial enterprises above designated size having R and D institution        | a       | 5          |
|   |                        | X6: The proportion of enterprise investment to R and D fund                                      | %       | 7          |
|   | Innovation Ability     | X7: The number of patent authorized per million population                                       | %       | 8          |
|   |                        | X8: The per capita GDP   | %       | 8          |
|   | Innovation potential   | X9: R and D personal full-time equivalent  | manyear | 9          |
|   |                        | X10: The proportion of commodity import and export trade volume in a city to the nation's total  | %       | 10         |
|   |                        | X11: The proportion of foreign Capital actually used to the National Cities's total              | %       | 11         |
|   | Innovation environment | X12: The number of university student per million population                                     | %       | 12         |
|   |                        | X13: Urban air quality levels  | -       | 13         |
|   |                        | X14: Urban sewage treatment rates  | %       | 14         |
|   |                        | X15: The number of internet users per hundred population   |         |            |

**Table 2: Original data of innovative city evaluation**

| City         | X1   | X2   | X3     | X4   | X5  | X6    | X7         | X8    | X9       | X10   | X11  | X12     | X13  | X14   | X15    |
|--------------|------|------|--------|------|-----|-------|------------|-------|----------|-------|------|---------|------|-------|--------|
| Beijing      | 3.91 | 5.82 | 6.58   | 3800 | 305 | 37.70 | 2703.13    | 75943 | 191779.0 | 10.14 | 3.48 | 483.51  | 0.33 | 80.98 | 43.37  |
| Tianjin      | 3.53 | 2.49 | 3.14   | 760  | 320 | 77.10 | 1116.72    | 72994 | 5200.0   | 2.77  | 5.93 | 531.86  | 0.33 | 83.00 | 17.97  |
| Shijiazhuang | 3.26 | 1.4  | 1.48   | 166  | 94  | 63.11 | 232.42     | 33915 | 19566.2  | 0.37  | 0.13 | 1370.43 | 0.50 | 95.30 | 13.27  |
| Taiyuan      | 3.45 | 3    | 2.48   | 128  | 88  | 65.36 | 1373.19    | 50225 | 21153.3  | 0.27  | 0.15 | 1156.84 | 0.33 | 66.10 | 26.24  |
| Shenyang     | 4.30 | 2.1  | 2.97   | 172  | 116 | 53.63 | 431.49     | 62357 | 19693.0  | 0.26  | 2.76 | 676.31  | 0.50 | 78.00 | 18.89  |
| Shanghi      | 4.34 | 2.81 | 6.12   | 1324 | 638 | 67.60 | 3412.82    | 76074 | 132900.0 | 23.03 | 6.08 | 383.83  | 0.05 | 81.00 | 366.35 |
| Nanjing      | 5.01 | 2.9  | 3.05   | 470  | 113 | 53.64 | 1446.82    | 6437  | 44995.9  | 1.53  | 1.54 | 1444.14 | 0.50 | 59.16 | 23.36  |
| Hngzhou      | 2.99 | 2.8  | 4.68   | 2018 | 501 | 82.10 | 3843116.00 | 69828 | 54700.0  | 1.76  | 2.38 | 952.91  | 0.50 | 93.22 | 31.62  |
| Hefei        | 4.37 | 2.4  | 5.65   | 438  | 407 | 65.82 | 809.58     | 54796 | 22345.0  | 0.33  | 0.78 | 1728.25 | 0.50 | 85.11 | 10.86  |
| Nanchang     | 3.72 | 2.1  | 153.00 | 97   | 42  | 61.96 | 325.73     | 43769 | 18002.0  | 0.18  | 1.10 | 2312.46 | 0.25 | 92.00 | 16.21  |
| Jinan        | 3.27 | 2.37 | 1.48   | 269  | 204 | 77.98 | 1588.03    | 57966 | 30067.0  | 0.25  | 0.66 | 1803.74 | 0.50 | 89.60 | 19.42  |
| Zhengzhou    | 3.59 | 1.47 | 2.23   | 250  | 186 | 61.00 | 581.52     | 49947 | 25928.2  | 0.17  | 1.04 | 1024.20 | 0.33 | 97.20 | 15.04  |
| Wuhan        | 4.04 | 2.6  | 2.01   | 523  | 299 | 77.90 | 1214.85    | 58961 | 46437.0  | 0.61  | 1.80 | 1692.95 | 0.25 | 94.96 | 25.34  |
| Chengdu      | 3.91 | 2.5  | 1.38   | 853  | 270 | 49.80 | 2261.05    | 48510 | 43505.0  | 0.83  | 2.66 | 618.37  | 0.33 | 91.30 | 14.41  |
| Xi'an        | 5.15 | 6.1  | 1.17   | 380  | 219 | 31.20 | 1026.79    | 38341 | 52611.0  | 0.35  | 0.86 | 1274.47 | 0.33 | 72.29 | 18.68  |

