Research on the current situation of peasant-workers in construction industry based on AHP

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Abstract

This paper establishes evaluation indexes system of the construction peasant-workers' current situation in the principle of Maslow's hierarchy theory of needs. Then, it analyzes the weight of each evaluation index on the basis of the AHP model, and evaluates the current situation of the peasant-workers with fuzzy comprehensive evaluation method. Through the analysis, we can grasp the key indexes affecting the management of the peasant-workers in construction industry. Finally, the article proposes several incentive measures about the management of the peasant-workers in aspects of salary, security and enterprise culture for the purpose of strengthening the management of the peasant-workers with limited resources.

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Keywords: construction industry; management of peasant-workers; AHP; fuzzy comprehensive evaluation

1. Introduction

In recent years, with the rapid development of Chinese economy, there is a substantial increase in construction labor demand. The diversification of the employment forms and the participants in construction industry make it complicated in the management of the peasant-workers .The management of the peasant-workers is a complex social system project and doing the job well is not only solving the "three rural" issue, maintaining the legal rights of the peasant-workers, but also realizing the management goals and promoting sustainable and healthy development of the construction industry. This paper utilizes Analytical Hierarchy Process (AHP) to study the index about the management of the peasant-workers, and applies fuzzy comprehensive evaluation method to propose targeted measures as a new way trying to improve the management level of the peasant-workers in construction industry.

2. Evaluation index system of the peasant-workers' current situation in construction industry

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2.1. The principle of establishing evaluation index system

This paper establishes index system of the management of the peasant-workers in the principle of Maslow's hierarchy theory of needs. Maslow's hierarchy theory of needs, known as the basic hierarchy theory of needs, is one of the behavioral science theories. It is proposed by the American psychologist Abraham Maslow in the paper of *theory of human motivation* in 1943[1]. According to this theory, we divide the evaluation index into five kinds: physiological need index, security need index, social need index, respected need index, self-realization need index.

2.2. Evaluation index of the peasant-workers' current situation

- Physiological need index

Physiological need is the basic requirement to maintain the peasant-workers' own life, including hunger, thirsty, clothing, shelter, sex. If these requirements are not satisfied, the survival of the peasant-workers becomes a problem. In this sense, physiological need is a strong driving force to mobilize the enthusiasm of the peasant-workers. The indexes of physiological need include the level of the wage, housing and food, labor intensity and couple separated.

- Security need index

Security need means that the peasant-workers have the requirement to ensure their safety, prevent their career and property from being lost and avoid the invasion of occupational diseases. At present，construction accidents happen frequently in our country. The rate of the peasant-workers' signing labor contract is relatively low and their social insurance has been marginalized, they also worry about their pension, sickness, and work injury medical [2]. Therefore safety indexes include wage paid in full without delay, safety in production, signing labor contract and social insurance.

- Social need index

Social need includes two parts. Firstly, the need of love, which means the peasant-workers hope the partner-ship can be harmonious. Secondly, the sense of belonging, which means the peasant-workers hope to become a member of the group, and care about each other. Social need indexes are classified as three aspects: harmonious colleagues, family harmony and leisure life.

- Respected need index

Everyone wishes to have a stable social status, and hope that their abilities and achievements can be recognized and respected by the society. Respected need is divided into internal and external respect. Currently, the peasant-workers wish to be respected by the managers and accepted by the urban residents.

- Self-realization need index

This is the highest level of the requirement, which indicates that the peasant-workers try their best to achieve personal goals and aspirations. The indexes of self-realization need include values and future expectation.

3. AHP model of the evaluation index

Analytical Hierarchy Process, AHP for short, proposed by the U.S. specialist of operations research TL.Saaty in the 1970s, which is a multi-objective decision method combined with qualitative analysis and quantitative analysis [3]. Analytical Hierarchy Process makes people's thought process and subjective judgment results hierarchical and quantitative so that uncertainties have been greatly reduced. Applying AHP can solve complex management problems which are difficult to quantify and finally get a satisfying result. Consequently, AHP is a scientific method to confirm the weight [4].

