Research on the Comprehensive Value Evaluation Method of Research Institutions in Power Grid Enterprises

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Abstract. With the deepening of the in-depth promotion of the "double-carbon" strategy and the deepening of the market-oriented reform of the power industry, the power grid enterprises increasingly pay more attention to "seeking efficiency from management", and comprehensively improve the management efficiency and input-output quality and efficiency. As an important support department of power grid enterprises, power grid research institutions deepen the research of comprehensive value evaluation of business, which has certain demand urgency and innovation leading. This paper takes the research institute of power grid enterprises as the research object, constructs a comprehensive business value evaluation method model of enterprises, and ranks the comprehensive value of different business departments. In this paper, six departments of a provincial power grid company are selected for empirical analysis to verify the rationality of the model.

Keywords: power grid · research organization · comprehensive business value · evaluation method

1 Introduction

To promote the optimization of resource allocation and improve lean and high-quality management is an urgent need to enhance the vitality and competitiveness of central enterprises, and it is an important measure to establish a modern enterprise system and form a flexible and efficient market-oriented operation mechanism. With the influence of complex internal and external business environment, power grid enterprises are facing stricter supervision and business growth pressure, and it is of great significance to deepen the transformation and upgrading of performance management to adapt to the market competition environment. Therefore, combined with the current management situation, this paper deeply analyzes the business characteristics of power grid research institutions, and constructs the business comprehensive value evaluation method, so as to provide a powerful tool for scientifically quantifying the resource input and value contribution among various business departments.

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Literature [1] carefully analyzes the problems existing in the performance management of power grid enterprise management organs, and puts forward scientific and feasible optimization countermeasures and suggestions. Literature [2] is completed after integrating relevant investigation and research, and briefly analyzes the application measures of compensation and performance management in human resource management of power grid enterprises in the new era. Based on the perspective of "triple performance", according to the characteristics of public utility enterprises, and taking the power grid operation enterprises as an example, the document [3] builds a set of comprehensive evaluation index system reflecting the sustainable development concept from the three aspects of economy, society and environment. Literature [4] is based on the performance excellence management mode, with power grid enterprises as the research object, focus on the design and optimization of the process management system, based on the ADLI four elements cycle on the implementation of the key process management research, explore the process identification, process design, process implementation and process improvement of new ideas and solutions. Literature [5] builds a "satellite" employee salary performance-management model, integrating the main base binary thought and PDCA performance management cycle as the main body, in order to find the balance between employees' work enthusiasm and corporate culture, and provides reference for the daily management of human resources salary performance of power grid enterprises.

To sum up, for the power grid enterprise performance appraisal research is more, but there is no relevant research on power grid research institutions, at the same time the assessment of lack of internal simulation market related, not fully combined with the current management status and management situation, so it is not applicable to the comprehensive value evaluation of research institutions business. This paper combines the business characteristics of research institutions, further fusion within the mold simulation of market related concepts and content, build a systematic and innovative business comprehensive value evaluation index system, and through scientific methods to achieve the comprehensive evaluation of business value, can guide the subject to active management and value creation, strengthen the enterprise management level.

2 Construction of Business Value Evaluation Index System

As a professional research institution affiliated to the power grid company, it comprehensively supports the company's construction of the power grid in power grid planning, energy economy, strategic research, policy analysis, investment evaluation, project evaluation and other aspects. Therefore, the evaluation index system is constructed according to different business characteristics and corresponding principles.

(1) Systems science. Closely around the strategic development direction of the company, reflect the value evaluation objectives, formulate a scientific, comprehensive and satisfying standard evaluation system, ensure the scientific evaluation results, and realize the quantitative evaluation of business value.
(2) Practical and effective results. Make full use of the relevant content of the existing assessment system, and integrate the relevant regulations of each index.

Table 1. Evaluation Index System Table

order number	Level 1 indicators	Secondary indicators	unit
1	Efficiency contribution	Business importance	-
2		Support the number of departments	individual
3	Cost saving	Unit and employee costs and expenditure	Ten thousand yuan/person
4	Benefit output	Contribution to output value	100 million
5		Module profit	100 million
6		Unit employee output value	Ten thousand yuan/person

The system clearly defines the actual characteristics of the business of each department, improves the connotation of the evaluation index system, and ensures that the index data is easy to collect, can be analyzed and comparable, so that the index system is practical, practical and effective.

