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# Research on talent attraction evaluation of China western region based on AHP

**Shuangshuang Chen, Shengbang Song***
**School of business, Hohai University, Nanjing, 211100, (CHINA)**
**E-mail: brenda1981@163.com**

## ABSTRACT

The problem of introducing and keeping talents in China western region results in lacking of talent. Related research about talent in China western region is relative lack. This paper focuses on talent attraction evaluation research in China western region. By Delphi method, we build talent attraction evaluation index system. Using analytic hierarchy process (AHP) to determine index weight, and set up evaluation model to carry on quantitative analysis by the data in 2008-2012 in western 12 provinces. We get conclusions: First, talent attraction appear unbalanced condition in China western region, Sichuan has relatively the strongest talent attraction , Shaanxi and Chongqing follow by, and other provinces has the lowest levels. Second, technology innovation and entrepreneurship condition, career development condition and education condition are advantageous factors affected talent attraction of China western region and also weak short board of other nine provinces. The paper primarily carries out empirical research on talent attraction in China western region. Research method is more scientific and research process is deeper compared with existing related research. The research will help to solve the plight of hard to attract and retain talent in China western region, and provide new perspective and reference for its talent team construction.

## KEYWORDS

Talent attraction; Evaluation index system; AHP; Delphi method; China western region.



## INTRODUCTION

In 2014, “The Silk Road Strategy” and “The Yangtze River Economic Belt Strategy” were carried out to be the national strategy. After “The Western Development Strategy”, these two strategies are important strategy to promote the development of western economy. The economy development needs the talent as strong support. Because of the limitation of geography, natural environment conditions in China western region, there exists the serious problem of attracting talent and retain talent. So this paper takes the western talent attraction as the research subject and tries to provide reference for western talent team construction.

At present, there is no concrete China western region’s talent attraction evaluation research at home and abroad. In domestic, there are a small number of talent attraction research about western local region such as Qin Fangming’s study of Xinjiang talent attraction and turnover rate[1], Li Hua’s study of Xi 'an talent attraction evaluation and comparative[2]. China lacks of overall talent attraction evaluation in the western region. Foreign countries mainly concentrated in two aspects of talent flow and talent attraction. Talent flow study mainly focused on talent flow factors and constructing talent flow model; Talent attraction study mainly focused on theories and empirical studies under industrial clusters theory [3-7]. Domestic research both involves the talent flow and the talent attraction evaluation. About talent attraction evaluation, Zhou Juntan and Zhang Ruihong studied it from the perspective of industrial cluster[8,9], and Gao Ziping evaluated Shanghai’s talent attraction by AHP[10], and Yong Qinxi evaluated Fujian’s talent attraction by entropy evaluation method[11] .Throughout these studies, the evaluation method is relatively single, evaluation index is not exact and cannot combined with regional characteristics to build. In view of these studies shortages, with the characteristics of China western region, this paper carries out study on the western region’s talent attraction evaluation by the Delphi method and AHP, and will find out the advantageous factors of talent attraction in China western region.

## CONSTRUCT EVALUATION INDEX SYSTEM

### China western region introduction

China western region, usually referring to west of connected line between the Qin ling Mountains and the Yellow River, includes 12 provinces and municipalities of Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Guangxi in southwest China and Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia in northwest China. Western region land area is 6.81 million kilometers, accounting for 71% of China total area, and has a relatively scarce population of about 350 million, accounting for 28% of China total population. Western region has vast territory, rich natural resources, and diversity ethnic and cultural, but economic development seriously lags behind compared with China eastern and central regions. These condition dues in large part to the limitation of natural conditions in western region which restricts attracting and keep talents. Therefore, how to promote the talent attraction and retain the talents in the western region has become an important part of the western economic development today.

### Construct evaluation index system based on Delphi method

Following the index set principles of independence, accessibility, quantifiable, comparable, understandable, the paper constructs evaluation index system by Delphi method and also specially combines with western region’s characteristics.

Step 1, set talent evaluation index initially. First of all, according to the literature research results on the talent attraction, we preliminary set a total of 45 talent attraction evaluation index. During this process, we select indexes comprehensively from macroscopic to microcosmic, and consider

government level policy factors , social level talent flow factors, individual talent of various factors such as choosing a concept for career selection[12,13].

Step 2, determine talent experts. According to the needs of paper's research content, we contact 15 talent experts to select indexes. In order to better reflect the western region characteristic, we choose eight experts from China western region, the other seven experts from central and eastern region. These 15 experts will determine talent evaluation index and weight of the indexes.

