Analysis of Incentive Compensation Distribution Model based on Human Resource Input and Output Efficiency

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Abstract. The rationality of compensation distribution in large enterprise group has been a hot research topic in theory and practice. The paper uses the DEA model to make a quantitative assessment of the efficiency of human resources input and output. And it takes the result of efficiency and performance evaluation as the basis of incentive compensation distribution. Finally, it puts forward a set of incentive compensation distribution model based on human resources input and output efficiency, and it provides a reference method for a large group of companies to achieve scientific quantification of compensation distribution and incentive oriented implementation.

Introduction

Compensation system design is an important link in the process of enterprise human resources management. Reasonable and attractive compensation incentive system can not only inspire staff's work enthusiasm and the initiative effectively, but also promote employees strive to achieve the goals of the organization and improve organization efficiency. Besides that, it is conducived to the attraction and retention of a good quality and competitive team in the increasingly fierce competition of the human resources in era of knowledge economy. In accordance with the requirements of the unified supervision of the SASAC, it implements the plan management of total wages in the compensation distribution .Under this mode, it is an important problem that has been exploring   how to implement a reasonable compensation distribution and how to use of incentive pay effectively for large enterprise groups of central enterprises.

   The efficiency of human resources is refers to the effective output of human resource in the process of investment in the enterprise organization. It is human resource input and output ratio, an important manifestation of human resource allocation and human resources of total factor productivity [1]. We can understand it from two aspects: one is about the human resource utilization, it should maximize the use of invention in human resources for businesses, that is per unit of input must be the greatest degree of output, or under the condition of a given output of human resources investment minimum in number to avoid the waste of human resources; the other aspect refers to the human resource allocation problem, namely, how to optimum allocation on the limited resources of the structure and avoid input redundancy. From the perspective of human resources efficiency of compensation distribution, it can be helpful to promote the member enterprises and improve human resource utilization level, and optimize the efficiency of human capital allocation from the group as a whole. As a basis for the allocation of incentive compensation can be more effective to achieve the incentive effect of pay. Therefore, the research constructs the human resource input output model, with which calculate the value of efficiency. And the efficiency value

is included in the incentive compensation system to realize the scientific quantification and incentive orientation of compensation distribution.

Brief introduction of DEA model

Data envelopment analysis(DEA)was first introduced by Charnes, the operational research scientist[2]. Their first model was named C^2R model, which was used to evaluate the relative effectiveness among the Departments. From the view of the production function, this model is a method of efficiency evaluation that used to study "production department" with multiple input and multiple output. Use DEA model we can calculate the relative efficiencies of a given sample multiple decision making unit. It compares weighted average of every institution in the sample input and output with the best body in the sample. It follows that which is the effective organization and which is invalid in the sample, and thus gives the corresponding improvement measures.

In the field of human resources, some researchers as Liu Ling takes 17 major industries of our country's high-tech industry as the sample size , uses DEA method to measure the efficiency of human resource of China's high-tech industrial technology[3]. Li Lixian has carried on the overall appraisal of our country commercial bank human resources efficiency using DEA [4]. Peng Chen and Xiaodong Zhang use DEA model to analyze the human resource development and utilization efficiency of China's Marine Science and technology[5].

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The selection of input and output index.   The connotation of human resource investment. The input of human resource is mainly from the three aspects of quantity, quality and structure, which influence the efficiency of human resources. First of all, the human resource efficiency depends on the number of employee of an enterprise , especially in the traditional economy. The main production of human resources is the number of workers, and the number of workers and the per capita indicators reflects the investment of human resources in terms of quantity; secondly, the enterprise output also depends on the quality index as the workers the education level of personnel. Except that the equivalent density index reflects the investment of human resources in terms of quality; thirdly, the input of human resource is also reflected in the structure of human resources, the efficiency of the same number, the same quality of human resources but in different time and place or position is different. The reasonable structure of human resources allocation helps to improve the efficiency of human resources, and some structural indicators reflect the structure of the investment in human resources. Therefore, human resources is starting from the view of elements but not only including the elements of the personnel quantity.

The connotation of human resource output. The level of human resources efficiency largely depends on the effective contribution degree of human resources around enterprise performance in enterprises .So we can use enterprise performance indicators to measure the output of human resources.

In summary, determining a measure of enterprise human resources investment indicators include the average number of employees, personnel cost rate, equivalent talent density, talent introduction of index, labor structure, high skill talent proportion. Output indicators include full labor productivity, wage profit rate, per capita operating income.