2009) Factor Analysis is through appropriate combinations of the plurality of indicators that possible existing correlation, into a few unrelated indicators, while the few indicators contains most of the information of the original indexes, to achieve the purpose of simplifying the problem. It is mainly based on the objective data of indicators to evaluate and is able to eliminate the influence of correlation and human factors and to reduce the workload of the indicators selected, simply to calculate and easy to operate. In the comprehensive evaluation process, determining the index's weight is objective and reasonable and to overcome the defects of the artificially determining the weight in certain evaluation methods.

We select 2010 evaluation Year, selected a total of 15 cities to collect the raw data from China's eastern, central and western regions. Data sources mainly is "Chinese cities Statistical Yearbook 2011", "China Science and Technology Statistics Yearbook 2011", cities 2010

national economic and social development of statistical commune, cities R and D Resources main data commune cities network technology, statistical information released the main data and the like.

We choose 2010 as the year of assessment, from the eastern and western regions in China selected 15 city data collection. Data is the main source of "China City Statistical Yearbook 2011", "science and technology of China Statistical Yearbook 2011", the city of the 2010 national economic and social development statistical bulletin, the city R andD resources inventory data bulletin, the city of science and technology network, statistical information network released data etc.

**Original data:** The original data of innovative city evaluation is as followed Table 2.

**Original data standardization:** While facing different levels or different units of data it need to treatment before

**Table 3: Data standardization in innovative city evaluation**

| City         | X1    | X2    | X3    | X4    | X5    | X6    | X7    | X8    | X9    | X10   | X11   | X12   | X13   | X14   | X15   |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Beijing      | -0.02 | 2.20  | 1.93  | 3.07  | 0.34  | -1.60 | 1.10  | 1.42  | 2.91  | 1.19  | 0.74  | -1.20 | -0.66 | -0.26 | -0.01 |
| Tianjin      | -0.63 | -0.27 | 0.03  | -0.02 | 0.43  | 0.05  | -0.34 | 1.19  | 0.01  | -0.01 | 2.06  | -1.11 | -0.66 | -0.08 | -0.29 |
| Shijiazhuang | -1.06 | -1.08 | -0.89 | -0.62 | -0.93 | 0.11  | -1.14 | -1.76 | -0.67 | -0.41 | -1.05 | 0.36  | 0.99  | 1.00  | -0.34 |
| Taiyuan      | -0.75 | 0.11  | -0.34 | -0.66 | -0.97 | 0.26  | -0.11 | -0.53 | -0.63 | -0.42 | -1.04 | -0.01 | -0.66 | -1.58 | -0.20 |
| Shenyang     | 0.60  | -0.56 | -0.06 | -0.61 | -0.80 | -0.53 | -0.96 | 0.39  | -0.66 | -0.42 | 0.36  | -0.86 | 0.99  | -0.53 | -0.28 |
| Shanghi      | 0.66  | -0.04 | 1.67  | 0.56  | 2.35  | 0.41  | 1.74  | 1.43  | 1.69  | 3.29  | 2.14  | -1.37 | 0.99  | -0.26 | 3.60  |
| Nanjing      | 1.74  | 0.03  | -0.02 | -0.31 | -0.82 | -0.53 | -0.04 | 0.52  | -0.14 | -0.22 | -0.30 | 0.49  | 0.99  | -2.19 | -0.23 |
| Hingzhou     | -1.49 | -0.04 | 0.88  | 1.26  | 1.52  | 1.38  | 2.13  | 0.96  | 0.06  | -0.18 | 0.16  | -0.37 | 0.99  | 0.82  | -0.14 |
| Hefei        | 0.72  | -0.34 | 1.41  | -0.34 | 0.95  | 0.29  | -0.62 | -0.18 | -0.61 | -0.41 | -0.70 | 0.99  | 0.99  | 0.10  | -0.37 |
| Nanchang     | -0.33 | -0.56 | -0.86 | -0.69 | -1.25 | 0.03  | -1.05 | -1.01 | -0.70 | -0.44 | -0.53 | 2.02  | -1.49 | 0.71  | -0.31 |
| Jinan        | -1.04 | -0.36 | -0.69 | -0.52 | -0.27 | 1.10  | 0.09  | 0.06  | -0.45 | -0.43 | -0.77 | 1.13  | 0.99  | 0.50  | -0.28 |
| Zhengzhou    | -0.52 | -1.03 | -0.47 | -0.53 | -0.38 | -0.04 | -0.82 | -0.55 | -0.54 | -0.44 | -0.56 | -0.25 | -0.66 | 1.17  | -0.32 |
| Wuhan        | 0.19  | -0.19 | -0.59 | -0.26 | -0.12 | 1.10  | -0.25 | 0.13  | -0.11 | -0.37 | -0.16 | 0.93  | -1.49 | 0.97  | -0.21 |
| Chengdu      | -0.03 | -0.27 | -0.94 | 0.08  | 0.13  | -0.99 | 0.70  | -0.65 | -0.17 | -0.33 | 0.30  | -0.96 | -0.66 | 0.65  | -0.33 |
| Xi'an        | 1.96  | 2.41  | -1.06 | -0.40 | -0.18 | -2.04 | -0.42 | -1.42 | 0.02  | -0.41 | -0.66 | 0.19  | -0.66 | -1.03 | -0.28 |

