

Research on High-Quality Development Evaluation System of Listed Companies in the Power Industry Held by Central Enterprises Based on Comprehensive Empowerment-TOPSIS Method

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Abstract. Power enterprises are an important support for the development of the national economy, and their high-quality development is of great significance for ensuring national energy security and promoting economic transformation and upgrading. This paper focuses on the attributes and characteristics of listed companies in the power industry, and innovatively builds a set of hierarchical high-quality development index system of listed companies in the power industry. Based on the index system and TOPSIS evaluation method, the high-quality development level of 30 listed companies in the power industry held by central enterprises is comprehensively analyzed. According to the evaluation results, the high-quality development of 30 listed companies in the power industry held by central enterprises is unbalanced and inadequate, and there is still great potential for development. Listed companies in the power industry should seize the opportunity to promote high-quality strategic deployment and improve market competitiveness.

Keywords: power industry; listed companies; high-quality development index system; empirical research

1 Introduction

In 2017, the 19th National Congress of the CPC first put forward the expression "high-quality development", which is unique to the development with Chinese characteristics. Report to the 20th National Congress of the CPC put forward that achieving high-quality development is one of the essential requirements of Chinese modernization and the primary task of building a modern socialist country. Promoting the high-quality development of the listed companies is a necessary prerequisite for the realization of the high-quality development of the capital market, as listed companies are the mainstay of China's economic development and the cornerstone of the sustainable development of the capital market. The comprehensive evaluation of the high-quality development level of listed companies can help them grasp the development

opportunities of the capital market with Chinese characteristics, seize the high ground in the industry, and support the construction of the capital market with Chinese characteristics.

Since the 18th National Congress of the CPC, a new energy security strategy of "Four Reforms and One Cooperation" has been put forward. Major decisions and deployments have been made to accelerate the construction of a new power system and a new energy system. Listed companies in the power industry, as the "forerunners" of supporting industrial development and modern industrial system construction, build a high-quality development pattern, which is conducive to providing basic energy supply and playing a better role of ensuring social stability and sustainable development. Currently, however, there is a vague positioning on the high-quality development of listed companies in the power industry, lacking of a unified and specific measurement indicators and standards for the high-quality development of listed companies in the power industry. Therefore, it is urgent to build a set of high-quality development evaluation system of listed companies in the power industry.

2 Research on high quality development evaluation system of listed companies

In order to promote central enterprises to accelerate the realization of high-quality development, SASAC issued the Guiding Opinions on Deepening the Reform of State-owned Enterprises in 2015 and began to promote the functional classification assessment of central enterprises. Following the introduction of the operation assessment indicators featuring "two profits and one ratio" (net profit, total profit, asset-liability ratio) in 2019; In 2020, the profit margin of operating income and the R&D spending ratio were added into the indicators to form "two profits and three ratios". In 2021, the overall labor productivity was added to form "two benefits and four ratios". In 2023, the "two profits and four ratios" is adjusted to "one profit and five ratios", replacing net profit and profit margin of operating income with return on equity and operating cash ratio respectively, guiding enterprises to pay more attention to input-output efficiency and operating cash flow, and improving the quality of capital return and operating performance.

In academia, Dan Tian and Bao Ding [1] take organizational resilience as the starting point and build a measurement index system for high-quality enterprise development in terms of goals and processes, including six dimensions of quality and benefit, green development, social sharing, innovation-driven, risk management and corporate governance. For state-owned listed companies, Zhen Shi [2] builds the "1+4+X" evaluation index system from three requirements of "pursuing benefits, improving efficiency and resisting risks" for high-quality development, among which "1" refers to the market value growth; "4" refers to the profitability, return on investment, operation management and risk prevention and control; "X" refers to the corporate governance modification index. For listed new energy companies, Jiao Xu and Xiaoqian Xiong [3] conduct a high-quality development performance evaluation research on 65 listed companies in the clean coal industry, wind power industry, nuclear power industry, solar energy industry and biomass energy industry in terms of profitability, operation ability, debt paying ability and innovation and development ability, etc. In Western countries, "high-quality development" of enterprises is often closely related to "sustainable development". Lapinskaite I, Miecinskiene A and Michejeva A [4] consider that the companies involved in sustainable development will

increase the company's value by improving operating efficiency, competing in both Lithuanian and international markets and contributing to improving people's quality of life.