Evaluation procedure.   The specific steps of using DEA to evaluate the performance of the project human resource management are as follows:

Determine the decision unit of evaluation, and then calculate all decision units in C^2R model, and take every evaluation object as a decision making unit (*DMU*). Suppose there are n evaluation objects, that is DMU_j, $j=1,2,3...n$. The evaluation index consist of m input index and s output index, thus the input and output vectors of DMU_i is $x_j = (x_{1j}, x_{2j}, L, x_{mj})^T$ and $y_j = (y_{1j}, y_{2j}, L, y_{sj})^T$, $j=1,2,L,n$ respectively. The model after non Archimedes infinitesimal(e) is disposed:

$$\begin{cases} \min q \\ s.t. \sum_{j=1}^{n} x_j l \leq q x_0 \\ \sum_{j=1}^{n} y_j l_j \geq v_0 \\ l_j \geq 0, j=1,2,L\,n, q \in E_1^+ \end{cases} \quad (1)$$

$$\begin{cases} \min[q - \hat{e}^T S^- + \hat{e}^T S^+] \\ s.t. \sum_{j=1}^{n} x_j l + S^- = q x_0 \\ \sum_{j=1}^{n} y_j l_j - S^+ = y_0 \\ l_j \geq 0, j=1,2,L\,n, q \in E_1^+, S^- \geq 0 \end{cases} \quad (2)$$

Among them $\hat{e}^T = (1,1,L,1)^T$, if $q_0 = 1$, $S^- = 0$, $S^+ = 0$ are satisfied, we said decision making unit DEA is effective.

Suppose the optimal solution for the model are q^0, l^0, S^{0-} and S^{0+}。

If $q^0 = 1$, and $S^{0-} = 0$, $S^{0+} = 0$, it is said that the decision making unit is DEA effective; if $q^0 = 1$, $S^{0-} \neq 0$ and $S^{0+} \neq 0$, it is said that the decision making unit is weak DEA effective; if $q^0 < 1$, it is said that the decision making unit is non DEA effective.

Its economic significance is: if a decision unit is DEA effective, it is both effective and effective from the production function view. That is to say, for these decision making units, their inputs X, the obtained outputs Y have reached the optimal.

Constructing the incentive compensation distribution model based on the value of the output efficiency of human resources. To balance the incentive pay distribution of the member companies in the enterprise group, on the one hand it needs to consider member companies' invest output efficiency, high input and output efficiency of the company with large proportion of compensation distribution; on the other hand it needs to consider the distribution history of all members of the company. Assume that the overall incentive compensation plan for the group enterprises is W. The incentive compensation distribution of each member companies is calculated as follows: to establish the human resources performance evaluation model of the member companies of enterprise group, and calculate the input-output efficiency value of human resources $q_i (i = 1,2,...,k)$; In combination with the member companies' historical compensation distribution R_i, the incentive compensation distribution of each member companies is:

$$w_i = W \times \frac{q_i \times R_i}{\sum_{i=1}^{k} q_i \times R_i} \quad (3)$$

Example analysis

It evaluates the input-output efficiency of each group member companies using DEA model. The input part of the DEA model includes the quantity, quality and structure of human resources, and the output part includes the total labor productivity, wage profit rate and per capita income of the member companies. The calculation process is completed by software DEAP 2.1.

Table 1 DEA model input and output section

UNIT	DEA model input section						DEA model output section		
	Quantity		Quality		structure				
	Average number of staff and workers	Personnel cost rate	Talent equival-ent density	Talent introdu-ction index	Percentage of technicians and senior technicians (%)	High skilled talent ratio (%)	Total labor productivity	Wage profit rate	Per capita operating income
Company1	9283	4.33	1.068	2.3	46.507	91.541	1114202	43.546	608.798
Company 2	15366	7.06	0.994	2.2	18.990	84.527	943535	48.639	269.028
Company 3	87957	10.38	1.051	1.1	50.534	80.174	283408	8.977	98.035
Company 4	31138	9.06	1.047	5	47.690	88.88	459188	11.851	233.739
Company 5	46921	7.78	0.964	1.8	32.882	83.354	396157	35.036	175.276
Company 6	76941	6.84	0.991	3.1	50.829	88.165	511600	47.676	248.515

In 2016 the company's overall incentive pay plan is W =549.4 billion yuan. combining of the 2010-2015 incentive compensation distribution data of each member of the group company, we can obtained that, amount of compensation distribution among member companies is 80.9 billion yuan , 59.1 billion yuan, 3.8 billion yuan, 41.9 billion yuan, 9.2 billion yuan, 237.5 billion yuan, as shown in the following table.

Table 2   pay distribution of member companies   of group

unit	Comprehensive evaluation of input output	Average pay distribution (100 million yuan)of 2010-2015	Compensation distribution in 2016 (100 million yuan)
Company1	1.000	56.5	80.9
Company 2	1.000	41.3	59.1
Company 3	0.308	86.2	38.0
Company 4	0.402	72.8	41.9
Company 5	0.782	82.2	92.0
Company 6	0.868	191.2	237.5

Conclusion

The human resources input and output efficiency of the large enterprise group is evaluated objectively and quantitatively through the DEA method. It can make further quantitative improvement to the existing compensation distribution system to take this value as the basic of incentive compensation distribution of member enterprise. In the incentive pay design part, it can also combine the human resources input and output efficiency value with the company's existing distribution structure , and make a further optimization of the allocation model.

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