the data statistics, so that the data is in more equal condition to analysis. We choose the treatment method of original data standardization, namely the data by subtracting the mean and divided by the standard deviation (Ma and Zhang, 2013; Song, 2013). Table 3 shows the data standardization in innovative city evaluation.

**Method to determine the index weight:** In this study, the factor analysis is used to the 15 indexes of the evaluation index system and comprehensive index with conversion to be instead of the original indexes, to measure and determine the innovation city development situations in different areas.

Using statistical analysis software SPSSv16.0 after data processing, the results were as followed Table 4.

Through calculating the initial factor loading matrix between 5 main factors and each variable, each load represents correlation coefficient of major factors and the corresponding variable. From the initial factor loading matrix, there was a certain relation of sample index and the main factor but because of the common factor itself, we find that the 10 variable loading in the first factors are relatively high it brings difficulties for the factor explanation, so choosing orthogonal rotation. (Xu, 2013; Yang and Zhao, 2013) And the results is as followed Table 5.

Table 6 show that the first five principal components could explain 86.147% of the original 15 variables and the numerical change can basically represent the change of the 15 original variables.

**First principal factors explanation:** From the factor loading matrix after orthogonal rotation, we can see that the first main factor is mainly composed of X4, X9, X7, X3, namely the number of high-tech enterprises, R andD personnel FTE, The number of Patent authorized per million population, The proportion of Local financial

**Table 4: Component matrix**

|     | Component |        |        |        |        |
|-----|-----------|--------|--------|--------|--------|
|     | 1         | 2      | 3      | 4      | 5      |
| x9  | 0.876     | -0.276 | -0.275 | -0.030 | 0.117  |
| x10 | 0.875     | 0.037  | 0.209  | -0.294 | 0.220  |
| x3  | 0.831     | 0.075  | 0.059  | 0.326  | 0.068  |
| x8  | 0.819     | 0.190  | 0.016  | 0.161  | -0.361 |
| x5  | 0.812     | 0.316  | 0.082  | 0.020  | 0.224  |
| x7  | 0.811     | 0.156  | -0.152 | 0.200  | 0.128  |
| x11 | 0.788     | 0.148  | 0.046  | -0.387 | -0.364 |
| x4  | 0.783     | -0.142 | -0.517 | 0.264  | 0.031  |
| x15 | 0.718     | 0.160  | 0.422  | -0.383 | 0.298  |
| x12 | -0.701    | 0.064  | 0.052  | 0.176  | 0.466  |
| x6  | -0.042    | 0.899  | 0.070  | 0.085  | -0.066 |
| x2  | 0.406     | -0.775 | -0.273 | 0.144  | 0.145  |
| x1  | 0.109     | -0.739 | 0.507  | -0.111 | 0.088  |
| x14 | -0.151    | 0.639  | -0.501 | -0.232 | 0.314  |
| x13 | 0.220     | 0.284  | 0.620  | 0.550  | 0.045  |

