ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research (ASSEHR), volume 300
2018 International Workshop on Education Reform and Social Sciences (ERSS 2018)

Talent Attraction Evaluation Model based on Data from Shenzhen City

Song Meng
North China Electric Power University, Baoding 071000, China
1253903640@qq.com

Abstract. What this topic needs to solve is the evaluation of the level of attraction of urban talents. According to the needs of talents, the level of urban talent attraction can be measured from the four dimensions of urban development prospects, income consumption level, living environment and government influence. The Analytic Hierarchy Process and The Entropy Method are used to combine the weights of the comprehensive decision-making indicators to ensure an objective evaluation of the level of talent attraction. In the analytic hierarchy model, each element is sorted according to importance, and a pairwise comparison matrix is constructed. Then, through the consistency pairwise comparison matrix, the weight of each element can be obtained according to the sum method. In the entropy model, the objective weights are made more objective and accurate. Finally, the combination weights, taking the comprehensive value of its weight as the comprehensive weight of the index, reducing the subjective randomness in the process of determining the weight of the index, making the evaluation result more objective and reliable.

Keywords: Analytic hierarchy process, entropy method, combined empowerment.

1. Subject Background

In the context of increasing competition for talents in countries all over the world and across the country, a city must maintain its competitive vitality and innovation.We must keep pace with the times but not blindly adjust the relevant talent attraction policy. In 2018, Shenzhen will increase the reform of the business environment as an important task to attract more outstanding high-tech enterprises and outstanding talents. For most people, the first concern is pre-development; the second is income; again the environmental factor. Based on this background, the following questions are answered: According to the mathematical model and the collected data, quantitative evaluation of the talent attraction level of Shenzhen City. It also made a quantitative evaluation of the impact of the government's “strengthening measures on the reform of the business environment” on the attractiveness of talents.

2. Model Establishment and Solution

2.1 Analytic Hierarchy Process.

According to the previous research results and the unique situation of Shenzhen itself, the Shenzhen talent attraction index system constructed by this paper mainly includes three levels of secondary indicators. The first layer is the target layer, which is based on the evaluation of talent attraction in Shenzhen. The second level is the criteria layer, which mainly includes the four dimensions of urban development prospects, income consumption level, living environment and government influence. The third layer is the indicator layer, which mainly includes 15 aspects such as per capita GDP, contribution rate of the tertiary industry, and investment in fixed assets.

2.2 Solving the Largest Eigenvalue and Eigenvector

Find the eigenvector (normalized) of each pairwise comparison matrix corresponding to the largest eigenvalue (λmax) of A as the weight vector ω,that is, ω is satisfied:

$$A\omega = \lambda\omega \tag{1}$$

Find the eigenvalues of each matrix, and the eigenvectors (after normalization) are shown in Table 1 below.

Table 1. Eigenvalues of pairwise comparison matrices, eigenvectors

Matrix	Maximum Eigenvalue λmax	Feature Vector (after normalization) ω
A	4.0155	[0.461,0.242,0.109,0.187]
B1	3.0092	[0.54,0.3,0.163]
B2	3.0015	[0.414,0.287,0.3]
B3	4.0458	[0.295,0.315,0.235,0.155]
B4	5.1725	[0.219,0.135,0.250,0.172,0.227]

2.3 Judgment Matrix for Consistency Check

In order to make a logical consistency of the importance of the influencing factors, a consistency test is required. For each judgment matrix, the consistency ratio is calculated. If the consistency ratio is less than 0.1, the test passes; if not, the judgment matrix needs to be reconstructed. Step 1: Calculate the consistency indicator CI:

$$\mathrm{CI}=\frac{\lambda\max\text{-}n}{n\text{-}1} \tag{2}$$

Step 2: Find the corresponding average random consistency indicator RI in Table 2:

Table 2. The value of Random consistency indicator RI

n	1	2	3	4	5	6
RI	0	0	0.58	0.9	1.12	1.24

Step 3: Calculate the consistency ratio CR

$$CR = \frac{CI}{RI} \tag{3}$$

When CR < 0.1, the judgment matrix is considered acceptable; when CR >= 0.1, the judgment matrix should be modified until it is acceptable. Find the CI, CR of each matrix as shown in Table 3.

Table 3. CI, CR value.

	A	B1	B2	B3	B4
CI	0.0052	0.0046	0.0008	0.0153	0.0431
RI	0.0058	0.0079	0.0014	0.0169	0.0385

If the value of CR is less than 0.1, the degree of inconsistency of A is within the allowable range.

2.4 Urban Attractiveness Factor Indicators and Weights Induction

Urban attractiveness factor indicators and weights are summarized in Table 4.