(3) Advanced and excellent. Adhering to the advanced theory and method to guide the scientific management mode, with the scientific management mode.

Promote the excellent management process, fully learn from the excellent management mode of advanced related enterprises at home and abroad, integrate the relevant concepts and contents of the internal model, ensure the advanced and excellent business value evaluation system, and effectively support the relevant management work.

The specific index system is shown as follows.

From Table 1, it can be seen that the evaluation index system is mainly constructed from three dimensions: efficiency contribution, cost savings, and benefit output, which are closely related to the business output value of research institutions of power grid enterprises.

3 Evaluation of the Model Construction

(1) Index normalization method

Use n evaluation indicators to evaluate m pending options. D_{ik} is the estimated value of the evaluation index i of the alternative k. d_{ik} For the results after the normalization treatment.

According to the characteristics of the indicators, the indicators are divided into positive indicators and reverse indicators, among which the positive indicators are normalized as follows:

$$d_{ik} = D_{ik} \Big/ \max D_{ik}$$

Reverse index normalization method is handled as follows:

$$d_{ik} = (\max D_{ik} - D_{ik}) \Big/ \max D_{ik}$$

(2) Basic principles and steps of hierarchical analysis method

1) First, the hierarchy structure is constructed, and the decision problems are refined and decomposed in detail, combed and constructed into a hierarchy from top to bottom. The complex problems are decomposed into multiple core elements. When applying AHP to analyze decision problems, the responsible problem is first decomposed into multiple elements, and then the elements are decomposed into several levels according to the attributes of the elements, and finally we construct a hierarchical problem structure model, which is used as the basis of hierarchical analysis calculation.
2) Construct the judgment matrix

   In order to reflect the weight correspondence between each element, it is necessary to construct a judgment matrix. Generally, the 1–9 scale method is adopted, and the number 1–9 and its reciprocal are used as the scale to evaluate the corresponding relationship between the elements.
3) Single-ranking consistency test

   Generally, the consistency index CI is used to test whether the judgment matrix is designed is reasonable and whether there is any logical error. It is usually believed that the judgment matrix is reasonable when the CI is < 0.10.
4) Agreement test of the total ranking

   After a single ranking consistency meets the requirements, the total ranking is also tested for consistency. If the test passes, the current weight ranking results can be used as the final decision basis.

(3) Basic principles and steps of entropy weight method

1) Set n evaluation indicators to decide and evaluate m pending options.

   Estimation of the evaluation index i for the scheme k to be selected. x_i^*: The ideal value of the evaluation index i. x_i^* The value varies according to the characteristics of the evaluation index. For the larger the profit index, the better; for the loss index (reverse index), the smaller the better (it can be converted to a positive index first).
2) Define the proximity of x_{ik}, x_i^*, D_{ik}:

$$D_{ik} = \begin{cases} \frac{x_{ik}}{x_i^*} & x_i^* = \max\{x_{ik}\} \\ \frac{x_{ik}}{x_i^*} & x_i^* = \min\{x_{ik}\} \end{cases} \tag{1}$$

3) Normalization treatment D_{ik}:

$$d_{ik} = D_{ik} \Big/ \sqrt{\sum_{i=1}^{n} \sum_{k=1}^{m} D_{ik}^2} \tag{2}$$

4) Overall entropy: The entropy E of the m schemes to be selected is evaluated by n evaluation indexes is:

$$E = -\sum_{i=1}^{n}\sum_{k=1}^{m} d_{ik} \ln d_{ik} \tag{3}$$

5) Overall entropy when the index is independent of the scheme:
If the relative importance of the evaluation index is irrelevant to the scheme to be selected, the entropy is calculated by the following formula:

$$E = -\sum_{i=1}^{n} d_{ik} \ln d_i \tag{4}$$

In formula:

$$d_i = \sum_{k=1}^{n} d_{ik} \tag{5}$$

In this way, the uncertainty of the relative importance of the evaluation index i to the evaluation of selection decisions can be determined by the following conditional entropy.

