Research on Comprehensive Evaluation Index System of Software Outsourcing Personnel Training

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Abstract. For the current status of the software outsourcing talent training and the lack of uniform evaluation criteria, this paper use AHP to research comprehensive evaluation index system of software outsourcing personnel training. First, from the foreign language knowledge, the overall quality, IT technology, software engineering, four areas, build a preliminary evaluation index system; Then study theoretical basis about how to use AHP to calculate the weight indicator system, including the construct matrix, single-level sort, level always sorts and so on; Finally, calculate the weight of each index in the initial evaluation index system, get the final evaluation system. The establishment of a scientific evaluation system is a basis for rational evaluation work, it is important for human resources management on software outsourcing and personnel evaluation research.

Introduction

In developed countries, the software industry is very powerful, Human resources are scarce, labor costs are higher, in order to reduce costs, take advantage of cheap labor in developing countries to manufacture software, delegated non-core businesses to external professional companies, this is the increasingly prosperous software outsourcing. The characteristics of the software outsourcing industry, non-polluting, low-power, high value-added and can provide large number of jobs, these are in line with our country's current industrial upgrading and transformation needs. Corresponds with the rapid development on software outsourcing is the lack of talent. Talents who come from universities and training institutions do not meet the requirements of outsourcing enterprises, talent training and talent needs disjointed, which requires a scientific and rational evaluation of talents comprehensive skills on software outsourcing, evaluation index system is a scientific evaluation of the basic work. By multiple perspectives analysis of talents on software outsourcing, reflect talents comprehensive ability on software outsourcing from the multiple levels, all-round, provide useful guidance for the enterprise human resources management and the improvement of talents comprehensive ability on software outsourcing.

Establishment Of Preliminary Evaluation System

In this paper, the indicators described here as a preliminary study to establish the evaluation index system [1]. The preliminary evaluation index system is divided into two, one level index including Foreign language knowledge, overall quality, IT technology, software engineering, four, each of a number of indicators under the two level indicators, as follows:

(1) Foreign language knowledge. Software outsourcing talents should not only understand the industry specific knowledge but also know software development skills. Meanwhile, software outsourcing talents must have good oral communication skills, especially understand and expression of software outsourcing technical jargon, to read and understand customer requirements made in foreign country and external design book. This requires in talent training process to enhance foreign country language education, use the advantage that China has, allow people to learn computer technology, with foreign country literacy and communication skills, and understanding of foreign country culture, lifestyle and working methods [2]. Two indicators on the evaluation of Foreign language knowledge, including: Basic level of Foreign country language, literature reading

comprehension, writing skills, oral communication skills, Foreign country culture, customs, IT professional vocabulary, knowledge of the Foreign country software.

(2) Comprehensive Quality. It refers to people's level of knowledge, morality and various abilities of our comprehensive literacy. Along with new era, social is no longer just need the talent that masters a single high-tech skill, but the talent that has more comprehensive high-quality, wide knowledge, strong foundation, personal charm, to be able to cope with new challenges. The State Council issued "on the reform of education to promote quality education decision" request "make a establishment of evaluation and inspection system for quality education", without quality evaluation system, it is difficult to realize the talents quality education scientific [3]. Comprehensive high-quality talents have development potential, creativity and the ability to analyze and solve problems. According to China's software outsourcing feature, two indicators on the evaluation of comprehensive quality, include: unity and cooperation, spirit of dedication, ethical standards, technology innovation, communication skills, self-learning, adaption to new environment, English level.

(3) IT technology. The level of IT technology affects the development of China's software outsourcing; talent shortage has become a major constraints factor in the development of China's outsourcing. At present, China's software outsourcing projects are mainly low-end outsourcing exports, mainly focused on data entry, coding, testing, etc., the core technology R & D is relatively low, less high-end projects, so that a high level of IT training technical talents have been become a very important task. To cultivate high-end IT technology professionals, first, establish a sound scientific curriculum, highlighting the importance of IT technology the role of the core courses; Second, increase the practice of practical training session, increase the synthesis, the ratio of the design of experiments, and strengthen practical ability; Third, use case-driven project to replace the traditional teaching mode, so that people really grasp the essence of IT technology; Fourth, promote the school-enterprise cooperation actively [4], put the knowledge Learned in the classroom into actual environment, master the IT technology as soon as possible. Two indicators on the evaluation of IT technology, including: development tools, programming skills, analysis and design, software testing, software knowledge, hardware knowledge, Internet knowledge, the operating system.