Step 3, determine talent evaluation indexes by Delphi method. We present 45 talent evaluation indexes which are obtained in the first step to 15 talent experts who will score these indexes. According to the sequence from high to low we retain 30 indicators. Then the second, three rounds of screening, and ultimately we construct the talent attraction evaluation index system that is composed of five dimensions of primary indexes (TABLE 1 primary index) and 15 secondary evaluation indexes(TABLE 1 secondary index).

Step 4, determine quantitative explanation index of secondary index. In order to analysis these indexes quantitatively, we consult 15 experts to form each secondary index explanation (TABLE 1 explanation index of secondary).

## DETERMINE INDEX WEIGHT BASED ON AHP

### Construct index judgment matrix based on AHP

According to the relative importance judgment of each index by 15 experts, we constructs index judgment matrix shown in TABLE 2. Matrix is divided into 6, 1 primary index judgment matrix as shown in TABLE 2 called matrix, and 5 secondary index judgment matrixes as shown in TABLE 2 called matrix 2,3,4,5 and 6.

### Calculate evaluation index weight

Step 1, calculate the product of the judgment matrix elements of each row according to the formula (1).

$$M_i = \prod_{j=1}^{n} a_{ij} \qquad i = (1, 2\ldots n) \tag{1}$$

Step 2, calculate the NTH root of mi according to the formula (2).

$$\overline{w_i} = \sqrt[n]{m_i} \qquad i = (1, 2\ldots n) \tag{2}$$

Step 3, standardized $\overline{w_i}$ according to the formula (3), and get the weight of each index. Specific weight calculation results are shown in TABLE 3.

$$w_i = \frac{\overline{w_i}}{\sum_{i=1}^{n} \overline{w_i}} \qquad i = (1, 2\ldots n) \tag{3}$$

Step 4, calculate the maximum characteristic root $\lambda$ according to the formula (4). Calculation results show ordinal that $\lambda$ as 5.1, 3.039, 5.25, 2, 2, and 3.039 of matrix is 1, 2, 3, 4, 5, and 6.

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{\sum_{j=1}^{n} a_{ij} \times w_i}{w_i} (i, j = 1, 2, n) \quad (4)$$

**TABLE 1 : Talent attraction evaluation index system of China western region**

| Primary Index and Code | Secondary Index and Code | Secondary Index | Explanation of Secondary Index |
|---|---|---|---|
| Economic Condition $X_1$ | Economic Level | $X_{11}$ | GDP Per Capita/Yuan |
| | Economic Growth | $X_{12}$ | GDP Growth Rate/% |
| | Economic Structure | $X_{13}$ | Tertiary Industry Proportion in GDP/% |
| Life livable Condition $X_2$ | Standard of Living | $X_{21}$ | Average Disposable Wage of the Urban Units/Yuan |
| | House Price | $X_{22}$ | Average Price of Commercial house/ Yuan/m2 |
| | Transport | $X_{23}$ | City Road area per Capita/ m2 |
| | Medical | $X_{24}$ | Health technical persons(10000 person) |
| | Culture and Entertainment | $X_{25}$ | Cultural Expense Per Capita/Yuan |
| Career Development Condition $X_3$ | Employment Structure | $X_{31}$ | Third Industry Employment proportion/% |
| | Employment Level | $X_{32}$ | Urban Registered Unemployment Rate/% |
| Education Condition $X_4$ | High Education Development | $X_{41}$ | Colleges and Universities Numbers |
| | High Education Universal | $X_{42}$ | Students in Colleges and Universities per 10000 person |
| Technology Innovation and Entrepreneurship Condition$X_5$ | Scientific and Technological Level | $X_{51}$ | R&D Investment Intensity Proportion/% |
| | Innovation Level | $X_{52}$ | Total Patents Granted |
| | Entrepreneurial Environment | $X_{53}$ | Fixed-asset Investment Per Capita (10000 Yuan) |