3.1. Establishing AHP structure system

According to the evaluation index system of the management of the peasant-workers above, index system of AHP structure is established as follow in Fig.1.
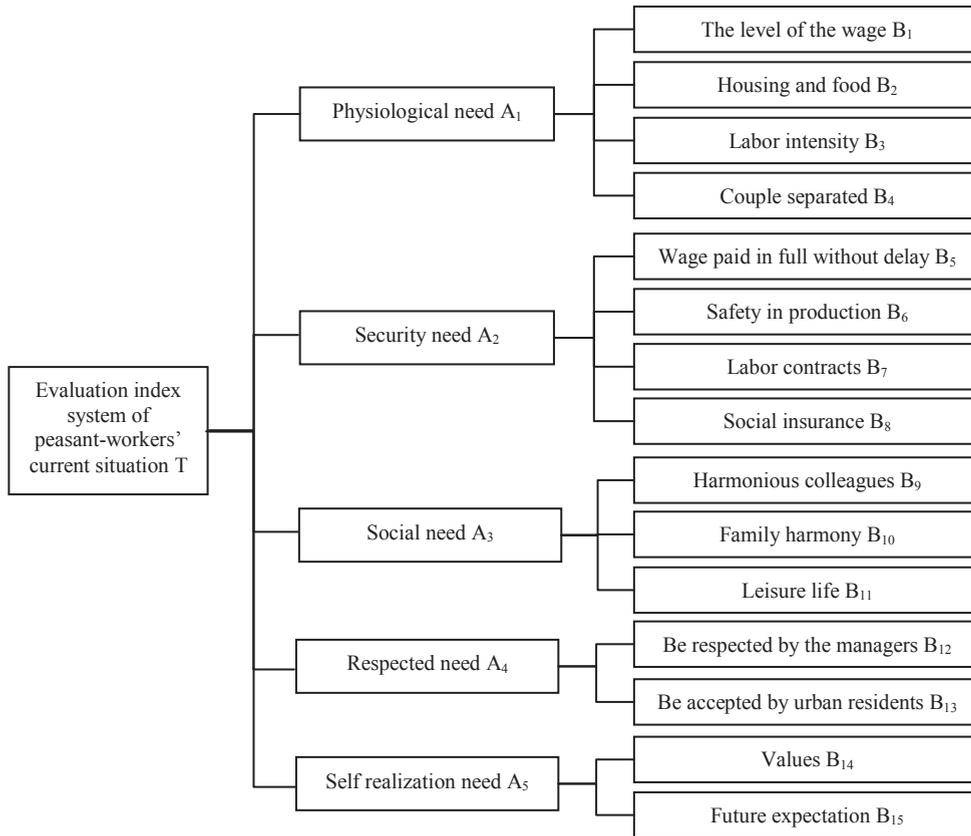
Fig.1. Index system of AHP structure

3.2. Structuring the judgment matrix

Compared the importance of the different factors, we indicate it with number1-9. Through the investigation of the present situation in construction industry, and combined with the experts' evaluation in this field ,we build judgment matrix A of the second layer and judgment matrix B_1 , B_2 , B_3 , B_4 , B_5 , B_1 of the third layer.

$$A = (a_{ij})_{5\times5} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{15} \\ a_{21} & a_{22} & \cdots & a_{25} \\ \cdots & \cdots & \cdots & \cdots \\ a_{51} & a_{52} & \cdots & a_{55} \end{bmatrix} = \begin{bmatrix} 1 & 1 & 3 & 6 & 9 \\ 1 & 1 & 4 & 5 & 8 \\ \frac{1}{3} & \frac{1}{4} & 1 & 3 & 5 \\ \frac{1}{6} & \frac{1}{5} & \frac{1}{3} & 1 & 3 \\ \frac{1}{9} & \frac{1}{8} & \frac{1}{5} & \frac{1}{3} & 1 \end{bmatrix} \qquad B_1 = (b_{ij})_{4\times4} = \begin{bmatrix} 1 & 5 & 7 & 3 \\ \frac{1}{5} & 1 & 3 & 1 \\ \frac{1}{7} & \frac{1}{3} & 1 & \frac{1}{2} \\ \frac{1}{3} & 1 & 2 & 1 \end{bmatrix}$$