Extraction method: Principal component analysis. A: 5 components extracted

**Table 5: Rotated total variance explained**

| Component | Rotation sums of squared loadings |              |                |
|-----------|-----------------------------------|--------------|----------------|
|           | Total                             | Variance (%) | Cumulative (%) |
| 1         | 3.619                             | 24.129       | 24.129         |
| 2         | 2.798                             | 18.652       | 42.781         |
| 3         | 2.629                             | 17.530       | 60.310         |
| 4         | 2.343                             | 15.617       | 75.927         |
| 5         | 1.533                             | 10.220       | 86.147         |

Science and technology funding to local fiscal expenditure and the loading on first main factors are: 0.938, 0.775, 0.706, 0.659. We can clearly see that, the first factor explains the 24.129% original variables. The first principal factor mainly reflects the current situation of the development of innovative city. (Yuan, 2013).

**Second principal factors explanation:** The second factor is mainly determined by X15, X10, X5, namely The number of Internet users per hundred population, the proportion of commodity import and export trade volume in a city to the nation's total, The number of Industrial Enterprises above Designated Size having R and D institution and

**Table 6: Rotated component matrix**

|     | Component |        |        |        |        |
|-----|-----------|--------|--------|--------|--------|
|     | 1         | 2      | 3      | 4      | 5      |
| x4  | 0.938     | 0.078  | -0.017 | 0.280  | -0.076 |
| x9  | 0.775     | 0.393  | -0.229 | 0.321  | -0.152 |
| x7  | 0.706     | 0.371  | 0.129  | 0.264  | 0.198  |
| x3  | 0.659     | 0.355  | -0.030 | 0.292  | 0.405  |
| x15 | 0.109     | 0.931  | -0.054 | 0.229  | 0.142  |
| x10 | 0.368     | 0.826  | -0.108 | 0.335  | 0.059  |
| x5  | 0.496     | 0.633  | 0.197  | 0.246  | 0.264  |
| x1  | -0.122    | 0.227  | -0.874 | -0.042 | 0.052  |
| x6  | -0.179    | 0.088  | 0.807  | 0.092  | 0.357  |
| x14 | 0.046     | 0.114  | 0.803  | -0.237 | -0.343 |
| x2  | 0.204     | 0.486  | 0.043  | 0.802  | -0.056 |
| x11 | 0.204     | 0.486  | 0.043  | 0.802  | -0.056 |
| x12 | -0.305    | -0.202 | 0.117  | -0.773 | 0.041  |
| x8  | 0.483     | 0.219  | 0.081  | 0.688  | 0.319  |
| x13 | 0.021     | 0.154  | 0.009  | -0.019 | 0.890  |

loading on the second main factor are: 0.931, 0.826, 0.633, the first main factors explains 18.652% original variables. So the second principal factor reflects the international exchange of science and technology in the city.

**Third principal factors explanation:** The third factor is mainly determined by X1, X6, X14, X2, namely per million labor force engaged in R and D personnel quantity, The proportion of enterprise investment to R and D fund, Urban sewage treatment rates, The per capita GDP and loading on the fourth main factors are: -0.874, 0.807, 0.803, -0.651, the third factor explains 17.530% original variables. The third principal factor is mainly reflects the innovation city input.

**Fourth principal factors explanation:** The fourth factor is mainly determined by X11, X12, X8, namely the proportion of Foreign Capital Actually Used to the National Cities 's total, The number of university student per million population, per capita GDP and loading on the fourth main factors are as follows: 0.802, -0.773, 0.688, the fourth principal factor explains 15.617% of the original variables. The fourth principal factor mainly reflects the Economic Education environment of the Innovative city.

**Fifth principal factors explanation:** The fifth factor is determined by X13, namely Urban air quality levels, loading on the fifth main factor is 0.890, fifth main factors explains 10.220% of original variables. The fifth principal factor mainly reflects the natural environmental conditions of innovative city.