**TABLE 2 : Judgment matrix of evaluation index system**

| Primary Index Matrix | | | | | | |
|---|---|---|---|---|---|---|
| Matrix 1 | | X1 | X2 | X3 | X4 | X5 |
| | $X_1$ | 1 | 1/2 | 1/5 | 1/3 | 1/7 |
| | $X_2$ | 2 | 1 | 1/4 | 1/2 | 1/6 |
| | $X_3$ | 5 | 4 | 1 | 3 | 1/3 |
| | $X_4$ | 3 | 2 | 1/3 | 1 | 1/5 |
| | $X_5$ | 7 | 6 | 3 | 5 | 1 |
| **Secondary Index Matrix** | | | | | | |
| Matrix 2 | | $X_{11}$ | $X_{12}$ | $X_{13}$ | | |
| | $X_{11}$ | 1 | 1/3 | 3 | | |
| | $X_{12}$ | 3 | 1 | 5 | | |
| | $X_{13}$ | 1/3 | 1/5 | 1 | | |
| Matrix 3 | | $X_{21}$ | $X_{22}$ | $X_{23}$ | $X_{24}$ | $X_{25}$ |
| | $X_{21}$ | 1 | 1/3 | 7 | 5 | 3 |
| | $X_{22}$ | 3 | 1 | 8 | 6 | 4 |
| | $X_{23}$ | 1/7 | 1/8 | 1 | 1/3 | 1/5 |
| | $X_{24}$ | 1/5 | 1/6 | 3 | 1 | 1/3 |
| | $X_{25}$ | 1/3 | 1/4 | 5 | 3 | 1 |
| Matrix 4 | | $X_{31}$ | $X_{32}$ | | | |
| | $X_{31}$ | 1 | 1/3 | | | |
| | $X_{32}$ | 3 | 1 | | | |
| Matrix 5 | | $X_{41}$ | $X_{42}$ | | | |
| | $X_{41}$ | 1 | 1/3 | | | |
| | $X_{42}$ | 3 | 1 | | | |

| | | $X_{51}$ | $X_{52}$ | $X_{53}$ |
|---|---|---|---|---|
| Matrix 6 | $X_{51}$ | 1 | 1/3 | 3 |
| | $X_{52}$ | 3 | 1 | 5 |
| | $X_{53}$ | 1/3 | 1/5 | 1 |

**TABLE 3 : Talent attraction evaluation index weight of China western region**

| Index | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_{11}$ | $X_{12}$ | $X_{13}$ | $X_{21}$ | $X_{22}$ | $X_{23}$ | $X_{24}$ | $X_{25}$ | $X_{31}$ | $X_{32}$ | $X_{41}$ | $X_{42}$ | $X_{51}$ | $X_{52}$ | $X_{53}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weight | 0.048 | 0.073 | 0.253 | 0.115 | 0.510 | 0.258 | 0.637 | 0.105 | 0.273 | 0.485 | 0.035 | 0.068 | 0.139 | 0.250 | 0.750 | 0.250 | 0.750 | 0.258 | 0.637 | 0.105 |

Step 5, carry out consistency check according to the formula (5) and formula (6). Calculation results show that $CI$ value of 6 matrix ordinal is 0.0348, 0.0193, 0.0625, 0, and 0.0193. Combined with $RI$ values, we get eventually $CR$ value of the matrix ordinal is 0.030, 0.033, 0.059, 0 and 0.033. Obviously, $CR$ value of 6 matrixes are all less than 0.1. It shows consistency error is in the range of acceptable, and suggests 6 judgment matrix are all reasonable.

$$\mathbf{CI} = \frac{\lambda_{\max} - \mathbf{n}}{\mathbf{n} - \mathbf{1}} \quad \textbf{(5)}$$

$$CR = \frac{CI}{RI} \quad \textbf{(6)}$$

## DATA SOURCES AND DATA STANDARDIZATION

After determined above index weight, we begin to collect original data of index and carry on concrete standardization of the index. We referred to information from China Statistical Yearbook, China Technology Statistical Yearbook, China Labor Statistical Yearbook, China Population and Employment Statistics Yearbook, China economic information network statistics database and related provincial statistical yearbook. Finally we get a total of 5 years of index raw data for 12 provinces in China western region.

We take a linear standardized method to normalize the raw data. Through the method of linear standardized processing, set $\overline{X_{ij}}$ as standardized index, the data processing method is as formula (4.1). For negative effect index, taking the reciprocal of indexes' original data firstly, and then standardized them by formula (4.1). All normalized values are distributed between 0-1.

$$\overline{X_{ij}} = X_{ij} / \sum_{i=1}^{n} X_{ij} \quad (i, j = 1, 2 \ldots n) \quad \textbf{(4.1)}$$