Through sorting out the researches on high-quality development evaluation [5-8], it is found that the researches mainly focus on the overall evaluation of state-owned enterprises and listed companies, which do not reflect the characteristics of the industry in which listed companies are located as well as specific case studies. By building the high-quality development evaluation index system of listed companies in the power industry, this paper conducts an empirical research on the high-quality development of listed companies in the power industry in China, and provides evaluation methods for the high-quality development of listed companies in the electric power industry.

3 High-quality development evaluation index system of listed companies in the power industry held by central enterprises

3.1 Evaluation index

Listed companies in the power industry have both characteristics of the power industry and listed companies. The majority of listed companies are also held by state capital. Therefore, this paper summarizes the common characteristics and elements of the high-quality development of listed companies in the power industry held by central enterprises by superimposing the attributes of state-owned capital held by the power industry, listed companies and central enterprises and optimizing and recombining the modules with common characteristics. It can be summarized as "leading in seven fields", including leading in social value, leading in market performance, leading in modern governance, leading in excellent management, leading in innovation-driven development, leading in power supply, leading in the influence of state capital, as shown in Figure 1.

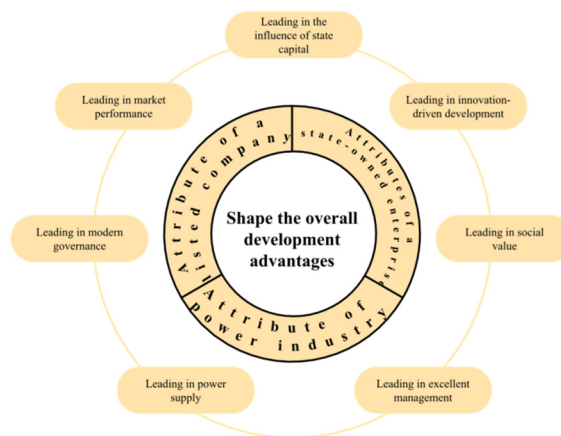


Fig. 1. High-quality development characteristics of "leading in seven fields" of listed companies in the power industry held by central enterprises

According to the development characteristics of "leading in seven fields", the evaluation index system suitable for the high-quality development of listed companies in the power industry held by central enterprises is built hierarchically. There are a total of 21 indicators, as shown in Table 1.

Table 1. High-quality development index system of listed companies in the power industry held by central enterprises

Serial number	First level index	Second level index	Third level index
1	social value	growth ability	growth rate of main business income
2			growth rate of total profit
3		profit quality	gross profit ratio
4		operation capacity	asset-liability ratio
5			total assets turnover
6			profit per capita
7	market performance	financing ability	introduction of strategic investor
8		shareholder return	return on equity
9			return on capital employed
10			ratio of cash dividends to net profit
11		market value management	PE-TTM
12			price-to-book ratio
13	modern governance	governance structure	ratio of independent directors
14		Information disclosure	evaluation of information disclosure
15	excellent management	integration with ESG concept	ESG scoring
16	innovation-driven development	innovation input	R&D investment intensity
17			proportion of R&D personnel
18		innovation output	number of patents
19	power supply	product and service	power generation
20			proportion of integrated energy income
21	influence of state capital	social responsibility	tax payable

Index weight is the key part in comprehensive evaluation. There are two kinds of methods to determine the index weight, i.e. subjective weight method and objective weight method. Using a single method to assign weights is one-sided, the index cannot be allocated in a scientific and rational way as well. Therefore, this paper adopts the combination of analytic hierarchy process and entropy weight method to assign weights to make index more scientific and weight assignment more rational. The comprehensive weight calculation method is as follows:

$$W = \alpha w_1 + (1 - \alpha)w_2 \quad (0 \leq \alpha \leq 1) \quad (1)$$

Where W is the comprehensive weight, w_1 is the subjective weight, w_2 is the objective weight, α is the coefficient.