Table 4. Urban attractiveness factor indicators and weights induction

Evaluation target	Evaluation of primary indicators	Evaluation of secondary indicators	Data used in the evaluation indicators(2011-2016)	Weights
Talent attraction	Urban development prospects	gross domestic product	gross domestic product	0.249
		Contribution rate of the tertiary industry	Contribution rate of the tertiary industry	0.138
		Fixed assets investment	Fixed assets investment	0.075
	Income level	Average wage of employees	Average wage of employees	0.100
		Consumer price index	Consumer price index	0.069
		Resident disposable income	Resident disposable income	0.073
	living environment	traffic	traffic	0.032
		education	education	0.034
		air quality	air quality	0.026
		Health care institution	Health care institution	0.017
	Government influence	Industrial Development	Industrial Development	0.041
		Commercial land	Commercial land	0.025
		Financial development	Financial development	0.046
		Trade development	Trade development	0.032
		Industrial Development	Industrial Development	0.042

AHP weights matrix:

w = [0.249, 0.138, 0.075, 0.100, 0.069, 0.073, 0.032, 0.034, 0.026, 0.017, 0.041, 0.025, 0.046, 0.032, 0.042].

2.5 Entropy Method

The concept of entropy originated from thermodynamics, and later Shannon introduced information theory. According to the definition and principle of entropy, when the system has n possible (independent) states,

First find the forward indicator:

$$x'_y = \frac{x_{ij}-\min\{x_{ij},\ldots,x_{nj}\}}{\max\{x_{1j},\ldots,x_{nj}\}-\min\{x_{1j},\ldots,x_{nj}\}} \tag{4}$$

x'_{ij} is the value of the jth indicator of the i-year (i=1, 2,...,n; j=1,2,...,m), for the sake of convenience, the normalized data is x_{ij}.

Calculate the proportion of the i-year in the i-th year under the index:

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}, i = 1, \ldots, n; j = 1, \ldots, m \tag{5}$$

Calculate the entropy of the jth indicator:

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}) \quad k = \frac{1}{\ln(n)} > 0, e_j \geq 0 \tag{6}$$

Calculate information entropy redundancy:

$$d_j = 1 - e_j \tag{7}$$

Calculate the weight of each indicator:

$$\omega_j = \frac{d_j}{\sum_{j=1}^{m} d_j} \tag{8}$$

Calculate the combined weights of each indicator:

$$s_i = \sum_{j=1}^{m} \omega_j p_{ij} \tag{9}$$

The weights obtained by the entropy method are as follows:

s = [0.3240, 0.1624, 0.1098, 0.0163, 0.0786, 0.0803, 0.0094, 0.0162, 0.0231, 0.0122, 0.0390, 0.0119, 0.0427, 0.0320, 0.0420]

2.6 Combination Empowerment

In order to make the determination of the weight of the evaluation index more scientific and accurate, this paper combines the analytic hierarchy process with the entropy method, and takes the comprehensive value of its weight as the comprehensive weight of the indicator. The two methods complement each other and can fully consider the expert's knowledge. And experience, can reduce the subjective randomness in the process of determining the weight of indicators, making the evaluation results more objective and reliable, and the comprehensive weight calculation formula is

$$z_j = \frac{w_j s_j}{\sum_{j=1}^{m} w_j s_j} \tag{10}$$

Where wj is the weight value obtained by the analytic hierarchy process, and s j is the weight value obtained by the entropy method.Get the integrated weight value:

z = [0.1153, 0.1043, 0.1297, 0.0144, 0.0255, 0.0144, 0.0261, 0.0424, 0.0788, 0.0634, 0.0842, 0.0422, 0.0822, 0.0885, 0.0885].

2.7 Importance Scale

The importance scale table is shown in Table 5.

Table 5. Importance Scale

index	6	5	4	3	2	1
gross domestic product	>180	150-180	120-150	90-120	60-90	<60
Contribution rate of the tertiary industry(%)	>75	65-75	55-65	40-55	30-40	<30
Fixed assets investment	>0.55	0.45-0.55	0.35-0.45	0.25-0.35	0.2-0.25	<0.2
Average wage of employees	>110	90-110	70-90	50-70	40-50	<40
Consumer price index	>800	700-800	600-700	500-600	400-500	<400
Resident disposable income	>6	5-6	4-5	3-4	2-3	<2
Average number of buses per 10,000 people	>14	13-14	12-13	11-12	10-11	<10
Average number of medical institutions per 10,000 people	>3	2.5-3	2-2.5	1.5-2	1-1.5	<1
One-day air quality days	>360	340-360	320-340	280-320	240-280	<240
Average number of secondary schools per 10,000 people	>30	25-30	20-25	15-20	10-15	<10
Industrial Development(%)	>20	15-20	10-15	5-10	1-5	<1
Import and export total index	>120	110-120	100-110	90-100	80-90	<80
Commercial land(Billion)	>2.5	2.0-2.5	1.5-2.0	1.0-1.5	0.5-1.0	<0.5
Financial growth rate(%)	>16	13-16	8-13	4-8	0-4	<0
Factory gross output value growth rate (%)	>115	112-115	108-112	104-108	100-104	<100

References

[1]. T L Saaty. The analytic hierarchy process [M].New York:McGraw,1980.

[2]. ZHAO Y W.A new integrated design method based on fuzzy matter-element optimization[J].Journal of Materials Processing Technology,2002,129(1):612-618.