(4) Software Engineering. Develop and maintain software, using engineering concepts, principles, techniques and methods, put the time-tested and proven right management techniques and the best current techniques, methods and tools together, that is software engineering. Software engineering is a systematic method for software development, operation, maintenance, and retirement. To engage in software outsourcing permanently, we must follow the requirements of the contract quality and quantity time with the Foreign country side to provide software products. Accordance with the requirements of the contract quality and quantity provides software products on time to the Foreign country side According to the U.S. Survey of the implementation of software engineering, software development is still difficult to predict, only about 10% of the projects scheduled to cost and schedule delivery. Only about 10% of the project is delivered under the scheduled cost and progress. For this situation, it is necessary to use software engineering ideas and methods to guide software development, which requires the outsourcing talent in-depth study and understanding of the essence of software engineering and successfully applied to software outsourcing the actual work. Two indicators on the evaluation of software engineering capabilities, including: software engineering standard, outsourcing process specification, software project management, software development, writing documentation, quality control, configuration management.

Theoretical Basis Of Index Weight Calculation

AHP is broken down into decision-making objectives, guidelines, programs and other levels, further qualitative and quantitative analysis of the decision-making methods. U.S. operations research expert, University of Pittsburgh professor T.L.Satty in the early 1970s, applies network theory and the multi-objective comprehensive evaluation method, proposes a hierarchical weight decision analysis method. AHP calculation process is shown in Fig. 1 [5].

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                    │  Start  │
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        ┌────────────────────────────────────────┐
        │ Establish analytical Hierarchy structure model │
        └────────────────────────────────────────┘
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        ┌────────────────────────────────────────┐
        │       Construct judgment matrix A       │
        └────────────────────────────────────────┘
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        ┌────────────────────────────────────────┐                ┌──────────┐
        │      Find the characteristic vector of A │◄──────────────│ Update A │
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        ┌────────────────────────────────────────┐                    │
        │    Find the maximum characteristic of A │                    │
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        │             Consistency test            │                    │
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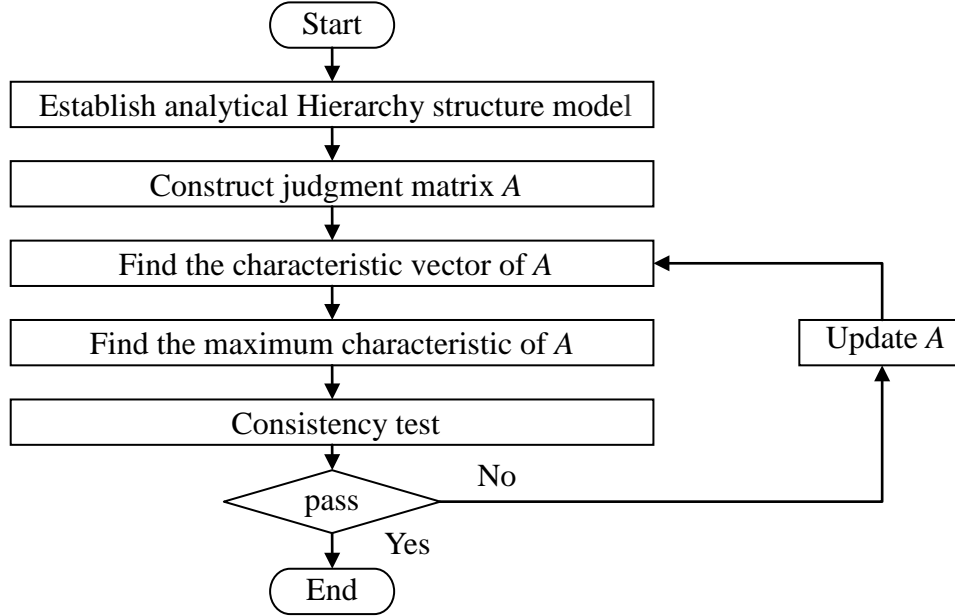
Fig. 1. AHP calculation process

(1) Construct Judgment Matrix. An important feature of AHP is to use the importance between the ratios of two forms expressed the importance of the corresponding two level programs. It is difficult to determine the relative importance of various indicators directly, therefore, the comparison between the two, according to their degree of importance rating, the results of pairwise comparison matrix is called judgment matrix [6].

(2) Level Single Sort. Level single sorting, is refers to use linear algebra knowledge of the biggest characteristic value to calculate matrix and the corresponding feature vector, normalize the feature vector , the results are weights from   the evaluation index of the level about the relatively importance of the index above [7-8]. Usually have root method, and the plot method, here take root method.