Considering the analytic hierarchy process (AHP) and entropy weight method and in combination with expert opinions, α is determined to be 0.6. Therefore, the comprehensive weight determination formula is:

$$W = 0.6w_1 + 0.4w_2 \quad (2)$$

Where W is the comprehensive weight, w_1 is the subjective weight, w_2 is the objective weight.

3.2 TOPSIS evaluation method

C.L. Hwang and K. Yoon [9] first proposed the TOPSIS evaluation method in 1981, which is a comprehensive evaluation method based on the proximity between the evaluation object and the idealized target. The calculation method is as follows:

Assuming that there are n evaluation objects and m evaluation index, the index value of the i -th evaluation object constitutes a vector $X_i = (x_{i1}, x_{i2}, \dots, x_{im})^T$.

(1) Firstly, the inverse index value is turned forward by taking its opposite number, and then standardized according to the formula.

$$X'_{ij} = \frac{x_{ij} - \bar{X}_j}{s_j} \quad (3)$$

Where X'_{ij} represents the standard value, x_{ij} represents the raw value, \bar{X}_j represents the sample mean, s_j represents the sample standard deviation.

(2) The standardized index value is multiplied by the weight to obtain the weighted value.

$$u_{ij} = w_j * X'_{ij} \quad (4)$$

Where u_{ij} represents the weighted index value, w_j represents the j -th index weight, X'_{ij} represents the standard value.

The vector formed by the maximum value of the weighted value is a positive ideal point, and the one formed by the minimum value is a negative ideal point.

(3) Calculate the Euclidean distance between the standardized index value sequence and the positive and negative ideal points.

$$d_i^+ = \sqrt{\sum_{j=1}^m (u_{ij} - v_j^+)^2} \quad (5)$$

$$d_i^- = \sqrt{\sum_{j=1}^m (u_{ij} - v_j^-)^2} \quad (6)$$

Where d_i^+ represents the Euclidean distance of positive ideal point, d_i^- represents the Euclidean distance of negative ideal point, v_j^+ 、 v_j^- are the maximum and minimum values of the weighted j -th index respectively. u_{ij} represents the weighted index value.

(4) Calculate the relative proximity coefficient.

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad (7)$$

Where c_i represents the relative proximity between the i -th evaluation object and the positive ideal point. The larger the value, the closer the state of the evaluation object is to the positive ideal value.

4 Empirical research

4.1 Data source

The 30 power companies held by central state-owned enterprises and listed in Shanghai and Shenzhen Stock markets are taken as the evaluation objects. The basic data of the evaluation objects are collected from Wind, Ifind, corporate annual reports and stock exchange websites, etc.

4.2 Weight calculation

Using the comprehensive weighting method, the weights of 21 indicators are obtained, as shown in Table 2.

Table 2. High-quality development index weight of listed companies in the power industry held by central enterprises

