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Research on Comprehensive Evaluation Model of Multidimensional Financial Indicators Constructed on the Basis of Fuzzy Mathematical Methods

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Abstract Financial evaluation, as a key part of enterprise management, has long provided the core basis for measuring the operating results and financial health of enterprises. This paper proposes a comprehensive evaluation index system of multidimensional financial indicators with profitability, operating ability, solvency and development ability as the first-level indicators. Through the hierarchical analysis method to calculate the comprehensive weights, combined with the fuzzy comprehensive evaluation method to construct the affiliation matrix, constituting a comprehensive evaluation model of multi-dimensional financial indicators. Taking A real estate company as the research object, the proposed multidimensional financial indicators comprehensive evaluation model is used to conduct multidimensional analysis of the financial status of A company. According to the evaluation results based on the fuzzy comprehensive evaluation method, the financial performance of Company A in 2022-2024 shows a significant downward trend, and the financial performance of Company A in 2024 belongs to the category of “poor”, and the degree of affiliation reaches 0.5332, which is high, and there is an urgent need to improve the financial performance of the company.

Index Terms Hierarchical Analysis, Fuzzy Comprehensive Evaluation Method, Affiliation Matrix, Corporate Management, Financial Evaluation

I. Introduction

The setting of enterprise performance appraisal indexes has an important influence on the significance of enterprise development, and the appraisal indexes should not only guide the enterprise value orientation, but also reflect the overall appraisal of the enterprise's business performance in the accounting period [1], [2]. Among them, financial indicators as the focus of enterprise performance appraisal, appraisal policy makers should spend a lot of time and energy on the setting of financial indicators [3]. Some studies have shown that by constructing a comprehensive evaluation model of multidimensional financial indicators, it can ensure the balance between the interests of the company and the interests of individuals, and realize a win-win and multi-win situation [4], [5].

The enterprise financial evaluation system under the multidimensional perspective is a comprehensive assessment framework with both depth and breadth. It goes far beyond the single dimension of traditional financial indicators, expanding the scope of evaluation to multiple key areas such as financial indicators, operational efficiency, customer service, and technological innovation, etc. It provides an in-depth analysis of core financial indicators such as profitability, solvency, and asset operational efficiency of the enterprise, in order to accurately measure the financial health of the enterprise and the efficiency of capital utilization [6]-[9]. Meanwhile, the introduction of the customer service dimension enables the evaluation system to consider the enterprise's responsiveness to customer needs, service quality, and customer satisfaction, which is crucial for enhancing customer loyalty and corporate reputation [10]-[12]. In addition, the assessment of technological innovation capability focuses on the enterprise's R&D investment, the speed of new product development, and the ability to transform technological achievements, which is not only the power source of the enterprise's sustained growth, but also the key for it to stay ahead of the curve in the fierce market competition [13]-[15].

In order to realize the comprehensive evaluation of multidimensional financial indexes of enterprises, this paper builds a scientific and reasonable comprehensive evaluation index system of financial indexes as the basis for enterprises to carry out financial performance evaluation, and selects four aspects of profitability, operating ability, solvency, and development ability as the first-level evaluation indexes, and proposes 12 corresponding second-level evaluation indexes from them. Based on the established multi-dimensional financial index comprehensive evaluation index system, a multi-dimensional financial index comprehensive evaluation model is proposed. The

integrated weights of quantitative and qualitative indicators are obtained through the hierarchical analysis method, and the scores of each financial indicator are investigated through questionnaires issued to experts, and the affiliation matrix is obtained after normalization. Combining the weights obtained by the hierarchical analysis method and the affiliation matrix to obtain the affiliation vector, and finally obtain the combined scores of quantitative and qualitative indicators. Taking A real estate company as a case study object, applying this paper's multidimensional financial index comprehensive evaluation model to analyze its financial status from 2022 to 2024, and pointing out the financial performance status and problems faced by A company.

II. Comprehensive evaluation indicator system with multidimensional financial indicators

With the in-depth development of the market economy, the continuous improvement of enterprise multidimensional financial indicators comprehensive evaluation index mechanism has attracted much attention. Through the establishment and implementation of multi-dimensional financial indicators comprehensive evaluation index program, can effectively standardize the enterprise financial management behavior, boost the sustainable development of enterprises.

Constructing a scientific and reasonable comprehensive evaluation index system of financial indicators is the basis for enterprises to carry out financial performance evaluation. This chapter is guided by the Operational Guidelines for the Preparation of Financial Reports by Government Departments, and based on relevant materials such as enterprise final statements, financial statements, final reports, etc., using the basic theories of financial management and management accounting, and in the spirit of the principles of scientificity, feasibility, importance, and openness, the second-level indexes are selected from the four aspects of profitability, operating ability, solvency, and development ability, and the multidimensional comprehensive evaluation index system is constructed with the multi-dimensional financial indexes. Indicator system. The details are shown in Table 1.