**Comprehensive scores of each region sequencing:** Innovative city evaluation index is a dynamic and relative concept. Although the estimating results of 15 city innovative city development is not very accurate but from the top score of Table 7 it shows each city's innovative city construction development and difference.

**Table 7: Comprehensive score of each city**

| City         | F1    | F2    | F3    | F4    | F5    | Comprehensive score |
|--------------|-------|-------|-------|-------|-------|---------------------|
| Beijing      | 2.86  | -0.46 | -0.77 | 0.54  | -0.88 | 0.47                |
| Tianjin      | -0.60 | -0.48 | 0.64  | 2.41  | -0.45 | 0.21                |
| Shijiazhuang | -0.66 | -0.09 | 0.71  | -1.06 | 0.07  | -0.21               |
| Taiyuan      | -0.41 | -0.81 | -0.31 | 0.13  | 0.16  | -0.27               |
| Shenyang     | -1.04 | -0.66 | -0.64 | 1.20  | 0.74  | -0.22               |
| Shanghai     | 0.13  | 3.43  | -0.16 | 0.75  | 0.53  | 0.81                |
| Nanjing      | -0.48 | -0.57 | -1.65 | 0.25  | 1.52  | -0.32               |
| Hangzhou     | 1.60  | -0.44 | 1.56  | -0.03 | 1.18  | 0.69                |
| Hefei        | 0.16  | 0.11  | -0.06 | -1.15 | 1.47  | 0.02                |
| Nanchang     | -0.68 | 0.15  | 0.43  | -1.11 | -1.27 | -0.37               |
| Jinan        | 0.00  | -0.31 | 0.90  | -0.83 | 0.87  | 0.06                |
| Zhengzhou    | -0.61 | -0.09 | 0.71  | -0.05 | -0.82 | -0.13               |
| Wuhan        | -0.22 | 0.19  | 0.72  | -0.33 | -1.01 | -0.05               |
| Chengdu      | -0.11 | -0.07 | 0.11  | 0.38  | -1.13 | -0.08               |
| Xi'an        | 0.05  | 0.10  | -2.18 | -1.09 | -0.97 | -0.62               |

The comprehensive score is the highest in Shanghai and Hangzhou, scoring 0.81 and 0.69. The two city is located in the Yangtze River Delta region but the development of innovative city is not the same. Shanghai was mainly due to the second principal factors F2 scoring high, 3.43; and Hangzhou is due to the first, third, fifth factor with higher scores, respectively 1.6, 1.56, 1.18. The second principal factor mainly includes the factors of city international exchanges of science and technology. In this respect Shanghai as Chinese international metropolis far exceeds other cities. Hangzhou in investment and development of innovation, or natural environment is superior to other cities. Hangzhou is the national informatization pilot city, the electronic commerce pilot city and national software industry base, IC Design Industrialization base. In the information and new medicine, environmental protection, new materials the development of high-tech industry leads good momentum and this has become one of the features and advantages of Hangzhou.

The second are the cities of Beijing and Tianjin, scoring 0.47 and 0.21. The two city location adjacent to each other and both are the economic centers of the north. Beijing gains the highest F1 score of 2.86 and the higher F4 score of 0.54; Tianjin in F4 gets the highest score of 2.41 and in F3 gets higher scores of 0.64. The first factor F1 is mainly embodied current situation of the development of innovative city, Beijing as the capital of China, is the country's largest base of scientific and technological research institutions with Chinese Academy of Sciences, Chinese Academy of engineering and the Beijing Zhongguancun Science Park known as the Silicon Valley of China. Tianjin score of Fourth principal factor F4 is the highest and F4 reflects the Economic Education environment of Innovative City. Tianjin is the largest coastal open city in the north of China, North China International Logistic Center and international port city. Tianjin's score of F3 is higher, mainly because the

scientific research and experimental development investment funds in Tianjin city ranks the third in the country with many scientific research units, including the areas of aerospace, biomedicine and information industry.

Again are the cities of Jinan and Hefei, scoring 0.06 and 0.02. Jinan's F3 and F5 score are higher and Hefei's F5 score is higher. Jinan has beautiful natural scenery, ancient times known as "Spring City" reputation. Now it is with high-tech, information industry and IT industry ranks fourth in China and is approved by the state as "Chinese software famous city". Hefei in the national environmental friendly rankings in 2012 is the first one in the middle of the country and in "Nature Publishing index 2011 China" report released by the UK "natural" magazine, is ranked after Beijing and Shanghai according to the quality standard of study. So Hefei has the strong scientific research strength.