$$B_2 = (b_{ij})_{4\times4} = \begin{bmatrix} 1 & 3 & 7 & 9 \\ \frac{1}{3} & 1 & 3 & 5 \\ \frac{1}{7} & \frac{1}{3} & 1 & 2 \\ \frac{1}{9} & \frac{1}{5} & \frac{1}{2} & 1 \end{bmatrix} \qquad B_3 = \begin{bmatrix} 1 & \frac{1}{2} & 2 \\ 2 & 1 & 3 \\ \frac{1}{2} & \frac{1}{3} & 1 \end{bmatrix} \qquad B_4 = \begin{bmatrix} 1 & 4 \\ \frac{1}{4} & 1 \end{bmatrix} \qquad B_5 = \begin{bmatrix} 1 & 3 \\ \frac{1}{3} & 1 \end{bmatrix}$$

3.3. Hierarchical single sort and consistency check

The eigenvector of judgment matrix A corresponding to the maximum eigenvalue λ_{max} is ω. After normalizing, the data in ω is the weight of each factor. Next, we will calculate the eigenvector ω 、 the maximum eigenvalue λ_{max} 、 consistency index CI and consistency ratio CR of each judgment matrix.

The maximum eigenvalue λ_{max} of judgment matrix $A_{5\times5}$ = 5.1367, normalized eigenvector corresponding to the

eigenvalue: $\omega = \{0.3776, 0.3767, 0.1427, 0.0691, 0.0338\}$, the consistency index CI is shown in Eq. (1).

$$CI = \frac{\lambda - n}{n-1} = \frac{5.1367 - 5}{5 - 1} = 0.0342 \tag{1}$$

The consistency value $RI_5 = 1.12$ when n=5, therefore the consistency rate CR is shown in Eq. (2).

$$CR = \frac{CI}{RI} = \frac{0.0342}{1.12} = 0.0305 < 0.1 \tag{2}$$

The result indicates that A has passed the consistency check. Similarly, we could calculate the single sequence and consistency check of judgment matrix B_k (k=1, 2, 3, 4, 5), the results are as follows in Table.1.

Table 1. Hierarchical single sort of the matrix B_k and consistency check

k	ω_{k1}	ω_{k2}	ω_{k3}	ω_{k4}	$\lambda_{k\,max}$	$CI_k = \frac{\lambda_{k\,max} - n}{n-1}$	RI_k	$CR_k < 0.1$?
1	0.5953	0.1637	0.073	0.168	4.0648	0.0216	0.90	0.024 < 0.1
2	0.6095	0.2458	0.0913	0.0534	1.0346	0.0115	0.90	0.013 < 0.1
3	0.297	0.5396	0.1634	——	3.0092	0.0046	0.58	0.008 < 0.1
4	0.8	0.2	——	——	2	0	0	0 < 0.1
5	0.75	0.25	——	——	2	0	0	0 < 0.1
					B_k (k=1, 2, 3, 4, 5) passes the consistency check.			

3.4. Hierarchical total sort and consistency check

Through the analysis above, the weight of each factor $\{A_1,\ A_2,\ A_3,\ A_4,\ A_5\}$ in layer A is shown in Eq. (3).

$$\{a_1,\ a_2,\ a_3,\ a_4,\ a_5\} = \{0.3776, 0.3767, 0.1427, 0.0691, 0.0338\} \tag{3}$$

And the weight of each factor with regard to A_j in layer B is $\{b_{1j},\ b_{2j}, \cdots,\ b_{nj}\}$; Therefore, We use software to calculate the effect weight of each factor in B layer with regard to the management of the peasant-workers ω in Eq.(4)

$$\omega = (0.2248, 0.0618, 0.0276, 0.0635, 0.2296, 0.0926, 0.0344, 0.0201, 0.0424, 0.077, 0.0233, 0.0553, 0.0138, 0.0253, 0.0084)^T \tag{4}$$

