Original Paper

Research on Financial Performance Evaluation of Shenhuo Co., Ltd. Based on Entropy Weighting Method

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Abstract

With the implementation of China's "Dual Carbon" goals, the coal and electrolytic aluminum industries must undergo multi-dimensional coordinated transformation to balance emission reduction with high-quality development. Consequently, the financial performance of enterprises engaged in low-carbon environmental protection and energy-saving practices has garnered widespread societal attention. This study examines Shenhuo Co., Ltd.' s financial data from 2020 to 2024, establishing an evaluation framework across four dimensions: profitability, debt repayment, operational efficiency, and growth trajectory. Utilizing the entropy weighting method, we identify operational challenges in corporate management and propose targeted strategies to enhance overall financial performance, thereby promoting sustainable business development.

Keywords

entropy weighting method, Shenhuo Co., LTD., financial performance

1. Introduction

In the current macroeconomic landscape shaped by new development patterns and the "dual carbon" goals (carbon peaking and carbon neutrality), China's coal and electrolytic aluminum industries—serving as foundational sectors for the national economy and critical suppliers of energy and raw materials—are undergoing profound transformations and challenges. Factors including national energy structure optimization, increasingly stringent environmental policies, intensified resource constraints, and market supply-demand fluctuations have created an increasingly complex business environment for these enterprises. To address this, this study employs the entropy weighting method as a research tool, focusing on Shenhuo Co., Ltd.—a representative enterprise in the coal and electrolytic aluminum industries—as its primary subject. The research aims to evaluate the company's

financial performance, identify key financial indicators affecting its performance, and propose targeted optimization strategies. These findings are intended to provide theoretical references and practical guidance for enhancing corporate financial management and overall competitiveness, while offering valuable data support and decision-making references for industry policymakers and investors.

2. Literature Review

A review of the literature related to financial performance evaluation at home and abroad shows that although the relevant research in China is compared with that in foreign countries.

Although research in this field started relatively late, domestic studies on financial risk have significantly expanded in recent years, building upon the foundation laid by international scholars. Collaborative research between Chinese and global academics has contributed to the maturation of financial performance evaluation systems, with growing attention being paid to entropy weighting methodologies. As an objective weighting tool, the entropy value method demonstrates unique advantages in enhancing evaluation scientific rigor and precision. Particularly in cross-industry applications, this approach effectively integrates sector-specific characteristics to establish tailored evaluation frameworks, delivering more comprehensive and accurate performance assessment outcomes for enterprises. Lei Zhenhua et al. (2024), using the pharmaceutical manufacturing industry as a case study, developed a financial ecosystem performance evaluation index system based on entropy weighting and TOPSIS method. Their research identified operational capability, governance capacity, and ecological environment as key dimensions, noting that non-state-owned enterprises outperformed state-owned counterparts in financial ecosystem performance. Zhang Hongxia et al. (2023) applied entropy weighting to construct a financial performance evaluation system using 2012-2020 financial data from Wanyun Technology, a high-tech enterprise, demonstrating its scientific value in guiding corporate financial performance enhancement. Tian Miaomiao and Li Yulong (2023) further refined the evaluation framework by incorporating non-financial indicators like innovation capability into the four core competencies model. Through comprehensive analysis of photovoltaic industry listed companies 'financial performance over three years using entropy weighting-TOPSIS methodology, they enhanced the sector's performance evaluation system while providing practical references for industry development. Qi Yu and Ding Sheng (2023) carried out financial performance evaluation of listed forestry companies through entropy weighting-TPoS method. The study shows that their financial performance tends to be stable on the whole, but there are still some problems such as insufficient information disclosure and weak environmental awareness, so corresponding improvement suggestions are put forward.

3. Research Design

(1) Indicator Selection Based on the industry average value in Guotai An database and combined with relevant literature research on financial performance evaluation, 16 indicators in four dimensions of

profitability, operating ability, solvency and development ability are selected as the financial performance analysis indicators of Shenhuo Co., LTD.