6) Conditional entropy of the evaluation index i:

$$E_i = -\sum_{k=1}^{m} \frac{d_{ik}}{d_i} \ln \frac{d_{ik}}{d_i} \tag{6}$$

According to the extreme value of the entropy, (k = 1~m), namely d_{i1} $d_{i2.}$ d_{ik}, the closer the equal, the greater the conditional entropy, and the greater the uncertainty of the evaluation index to the evaluation decision.

7) normalize the above formula to obtain the entropy value of the importance of the evaluation decision of the evaluation index i.

$$e(d_i) = -\frac{1}{\ln m}\sum_{k=1}^{m} \frac{d_{ik}}{d_i} \ln \frac{d_{ik}}{d_i} \tag{7}$$

(4) Combination of the weight calculation process
The hierarchical analysis method is determined by the subjective weight, and the index weight is determined through the experience of experts, and the index weight is determined through the combination of qualitative and quantitative methods, which has certain subjectivity. The entropy weight method is used to determine the objective weight, and the data of the index calculates the weight of the objective weight, but ignores the influence of the subjective factors for the index relationship, to ensure the accuracy of the weight determination and at the same time meet the characteristics of the actual work.

(5) Determination of the comprehensive evaluation results

A linear model is used to summarize the normalized index values of each index to obtain the comprehensive score:

$$y = \sum_{j=1}^{m} w_j a_j \tag{8}$$

$$\sum_{j=1}^{m} w_j = 1, 0 \leq w_j \leq 1, j = 1, 2, \cdots m \tag{9}$$

The y is the comprehensive score value of the system, is the normalized index value, and the weight coefficient of the.

4 Empirical Analysis

In 2021, five departments under a company will be taken as the empirical analysis objects, and different experts' business importance score is 1–5 points. The following basic data are obtained through statistical analysis.

According to the indicator data in Table 2, construct the original matrix p. Data matrix L after being forward, normalized and normalized for the original matrix. The comprehensive weight is calculated by hierarchical analysis method and entropy weight method respectively, and the following results are obtained:

Table 3 shows the calculation of comprehensive weights using analytic hierarchy process and entropy weight method. The final evaluation results are calculated according to the relative paste schedule.

Table 2. Basic Data.

order number	Level 1 indicators	Secondary indicators	unit	A department	B department	C department	D department	E department
1	Efficiency contribution	Business importance	-	5	4	4	5	4
2		Support the number of departments	individual	4	3	2	3	4
3	Cost saving	Unit and employee costs and expenditure	Ten thousand yuan/person	30.4	29.7	32.4	28.5	27.9
4	Benefit output	Contribution to output value	100 million	0.81	0.63	0.74	0.70	0.68
5		Module profit	100 million	1.85	1.65	1.73	1.69	1.71
6		Unit employee output value	Ten thousand yuan/person	40.6	46.2	45.3	39.5	38.6

Table 3. The normalized data matrix.

order number	Evaluation index index	A department	B department	C department	D department	E department	weight
1	Business importance	1.00	0.80	0.80	1.00	0.80	0.14
2	Support the number of departments	1.00	0.75	0.50	0.75	1.00	0.10
3	Unit and employee costs and expenditure	0.92	0.94	0.86	0.98	1.00	0.14
4	Contribution to output value	1.00	0.78	0.91	0.86	0.84	0.22
5	Module profit	1.00	0.89	0.94	0.91	0.92	0.22
6	Unit employee output value	0.88	1.00	0.98	0.85	0.84	0.18

Table 4. Evaluation Results.

project	A department	B department	C department	D department	E department
Evaluation results	0.97	0.87	0.87	0.90	0.89

Table 4 shows the comprehensive evaluation results of each department calculated based on the principles of the evaluation method. From Table 4, it can be seen that Department A has the highest business value, followed by Department D and Department E, and the other two departments are relatively lower.

5 Conclusion

This paper presents a comprehensive evaluation method of business value, combined with the business characteristics of research institutions, fusion advanced scientific concept, realize business value quantitative evaluation, can provide a reference for resource allocation, can further stimulate employee motivation, mining enterprise potential, enhance enterprise vitality, guide the departments to active management and value creation, strengthen enterprise management level, improve the overall performance management level and innovation leading development.

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