Total sort consistency ratio $CR = 0.017 < 0.1$, indicates that hierarchical total sort has passed the consistency check. According to the result, draw a graph of the weight of each index in Fig. 2.
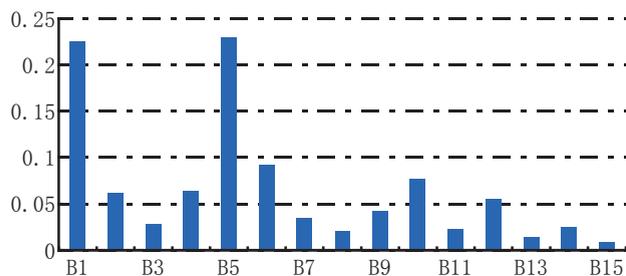

Fig.2. The weight of the evaluation index

4. Fuzzy comprehensive evaluation of the construction peasant-workers' current situation

Fuzzy comprehensive evaluation is a general assessment of the thing or phenomenon affected by many factors [5].In the evaluation index system of the peasant-workers' current situation, because some indexes are fuzzy, so the fuzzy comprehensive evaluation model is an effective approach.

4.1. Evaluation index set C

The evaluation index set C of the peasant-workers' current situation = {the level of the wage, housing and food, labor intensity, couple separated, wage paid in full without delay, safety in production, labor contracts, social insurance, harmonious colleagues, family harmony, leisure life, be respected by the managers, be accepted by urban residents, values ,future expectation}.

4.2. Assessment grade V

The assessment grades of evaluation index are divided into five kinds, V = {superior, good, fair, poor, inferior}, after numeralization, V = {90, 80, 70, 60, 50}.

4.3. Comprehensive score of the evaluation index

Through data collection and the investigation of the peasant-workers' and the managers in construction industry, we can get the evaluation index weight corresponding to different rating and calculate the comprehensive score for each index in Table 2.

Table 2. The comprehensive score of each index

Evaluation index	Assessment grade					Score
	Superior (90)	Good (80)	Fair (70)	Poor (60)	Inferior (50)	
The level of the wage B_1	0.1	0.2	0.4	0.2	0.1	70
Housing and food B_2	0.0	0.1	0.5	0.2	0.2	65
Labor intensity B_3	0.0	0.0	0.3	0.5	0.2	61
Couple separated B_4	0.0	0.0	0.2	0.4	0.4	58
Wage paid in full without delay B_5	0.0	0.1	0.3	0.4	0.2	63
Safety in production B_6	0.0	0.1	0.3	0.4	0.2	63
Labor contracts B_7	0.0	0.1	0.2	0.3	0.4	60
Social insurance B_8	0.0	0.0	0.0	0.6	0.4	56
Harmonious colleagues B_9	0.1	0.1	0.2	0.4	0.2	65
Family harmony B_{10}	0.0	0.1	0.4	0.4	0.1	65
Leisure life B_{11}	0.0	0.1	0.3	0.4	0.2	63
Be respected by the managers B_{12}	0.0	0.1	0.5	0.3	0.1	66
Be accepted by urban residents B_{13}	0.0	0.0	0.3	0.5	0.2	61
Values B_{14}	0.0	0.2	0.4	0.3	0.1	67
Future expectation B_{15}	0.0	0.0	0.3	0.4	0.3	60

According to the table above, we can obtain vector R constituted of the index score, shown in Eq.(5).

$$R = (70,65,61,58,63,63,60,56,65,65,63,66,61,67,60)^T \qquad (5)$$

4.4. Comprehensive evaluation value μ.

In the front section, we have calculated the weight of each index ω using the AHP model. We can calculate μ through Eq.(6).

$$\mu = \omega^T \times R = (0.2248, 0.0618, 0.0276, 0.0635, 0.2296, 0.0926, 0.0344, 0.0201, 0.0424, 0.077, 0.0233, 0.0553, 0.0138, 0.0253, 0.0084)$$
$$\times (70, 65, 61, 58, 63, 63, 60, 56, 65, 65, 63, 66, 61, 67, 60)^T = 64.53 \qquad (6)$$

According to the calculated results, the comprehensive score of the peasant-workers' current situation is 64.53, which means the whole level of the peasant-workers' life is on the poor level.