Table 1. Financial Performance Evaluation Indicators and Codes of Shenhuo Co., LTD

First-level indicators	Secondary indicators	Nature of indicators	Indicator coding
profitability	Total asset return on net profit (%)	forward direction	x1
	Operating margin (%)	forward direction	x2
	Return on equity (%)	forward direction	x3
	Return on assets (%)	forward direction	x4
operation capacity	Accounts receivable turnover (times)	forward direction	x5
	Inventory turnover ratio (times)	forward direction	x6
	Current assets turnover ratio (times)	forward direction	x7
	Total asset turnover (times)	forward direction	x8
debt paying ability	quick ratio (%)	moderate	x9
	cash ratio (%)	moderate	x10
	Interest protection multiple (%)	forward direction	x11
	asset-liability ratio (%)	moderate	x12
Development capacity	Operating income growth rate (%)	moderate	x13
	Net profit growth rate (%)	moderate	x14
	Total asset growth rate (%)	moderate	x15
	Return on equity growth rate (%)	moderate	x16

(2) Model construction

1. Constructing the Standardized Matrix. When building a multi-criteria evaluation matrix, assume there are a number of evaluation subjects (a_1, a_2, a_3,..., a_m) and b evaluation indicators (b_1, b_2, b_3,..., b_n). Let Xij represent the j-th indicator for the i-th subject (i=1,2,3,...,m; j=1,2,3,...,n) to establish the evaluation matrix X={xij}m×n (i=1,2,3,...,m; j=1,2,3,...,n). The original matrix is:

$$X_{ij}=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

2. Data standardization. Since indicators of different properties will have a great impact on the results, the influence of dimension should be removed in the calculation process and the data should be normalized. The processing process is shown in the formula:

For the processing of positive indicators:

$$b_{ij}=\frac{x_{ij}-min(x_j)}{max(x_j)-min(x_j)}$$

For the treatment of moderate indicators:

$$b_{ij}=1-\frac{|x_{ij}-d_{best}|}{max|x_{ij}-d_{best}|}$$

3. Non-negativity processing of indicators. After the original data is dimensionless, the range of index data can be taken to 0. In order to make the subsequent index entropy weighting meaningful, the dimensionless data is shifted as a whole, and the index shift amplitude is taken as 0.0001.

4. Calculate the contribution degree, information entropy value (Ej) and difference coefficient (Gj) of each index, and then obtain the weight (Wj) and comprehensive score of each index.

4. Financial performance evaluation of Shenhuo Co., Ltd. based on entropy weighting method

(1) Case Company Profile

Founded in 1998 and headquartered in Henan Province, Shenhuo Co., Ltd. (Henan Shenhuo Coal & Power Co., Ltd.) was listed on the Shenzhen Stock Exchange in 2000. The company has established a vertically integrated industrial chain encompassing coal mining, electrolytic aluminum smelting, aluminum processing (including high-end aluminum foil), and self-sufficient power supply. As a leading domestic producer in both electrolytic aluminum and high-end aluminum foil sectors, Shenhuo leverages its coal-electricity-aluminum integration model. Amid capacity control requirements for electrolytic aluminum production, the company optimizes energy structures through its two major production bases in Xinjiang and Yunnan while accelerating expansion into high-end aluminum processing and new energy sectors. By 2025, the company's electrolytic aluminum production capacity reached 1.7 million tons with an approved coal production capacity of 8.55 million tons. It is actively developing new energy businesses to drive green transformation.

(2) Performance evaluation process

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With the help of Guotai An Database and Shenhuo Co., Ltd. annual report, we obtained the enterprise financial indicators data from 2020 to 2024, and sorted out the original data of its financial performance evaluation indicators as shown in Table 2.

Table 2. Financial Indicators of Shenhuo Co., LTD from 2020 to 2024

Indicator	2020	2021	2022	2023	2024
x_1	0.004578	0.0534	0.150456	0.113715	0.088473
x_2	0.026908	0.155182	0.255287	0.219793	0.172286
x_3	0.023402	0.227463	0.482288	0.295537	0.190556
x_4	0.038479	0.11258	0.200492	0.138909	0.119198
x_5	20.75653	55.57993	79.17475	52.63358	48.52821
x_6	6.993772	9.178403	9.984637	9.007237	9.136647
x_7	1.030392	1.921141	2.165024	1.746092	2.512313
x_8	0.330148	0.603539	0.749098	0.635908	0.707589
x_9	0.446851	0.394114	0.592166	0.606706	0.411615
x_{10}	0.112752	0.08185	0.141645	0.217844	0.082828
x_{11}	1.177371	3.258168	12.14215	107.7161	94.28739
x_{12}	0.795072	0.731441	0.649765	0.579453	0.485699
x_{13}	0.067625	0.83163	0.239533	-0.11893	0.019869
x_{14}	-0.55759	11.10267	1.813587	-0.21549	-0.2869
x_{15}	0.227635	-0.11724	0.129828	-0.04332	-0.12539
x_{16}	-0.70318	5.72892	0.36652	-0.36891	-0.33302

After the above financial data are standardized and non-negativity processing, the values obtained are assigned weights. The entropy value, differentiation coefficient and weight of these 16 indicators are calculated respectively, and the weight of first-level indicators is also calculated. The results are shown in Table 3.