Serial number	First level index	Second level index	Third level index
1	social value (0.1719)	growth ability (0.0430)	growth rate of main business income (0.0149)
2			growth rate of total profit (0.0281)
3		profit quality (0.0308)	gross profit ratio (0.0308)
4		operation capacity (0.0981)	asset-liability ratio (0.0411)
5			total assets turnover (0.0191)
6			profit per capita (0.0379)
7	market performance (0.1527)	financing ability (0.0336)	introduction of strategic investor (0.0336)
8		shareholder return (0.0743)	return on equity (0.0227)
9			return on capital employed (0.0289)
10			ratio of cash dividends to net profit (0.0228)
11		market value management (0.0447)	PE-TTM (0.0166)
12			price-to-book ratio (0.0281)
13	modern governance (0.1441)	governance structure (0.0961)	ratio of independent directors (0.0961)
14		information disclosure (0.0480)	evaluation of information disclosure (0.0480)
15	excellent management (0.0891)	integration with ESG concept (0.0891)	ESG scoring (0.0891)
16	innovation-driven development (0.2302)	innovation input (0.1295)	R&D investment intensity (0.0781)
17			proportion of R&D personnel (0.0513)
18		innovation output (0.1008)	number of patents (0.1008)
19	power supply (0.1131)	product and service (0.1131)	power generation (0.0736)
20			proportion of integrated energy income (0.0395)
21	influence of state capital (0.0989)	social responsibility (0.0989)	tax payable (0.0989)

4.3 Comprehensive evaluation level

According to the index weights and the raw data of each index, the high-quality development level of 30 listed companies in the power industry held by central enterprises in 2022 are evaluated by using the SPSSPRO data analysis software. The specific results are shown in Table 3.

Table 3. The comprehensive ranking of the high-quality development level of 30 listed companies in the power industry held by central state-owned enterprises

Company code	Comprehensive score index
zggh	0.620609
zghd	0.540888
hngj	0.474048
cjdl	0.447293
gtdl	0.432755
gddl	0.426509
tyn	0.373654
hnsd	0.372207

Company code	Comprehensive score index
sxsl	0.366407
nwcn	0.361402
hdgj	0.360222
sxny	0.348503
cydl	0.34629
shdl	0.345017
mxdl	0.343523
dtfd	0.340533
ggdl	0.338451
hbny	0.336448
qydl	0.323088
hydl	0.320767
jnfd	0.312643
lydl	0.312643
nmhd	0.30751
gyfz	0.30596
jdgf	0.304407
fldl	0.299138
nwny	0.29415
yxny	0.291204
xcdl	0.29043
hdny	0.26935

In 2022, the average score of the high-quality development level of the 30 listed companies in the power industry held by the central state-owned enterprises was 0.3602, among which only 11 companies exceeded the average score, and the majority of the listed companies were in the middle and downstream level, showing an unbalanced overall development status.

The listed power companies held by the central state-owned enterprises fail to show their overall development advantages. So it is urgent to make efforts in the weak aspects of power industrial layout, value management, innovation and development. First of all, the companies shall be strictly conform to the national strategic arrangement, focus on the main business of electricity and improve the core function to highlight the market advantage; second, according to the regional characteristics, the companies shall strengthen the integration of internal resources and expand the integrated energy service businesses to promote the transformation into a quality and profitable company; third, the companies shall enhance the value-creating ability, pay more attention to long-term and overall value, and fulfill the economic, political and social responsibilities of state-owned capital; finally, the companies shall increase innovation investment in core technologies and build strong scientific and technological innovation talent teams in terms of “double carbon”, construction of new power system and other key steps to strengthen the national strategic support.

5 Conclusion

Starting from the dimensions of social value, market performance, modern governance, innovation-driven development, power supply and influence of state capital, this paper innovatively builds a hierarchical evaluation index system of high-quality development level of listed power companies held by central enterprises. TOPSIS method is adopted to conduct a comprehensive empirical evaluation of 30 listed power companies held by central state-owned enterprises. It provides theoretical and empirical support for studying the high-quality development of listed power companies.

The high-quality development of listed power companies is a long-term action. Companies should uphold the development orientation of "rooted in the main business, serving the industry, and creating value", seize opportunities, pull ahead the planning, actively integrate into the overall situation of national reform and development, and promote high-quality strategic layout. The companies should also follow the development trend and keep forward-looking to seize the high ground of development so as to lead the high-quality development and attract investment from the capital market.

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