5. Incentive measures of the peasant-workers

The front results indicate that the evaluation score of index is between 55 to 70, and the comprehensive assessment value μ= 64.53, the weight of each index ω=（0.2248，0.0618，0.0276，0.0635，0.2296，0.0926，0.0344，0.0201，0.0424，0.077，0.0233，0.0553，0.0138，0.0253，0.0084）[T]. Therefore, each index of the peasant-workers in construction industry is not satisfied well, meanwhile the whole level of the peasant-workers' living is on the poor level. The top five indexes of comprehensive weight are: paid wages in full without delay, the level of the wage, safety in production, couple separated and family harmony. These indexes are mainly distributed in the indexes of physiological need and security need.

Maslow thought hierarchy need is the hierarchical structure as a ladder from low to high, only when the low level of demand is satisfied, then can produce higher level of demand, therefore the most urgent need is the main power inspiring people's action [6]. As a result, the management of the peasant-workers should consider the physiological need and security need and pay more attention to the problems of paying wages, the level of the wage, safety in production and the family of the peasant-workers.

5.1. Salary incentive

Firstly, we should quickly establish long-term mechanism of wages to prevent and solve wage defaults , perfect the salary system and make sure the peasant-workers' salaries are paid in full without delay in order to maintain their basic life. Secondly, establish a scientific and reasonable wage growth system gradually. Achieve equal pay for equal work, and build up a reasonable salary increase method according to the abilities and qualifications of the peasant-workers.

5.2. Security incentive

We should establish security system for the peasant-workers. The peasant-workers usually pay no attention to the importance of the rules and regulations because of influenced by the freedom of work in the village. Construction accidents occur mostly on the peasant-workers; hence they usually are both victims and troublemakers. Construction enterprises should actively participate in the system authentication of health, safety and environment, organize trainings for the peasant-workers, and buy accident injury insurance for them, to create a guaranteed work environment full of incentives for the purpose of improving work efficiency.

Establishing the institution of visiting one's family for the peasant-workers and solving the problem of family members going along with them is also significant. The peasant-workers have the rights to enjoy the time of visiting one's family on the legal holidays every year, only in this way can we settle the stayed-problems of the relatives and the children. Separation and emotional problems are not effectively solved when the peasant-workers go out to work, causing a series of family and social problems. Consequently, the construction enterprise should give the peasant-workers humanistic care based on the spirit of "people-oriented".

5.3. Enterprise culture incentive

Enterprise culture incentives consist of constructing enterprise system, forming equal and harmonious enterprise

culture, eliminating the discrimination and prejudice towards the peasant-workers in construction industry, giving relatively fair rights to the peasant-workers, eliminating the sense of inferiority and the consciousness of to be a farmer, increasing the sense of belonging and the work passion of the peasant-workers.

6. Conclusion

According to Maslow's hierarchy theory of need, the paper researches the current situation of the peasant-workers in construction industry applying the AHP model and fuzzy comprehensive evaluation. We can draw the conclusions as follow: the whole level of the peasant-workers' living is on the poor level. The indexes of the physiological need, the security need and the social need weigh high but obtain low scores. The indexes of the respected need and the self-realization need weigh low, but the comprehensive scores of the five indexes have no obvious difference, that means the peasant-workers in construction industry not only have physiological, security and social needs, but also have respected and self-actualization needs. However, restricted by the economic and social development, we should primarily attach importance to the issue of wages, safety in production and the family problems of the peasant-workers. As a result, limited resources may acquire maximum incentive effect in order to improve the level of the peasant-workers' living gradually.

Acknowledgements

References

1. Cheng Guoping, Diao Zhaofeng.Principles of management. Press of Wuhan university of technology, 2006 .

2. Hou Xiaoli, Zhou Jianjun.Discussion of the strategies to Perfect the social insurance system of peasant-workers in our country. Journal of Legal System and Society.5 (2008)194-195.

3.Ye Zhen.Research and application with fuzzy comprehensive evaluation method based on AHP. South China university of technology,Nanjing,2010.

4. Zhu Jianjun.Research and application in some problems of the AHP. The university of northeast, Shenyang, 2005.

5.Zhang Lina.The application of AHP-fuzzy comprehensive evaluation method in the evaluation of ecological industrial park. Dalian university of technology, Dalian ,2006.

6.Wang Yulian.Discussion of the incentives in management with Maslow's hierarchy theory of need. Journal of Economist, 5 (2003)14-15.