## CONSTRUCT EVALUATION MODEL AND EVALUATION ANALYSIS

### Construct evaluation model

To construct talent attraction evaluation model as shown in formula (7). $E_{ij}$ indicates evaluation value , $\overline{X_{ij}}$ indicates standardized index value. $W_{ij}$ indicates weight of each index . $E_{ij}$ Value is between 0-1, the closer to 1 shows that the higher of the score. The higher score of index indicates it has the bigger contribution to the province talent attraction level. That is to say, these indexes are advantage contributing factor for province talent attraction. Based on the weights shown in table 3.2.1, by evaluation model, we calculate the talent attraction evaluation value of China western region and analysis the evaluation results.

$$E_{ij} = \sum_{ij=1}^{n} W_{ij} \overline{X_{ij}} \quad (i, j = 1,2,\ldots,n) \quad \textbf{(7)}$$

**The analysis of 12 provinces' talent attraction evaluation**

First of all, we calculate each province's talent attraction evaluation value $E_{ij}$ of 12 provinces. According to the size of the value, we analyze them. The higher of the $E_{ij}$ suggests that the level of the province talent attraction, on the contrary, the weaker. The calculation results are displayed in Figure 1.

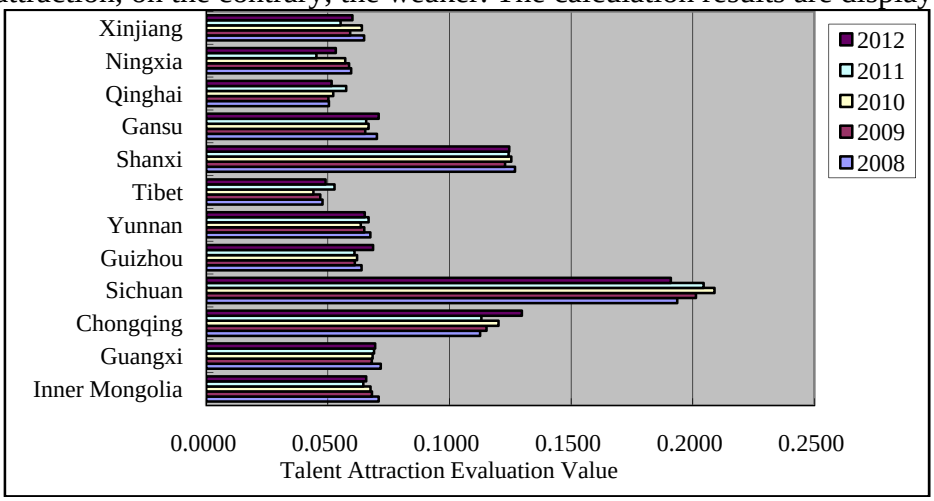


**Figure 1 : Talent attraction evaluation value in China west region in 2008-2012**

Figure 1 shows that 12 provinces which talent attraction evaluation value from high to low in turn is Sichuan, Shaanxi, Chongqing, Guangxi, Gansu, Inner Mongolia, Yunnan, Guizhou, Xinjiang, Ningxia, Qinghai and Tibet. Further analysis evaluation value, we find that some provinces have similarity evaluation value among all 12 provinces, such as Shaanxi and Chongqing which has value of 0.1248 and 0.1182 respectively. Other nine provinces including Guangxi, Gansu, Inner Mongolia, Yunnan, Guizhou, Xinjiang, Ningxia, Qinghai and Tibet have similar degree of the evaluation value which is below 0.08. Thus, we divide talent attraction in China western region into three categories: Sichuan is the strongest appeal provinces, Shaanxi and Chongqing occupy center; the weakest is Guangxi, Gansu, Inner Mongolia, Yunnan, Guizhou, Xinjiang, Ningxia, Qinghai and Tibet. And differences between these three categories are large. This suggests that talent attraction in China western region present imbalance and Sichuan, Chongqing and Shaanxi is more relative to attract and retain talent; the rest of the nine provinces of talent attraction is in a relatively backward state. So, which factors lead to such a big gap on talent attractions in all provinces in China western region? We further analyze internal structure of each province's talent attraction deeply.

**The analysis of internal structure of each province's talent attraction**

We calculate the total score of each evaluation index in 2008-2012 and analyze relative talent attraction contribution degree of each index. We first sum and average the value of 15 secondary evaluation index respectively from 2008 to 2012 and to get the average of every secondary evaluation index as shown in TABLE 4and Figure2. And then on this basis, we future sum and average the value of each secondary evaluation index of all 12 provinces and get the average of each secondary index in this 5 years ignoring the differences between the province .It is shown in Figure 3.