Calculate the product of line index in judgment matrix. The formula is:

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

Calculate the product of the *n-th* root. The formula is:

$$\overline{W_i} = \sqrt[n]{M_i} \tag{2}$$

Normaliz the vectors $\overline{W} = \{\overline{W_1}, \overline{W_2}, \cdots, \overline{W_n}\}$. The formula is:

$$w_i = \overline{W_i} \left/ \left[\sum_{i=1}^{n} \overline{W_i} \right] \right. \tag{3}$$

(3) Level Always Sorts. It refers to the importance of weight of a level of all the indicators relative to the top (total goals). Calculate by a hierarchical structure from top to bottom along the layer by layer, calculate the relative importance of weights and the relative merits of ranking value about the indicators which is compared between top and the bottom. If want to kown the weight which is get using level always sorts is satisfied to accept, there is need for comprehensive conformance test.

Evaluation Index System

(1) Results About Index Weight

   Through research and expert scoring system to construct judgment matrix, use AHP to get Table 1 Evaluation index original weight of the table of comprehensive evaluation index system of software outsourcing personnel training, as the calculation process and the derivation of the length is too large, this only gives the final result.

Table 1. Original weight on comprehensive evaluation index system of software outsourcing personnel training

one level index		two level index	
name	weight	name	weight
Foreign language knowledge	0.289	Basic level of foreign language	0.239
		Literature reading comprehension	0.198
		Writing ability	0.114
		Oral communication skills	0.167
		Foreign country culture and customs	0.083
		IT professional vocabulary	0.174
		Knowledge of the foreign country software	0.025
Comprehensive quality	0.213	Unity and cooperation	0.192
		Spirit of dedication	0.122
		Ethical standards	0.081
		Technology Innovation	0.117
		Communication skills	0.051
		Self-learning	0.226
		Adapt to new environments	0.174
		English level	0.037
IT technology	0.352	Development tools	0.115
		Programming capability	0.189
		Analysis and design	0.231
		Software test	0.166
		Software Knowledge	0.134
		Hardware knowledge	0.053
		Network knowledge	0.083
		Operating system	0.029
Software engineering	0.146	Software engineering standards	0.147
		Outsourcing process specification	0.251
		Software project management	0.218
		Software development process	0.042
		Document writing	0.172
		Quality Control	0.101
		Configuration Management	0.069

(2) Evaluation Index System After Reduction

   Two level indicators described above have different impact of comprehensive evaluation index system of software outsourcing personnel training, it can clearly express through Table 1. But too many indicators, capacity assessment process is too cumbersome; Some of the indicators have little effect on the comprehensive ability, to simplify the capacity assessment, reduct out these indicators. The results are that each level indicator retains six secondary indicators after reduction, use the above method to recalculated the weight, get the comprehensive evaluation index system as shown in Table 2.

Table 2. Weight on comprehensive evaluation index system of software outsourcing personnel training

one level index		two level index	
name	weight	name	weight
Foreign language knowledge	0.289	Basic level of foreign language	0.246
		Literature reading comprehension	0.204
		Writing ability	0.117
		Oral communication skills	0.170
		Foreign country culture and customs	0.085
		IT professional vocabulary	0.178
Comprehensive quality	0.213	Unity and cooperation	0.217
		Spirit of dedication	0.136
		Ethical standards	0.095
		Technology Innovation	0.122
		Self-learning	0.249
		Adapt to new environments	0.181
IT technology	0.352	Development tools	0.125
		Programming capability	0.204
		Analysis and design	0.251
		Software test	0.183
		Software Knowledge	0.146
		Network knowledge	0.091
Software engineering	0.146	Software engineering standards	0.151
		Outsourcing process specification	0.264
		Software project management	0.229
		Document writing	0.180
		Quality Control	0.105
		Configuration Management	0.071

Conclusion

Through the establishment of evaluation index system of software outsourcing personnel training, so that colleges and training institutions grasp the pulse of talent training, and then train more and more outstanding talents software outsourcing at all levels, promote our country's development on Foreign-oriented software outsourcing. This paper use AHP to construct evaluation index system, the accuracy of index weight depends on the value of matrix, the value of relative importance, sorting method and so on. This paper conducted a preliminary exploration on evaluation index system of talents comprehensive skills on Foreign-oriented software outsourcing, it is important for human resources management on Foreign-oriented software outsourcing and talent evaluation research.

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