Table 3. Calculation Results of Entropy Weighting Method

First-level indicators	Secondary indicators	Entropy value e	Differentiation index gj	Weight of secondary index jw	Weight of first-level indicators
profitability	Total net profit margin	0.8182	0.1818	0.0497	0.1896
	Operating margins	0.8454	0.1546	0.0422	
	Return on equity	0.8130	0.1870	0.0511	
	Return on assets	0.8294	0.1706	0.0466	

operation capacity	average accounts receivable turnover ratio	0.8334	0.1666	0.0455	0.1699
	inventory turnover ratio	0.8533	0.1467	0.0401	
	turnover of current assets	0.8386	0.1614	0.0441	
	turnover of total capital	0.8527	0.1473	0.0402	
debt paying ability	quick ratio	0.6768	0.3232	0.0883	0.4047
	cash ratio	0.5924	0.4076	0.1114	
	Interest coverage multiple	0.5630	0.4370	0.1194	
	asset-liability ratio	0.8086	0.1914	0.0523	
Development capacity	increase rate of business revenue	0.6869	0.3133	0.0856	0.2691
	net profit growth rate	0.8564	0.1436	0.0392	
	Total asset growth rate	0.6315	0.3685	0.1007	
	Return on equity growth rate	0.8404	0.1596	0.0436	

(3) Analysis of performance evaluation results

Entropy weights serve to measure the relative importance of each evaluation metric within the system. A higher entropy value indicates greater weighting for that metric in comprehensive assessments, thereby exerting more significant influence on final outcomes. When analyzing corporate financial performance, it's essential to consider not only overall scores across dimensions but also the actual values of specific financial indicators for systematic longitudinal comparisons and analyses. As shown in Table 3, Shenhuo Co., Ltd.' s financial metrics are ranked by descending weight order, with primary indicators in the following sequence: debt repayment capacity, growth potential, profitability, and operational efficiency.

1. Debt Repayment Capacity Analysis. As a core component of corporate financial health assessment, debt repayment capacity analysis not only directly reflects an enterprise's ability to manage debt burdens but also serves as a critical benchmark for measuring financial resilience and stability. For Shenhuo Co., Ltd., which operates in the non-ferrous metal smelting and processing industry, understanding its high leverage, cyclical nature, and heavy asset characteristics is crucial for analyzing its debt repayment capacity. Table 3 reveals that debt repayment capacity contributes most significantly to Shenhuo's financial performance, with the interest coverage ratio (I/CR) being the most influential secondary indicator. The I/CR changes from 2020 to 2024 reflect the company's transformation from debt pressure to significant optimization of its financial structure. The company's debt-to-asset ratio over the past five years shows a notable decline from 79.51% in 2020 to 48.57% in 2024, reaching the industry average level. This trend indirectly confirms the company's debt repayment capacity has

transitioned from "high-risk pressure" to industry-standard optimization. However, Shenhuo's quick ratio has remained significantly below the industry average of 1.34 throughout this period, indicating potential short-term debt repayment risks that warrant close monitoring.

2. Development Capability Analysis. A company's development capability reflects its inherent potential to continuously expand business scope, consolidate competitive advantages, and achieve long-term value growth in market competition. Unlike short-term profitability or debt repayment capacity, it focuses on the critical dimension of "how far and how stable the company can go in the future." As shown in Table 3, development capability ranks second in contributing to Shenhuo Co., Ltd.' s financial performance, accounting for 26.91% of the weight. The company's revenue growth rate declined from 6.7% in 2020 to a peak of 23.96% in 2022, then further to 1.99% in 2024—all below industry averages. The sharp decline in 2024's revenue growth may be related to cost pressures in the electrolytic aluminum sector and changes in income structure caused by divesting inefficient assets. Net profit growth rates were also affected by revenue fluctuations, even turning negative in 2023 and 2024, indicating cyclical declines in the company's development capability. Analyzing Shenhuo Co., Ltd.' s ROE growth fluctuations reveals the strong cyclical nature of the non-ferrous metals industry. The company's total asset growth rate from 2020 to 2024 followed a "rapid expansion-initiative reduction" trajectory, reflecting a transition from debt-driven expansion to strategic optimization. In summary, development capability requires further improvement.