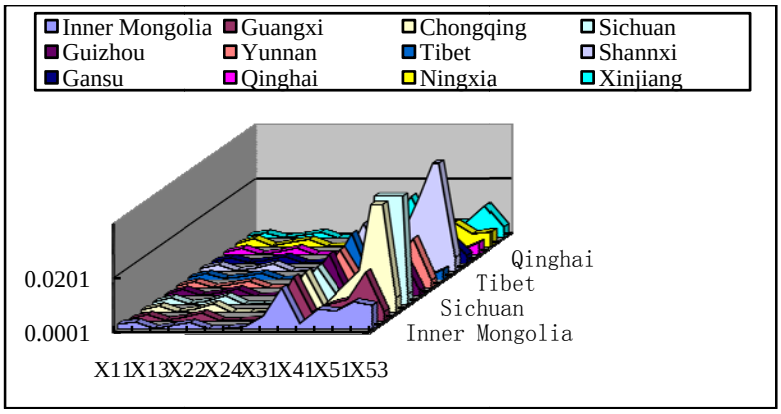


**Figure 2 : Provincial talent attraction evaluation index value in China western region in 2008-2012**

**TABLE 4 : Provincial talent attraction evaluation index value in China western region in 2008-2012**

| | **Inner Mongolia** | **Guangxi** | **Chongqing** | **Sichuan** | **Guizhou** | **Yunnan** | **Tibet** | **Shaanxi** | **Gansu** | **Qinghai** | **Ningxia** | **Tibet** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $X_{11}$ | 0.0020 | 0.0009 | 0.0011 | 0.0010 | 0.0007 | 0.0008 | 0.0009 | 0.0012 | 0.0008 | 0.0010 | 0.0011 | 0.0011 |
| $X_{12}$ | 0.0028 | 0.0025 | 0.0027 | 0.0026 | 0.0027 | 0.0024 | 0.0024 | 0.0026 | 0.0021 | 0.0026 | 0.0031 | 0.0021 |
| $X_{13}$ | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 |
| $X_{21}$ | 0.0015 | 0.0015 | 0.0015 | 0.0014 | 0.0014 | 0.0014 | 0.0013 | 0.0013 | 0.0012 | 0.0012 | 0.0017 | 0.0013 |
| $X_{22}$ | 0.0026 | 0.0031 | 0.0035 | 0.0034 | 0.002 8 | 0.0026 | 0.0025 | 0.0030 | 0.0026 | 0.0027 | 0.0028 | 0.0024 |
| $X_{23}$ | 0.0003 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0002 | 0.0002 | 0.0003 | 0.0003 |
| $X_{24}$ | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0003 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0005 |
| $X_{25}$ | 0.0011 | 0.0005 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0014 | 0.0006 | 0.0006 | 0.0014 | 0.0013 | 0.0010 |
| $X_{31}$ | 0.0050 | 0.0042 | 0.0058 | 0.0052 | 0.0057 | 0.0044 | 0.0054 | 0.0048 | 0.0053 | 0.0057 | 0.0052 | 0.0055 |
| $X_{32}$ | 0.0154 | 0.0163 | 0.0152 | 0.0140 | 0.0156 | 0.0142 | 0.0172 | 0.0178 | 0.0187 | 0.0160 | 0.0115 | 0.0156 |
| $X_{41}$ | 0.0023 | 0.0034 | 0.0027 | 0.0043 | 0.0024 | 0.0032 | 0.0008 | 0.0044 | 0.0022 | 0.0008 | 0.0008 | 0.0021 |
| $X_{42}$ | 0.0076 | 0.0064 | 0.0092 | 0.0072 | 0.0050 | 0.0060 | 0.0065 | 0.0119 | 0.0076 | 0.0053 | 0.0071 | 0.0061 |
| $X_{51}$ | 0.0068 | 0.0080 | 0.0157 | 0.0187 | 0.0079 | 0.0077 | 0.0038 | 0.0269 | 0.0133 | 0.0082 | 0.0090 | 0.0061 |
| $X_{52}$ | 0.0102 | 0.0181 | 0.0535 | 0.1366 | 0.0154 | 0.0183 | 0.0009 | 0.0438 | 0.0093 | 0.0017 | 0.0049 | 0.0121 |
| $X_{53}$ | 0.0089 | 0.0036 | 0.0056 | 0.0039 | 0.0023 | 0.0030 | 0.0040 | 0.0053 | 0.0030 | 0.0047 | 0.0056 | 0.00 2 |
| Average | 0.0010 | 0.0026 | 0.0004 | 0.0014 | 0.0028 | 0.0002 | 0.0004 | 0.0009 | 0.0052 | 0.0156 | 0.0024 | 0.0072 |