The next rank are Wuhan and Chengdu and Zhengzhou, the comprehensive scores are -0.05, -0.08, -0.13. Wuhan and Zhengzhou are with the high score of F3 innovation input, Chengdu is better in F4, economic environment of innovative city. Wuhan is the largest industrial, commercial city in the central region of China and "China Wuhan, Optics Valley" is second only to Zhongguancun in Beijing and is the second large Chinese intelligence intensive area, in 2011 the number of college students ranked the first in the world. Zhengzhou is an important center city in Central China and is an important integrated transport hub. In recent years, Zhengzhou achieved in the implementation of major science and technology projects, building development platform, to create innovative team. Chengdu as the important central city in Southwest China, has a good investment environment and enormous business opportunities, which has attracted wide attention of domestic and foreign enterprises, the two indicators of the total amount of foreign capital actually utilized and introduction of the world 500 strong rank first in the middle and west of China.

Then, there are Shijiazhuang, Shenyang and Taiyuan with the comprehensive scores of -0.21, -0.22 and -0.27. Shijiazhuang is higher in the F3 score and Shenyang and Taiyuan are higher in F4 and F5 score. Shijiazhuang has a number of national, provincial scientific research institutions and enterprises and is the Hebei province's science and Technology Center for the allocation of resources, to promote the rapid development of city innovation by talents, institutions, funding and other leading edge. Shenyang city is the central city in Northeast China, the center of economic, cultural, transportation and Trade in the northeast of China and is the national industrial city, China's "national environmental protection model city", "National Forest

city". Taiyuan is famous for the military, North China's cultural center and has the most energy source in China, is one of the heavy industry base, China's "national garden city". At present, Taiyuan has been basically established technical innovation system with enterprises as the main body, the market as the guidance and formed of a number of core technologies with independent intellectual property rights and product.

The last one is the Xi'an with comprehensive score of -0.62. Xi'an is better in F1 (innovation city development situation) and F2 (international exchange of science and technology) score but the score of F3, innovation investment is the lowest in the 15 city, F4 and F5 score are low. Xi'an City is an important innovation of knowledge and technology center in Chinese western region. In "2012 Blue Book: China City Competitiveness Report" published by Chinese Academy of Social Sciences, Xi'an ranked 36 in the cities of China in the comprehensive competitiveness and rose 3 place than last year. This show that the city is further narrowed the gap between east and west of China.

#### **ACKNOWLEDGMENT**

The study is the part of the work of the project 'the construction of a national innovative pilot city of Shijiazhuang City', which is commissioned by innovation system Office of the State Ministry of Science and Technology in China.

#### **REFERENCES**

- Gan, D. and Z. Huang, 2009. The Path Choice of Innovative City Construction: An Empirical Research of Wuhan City. Economic Science Press, China, pp: 30-70..
- Gao, T., J. Zhao and Y. Jia, 2013. The internet of things in the city of intelligent meter by reading technology application. J. Convergence Inform. Technol., 8: 429-437.
- Ma, J. and B. Zhang, 2013. Research on join-development and application of regional economy based on factor analysis and gravity model. J. Converg. Inform. Technol., 8: 1-7.
- National Innovation System Construction Strategy Research Group, 2011. The Innovative city Construction of the National Innovation System Development Report. Science Press, China, pp: 24-25.
- Song, D.J., 2013. Study on coordinated development of circulation industry and city economy taking China as an empirical test. Adv. Inform. Sci. Service Sci., 5: 49-55.

- Xu, Y., 2013. Sustainable development evaluation on ecological city based on meanvariance method. *Int. J. Digital Content Technol. Appl.*, 7: 427-435.
- Yang, X. and S. Zhao, 2013. A funding model of emergency Management-based on the factor analysis. *Adv. Inform. Sci. Service Sci.*, 5: 1228-1237.
- Yuan, D., 2013. Research on the model of sports industry competitiveness based on factor analysis and principal component analysis. *Int. J. Dig. Content Technol. Appl.*, 7: 288-296.