3. Profitability Analysis. Profitability serves as a critical metric for evaluating corporate financial health and sustainable operations. It not only reflects a company's profit-generating efficiency but also provides the core basis for assessing resource optimization and value creation capabilities. As shown in Table 3, profitability ranks third in contributing to financial performance, accounting for 18.96% of total contributions. Shenhuo Co., Ltd. achieved peak levels in both gross asset net profit margin and return on assets in 2022, though these have declined over the past two years. Despite this, they remain above industry averages. This is attributed to the profit scissors effect caused by falling coal prices and rising alumina prices, which directly compressed core business gross margins. Analysis of the company's operating profit margin from 2020 to 2024 reveals a decline in profitability, while return on equity dropped from 48.23% in 2022 to 19.06% in 2024. These figures highlight the need for improved profitability, with restoring the high-profit levels seen in 2022 becoming a key focus.

4. Operating Capacity Analysis. Operating capacity reflects a company's efficiency in allocating, managing, and utilizing current and non-current assets. It fundamentally measures the speed and effectiveness of management in converting existing resources into revenue and generating cash flow, serving as a key indicator of overall asset management quality and the viability of business strategies. As heavy-asset enterprises with cyclical core products, non-ferrous metal companies like Shenhuo Co., Ltd. rely heavily on asset management for sustainable growth and financial performance. Table 3 shows that operating capacity contributes the least to financial performance, accounting for approximately 17%. Shenhuo's accounts receivable turnover ratio exhibited a "rise first, then decline" pattern from

2020 to 2024, dropping from 79.17 times in 2022 to 48.53 times in 2024 – below industry averages – indicating slowed accounts receivable recovery and increased liquidity risks. Inventory turnover analysis reveals the company maintained efficient and stable levels from 2020 to 2024, exceeding industry averages, demonstrating effective inventory management and low stockpile rates. Meanwhile, current asset turnover rose from 1.03 in 2020 to 2.51 in 2024, surpassing the industry average of 2.16 in 2024. This demonstrates Shenhuo's resilience in maintaining asset efficiency during industry downturns, though challenges like liquidity risks and declining profitability remain key concerns for future development. However, from the perspective of total asset turnover, although the overall total asset turnover of Shenhuo Co., Ltd. increased from 0.33 in 2022 to 0.71 in 2024 from 2020 to 2024, it is still lower than the industry average of 1.1, indicating that there is still room for improvement in the overall asset management efficiency.

4. Suggestions for financial performance optimization

1. Optimize asset management and enhance solvency

Scientific debt management is crucial for optimizing corporate capital structures and ensuring financial stability. Key initiatives should be prioritized: First, implement proactive debt planning and structural optimization by formulating practical debt plans through thorough analysis of the company's capital structure. Prioritize active repayment of existing debts to optimize liabilities and reduce financial costs. Second, establish a debt risk emergency response mechanism that promptly initiates creditor communication when facing significant debt pressures and repayment difficulties. Finally, build a debt risk early warning and dynamic monitoring system by continuously tracking critical repayment capacity indicators. By setting predefined risk thresholds and developing contingency plans for different risk levels, companies can ensure swift responses and effective handling when risk signals emerge.

2. Strengthen the management of accounts receivable

Strengthening accounts receivable management is a core strategy to ensure stable corporate cash flow and reduce bad debt risks. Two key aspects require emphasis: First, enhancing daily monitoring and analysis mechanisms. Financial personnel must maintain high vigilance over accounts receivable, dynamically track collection progress, and conduct in-depth analysis of aging structures. Regular review of customer arrears information should be conducted, with a focus on analyzing specific causes of overdue payments based on comprehensive understanding of debt details. Based on these findings, differentiated collection strategies should be formulated and implemented to actively urge clients to fulfill repayment obligations, thereby ensuring the stability and sustainability of corporate cash flow. Second, establishing a professional training and performance evaluation system. Companies should systematically organize professional training for accounts receivable managers to deepen their understanding of the importance of receivables management, while equipping them with effective collection techniques and methods including communication negotiation and legal clause application.

3. Improve the construction of financial performance management system

Strengthening supervision and evaluation of financial performance management is crucial for ensuring effective implementation of improvement plans. First, establishing a comprehensive oversight system is essential. Regular internal and external audits can effectively verify the execution of corporate financial performance management systems, ensuring full compliance. Simultaneously, creating employee reporting channels encourages proactive participation in monitoring efforts, fostering multi-stakeholder collaboration. Second, developing a scientific evaluation mechanism is vital. Directly linking financial performance outcomes to employee compensation incentives and career development significantly boosts motivation, motivating staff to actively engage in performance management. Furthermore, providing timely feedback on evaluation results with targeted guidance helps employees clarify improvement directions, continuously enhance financial performance levels, and ultimately achieve win-win development for both the enterprise and individuals.

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