TABLE 4 and Figure 2 show that indexes evaluation value from $X_{11}$ to $X_{31}$ is very low but indexes evaluation value from $X_{31}$ to $X_{53}$ is higher of all 12 provinces. It is prominent the occupying area of evaluation index from $X_{31}$ to $X_{53}$ in Sichuan, Chongqing and Shaanxi provinces is far more than the other indexes. It indicates the value of these indexes is the biggest value of all the provinces. It also illustrates these indexes are key factors restricting talent attraction in 12 provinces of China west region.

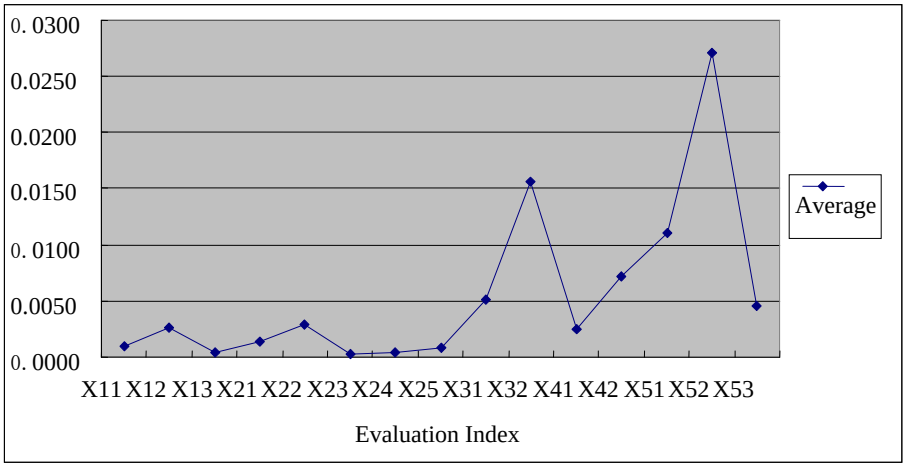


**Figure 3 : Talent attraction evaluation index average in China western region in 2008-2012**

From $X_{31}$ to $X_{53}$, these indexes are technology innovation and entrepreneurship condition, education condition and career development condition. That is to say, these three factors are main factors pulling the provincial talent attraction. We infer that talent work in China western region should put an emphasis on these aspects of technology innovation and entrepreneurship condition, education condition and career development condition. Figure3 shows that the average of $X_{52}$ ,$X_{32}$ ,$X_{51}$, $X_{42}$ , $X_{31}$ and $X_{53}$ are definitely too high. These indexes are corresponding to three primary indexes as technology innovation and entrepreneurship condition, career condition and education condition. It indicates these three factors are main advantageous factors for talent attraction in China western region. The conclusion is the same as the conclusion in Figure 2. In addition, the average of index from the $X_{11}$ to $X_{25}$ is relatively low. It suggests that the contribution of these indicators for talent attraction is smaller.

Combined with the weight of the indexes, we can see some evaluation index that experts think is relatively important but their value is relatively low. Such as $X_{12}$ and $X_{22}$, they are index of GDP growth rate and average price of commercial house. The weight of GDP growth rate and average price of commercial house are 0.031 and 0.035 respectively. But the average of them is 0.0026 and 0.0028 respectively (see TABLE 4). Both of them have greater relative weight but relatively low evaluation values of talent attraction in China western region. It states that they are important factors for talent attraction but cannot bring a greater contribution to the talent attraction and retention in western region. We infer that these factors need to be attached great importance and strengthened in talent work in China western region.

## CONCLUSION

The paper studies talent attraction evaluation under background of attracting and retaining talent in China western region. By Delphi method, we construct talent attraction evaluation index system. By AHP, we invite 15 talent experts to assign weight to each index. Combined with official statistics raw data on 12 provinces of western region in 2008-2012, we established evaluation model and evaluated talent attraction evaluation in China west region .At last, we get four conclusions: First, constructing talent attraction evaluation index system for China western region; Second, determining index weight through 15 talent experts. Third, finding the advantage factors of the provincial talent attraction factor which are technology innovation and entrepreneurship condition, career development and education condition. There is basically little national evaluation and comparison study for talent attraction in China western region. And our study can provide basis and reference for talent attraction and talent retaining and other talent team construct work in the western region.

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