Table 1: Financial evaluation index system

First-level indicators	Secondary indicators	Index calculation formula
Profitability	Net asset interest rate	Net interest rate of assets = net profit / average total assets
	Net sales margin	Net profit margin = net profit / sales revenue
	Cost rate	Cost rate = total cost during the cost period / operating cost
Operating capacity	Inventory turnover rate	Inventory turnover rate = sales cost / average inventory balance
	Accounts receivable turnover rate	Accounts receivable turnover rate = operating income / average balance of accounts receivable
	Total asset turnover rate	Total asset turnover = operating income / average total assets
Debt solvency	Flow ratio	Current ratio = current assets / current liabilities
	Fast ratio	Quick ratio = quick assets / current liabilities
	Asset-liability ratio	Total liabilities / total assets
Development capacity	Growth rate of operating income	Operating income growth rate = this year 's operating income growth / last year 's operating income
	Net profit growth rate	Net profit growth rate = net profit growth of this year / net profit of the previous year
	Growth rate of total assets	Growth rate of total assets = growth rate of total assets this year / total assets at the beginning of the year

II. A.Solvency

External financing such as bank loans and special bonds can give full play to the role of financial leverage and promote the rapid development of enterprises, but the excessive use of external financing will also bring high debt, high leverage and high risk, affecting the stable development of enterprises. Therefore, it is necessary to effectively analyze the solvency of the enterprise, so that the enterprise can formulate scientific financial policies, reasonable liabilities, control financial risks, and contribute to the sustainable development of the enterprise.

II. B.Operational capacity

Operational capacity is mainly manifested in whether an enterprise has a sufficiently high level of financial management, utilizes its limited resources in a scientific and reasonable manner, and completes its strategic development planning in a good and fast manner on the basis of both economic and social performance.

II. C.Profitability

The sources of income of enterprises generally include financial subsidy income, operating income, other income and other aspects. The internal and high-quality development of enterprises cannot be separated from the support and guarantee of capital and resources. Under the perspective of resource scarcity, the income-generating capacity of enterprises plays a key role in their stable development, so it is necessary to examine the income-generating capacity of enterprises.

II. D.Developing capacity

The sustainable development capability of an enterprise is mainly manifested in the long-term stable growth of enterprise income, the continuous improvement of enterprise facilities and other basic conditions, the gradual growth of scientific and technological investment, the continuous accumulation of capital, the deepening of the integration of different enterprises, and the continuous enhancement of risk-resistant capability.

III. Comprehensive evaluation model of multidimensional financial indicators

According to the relevant literature research on performance evaluation methods of scholars at home and abroad, the main evaluation methods adopted at present are hierarchical analysis method, fuzzy comprehensive evaluation method, data envelopment analysis method and entropy weight method. Through comparative research, it is found that the hierarchical analysis method conforms to the hierarchical principle of the establishment of the evaluation index system, and is suitable for the evaluation index system combining quantitative and qualitative indexes. The fuzzy comprehensive evaluation model is more flexible, has a wide range of application, and can be used in combination with the hierarchical analysis method, so that the combination of qualitative evaluation and quantitative evaluation leads to a comprehensive evaluation result [16]. At the same time, the fuzzy evaluation results are quantified to make the evaluation results more clear.

Based on the multidimensional financial indicators established in the previous chapter, this chapter will use hierarchical analysis to determine the weights of quantitative and qualitative indicators, combined with the fuzzy evaluation method to count and calculate the performance scores of the four dimensions of finance, customers, internal processes, and learning and growth, and construct a multidimensional financial indicators comprehensive evaluation model.

III. A. Hierarchical Analysis Calculation Procedure

In this paper, the hierarchical analysis method is selected to assign weights to qualitative and quantitative indicators [17]. Hierarchical analysis method is to decompose the analysis process into target layer, dimension layer and indicator layer, and to determine the weights for the indicators of the higher level based on the relative importance in the order of dimension layer-indicator layer and target layer-dimension layer, so as to decompose a qualitatively complex problem which is influenced by many factors into a quantitative problem.

Through the hierarchical analysis method, the analysis process is divided into the target level, the first-level indicator level and the second-level indicator level, which requires experts to combine a strong theoretical knowledge system and solid time experience to score the dimension indicators that have been set up in the way of answering the questionnaires, and then conduct consistency tests on the results after synthesizing the data results. It can be seen that the hierarchical analysis method can avoid subjective interference and has outstanding advantages.

1) Establishing hierarchical structure model

By clarifying the decision-making objectives, considering the dimensions and influencing factors, the indicators are grouped together from top to bottom according to the logical relationship to form a hierarchical structural model with three levels of hierarchy: the objective level, the criterion level and the indicator level.

2) Construct judgment matrix [18].

According to the importance of the index elements of this stratum relative to the index elements of the previous stratum, relevant scholars and experts are invited to score with reference to the 9-point scale method, and the scoring results form the judgment matrix.

3) Calculate the weights

Use the square root of achievement method to calculate the geometric mean of each row of the matrix, and seek its average value, and get the eigenvectors through normalization:

$$\overline{W}_i = \left\{ \prod_{i=1}^{n} a_{ij} \right\}^{\frac{1}{n}}, (ij = 1,2,\cdots,n) \tag{1}$$

$$W_i = \frac{\bar{W}_i}{\sum_{j=1}^{n} \bar{W}_i}, (ij = 1,2,\cdots,n) \tag{2}$$

4) Consistency test

After calculating the weights, test whether the judgment matrix results have consistency, the specific process is as follows:

(1) Calculate the maximum eigenvalue $\lambda_{\max}$ of the judgment matrix:

$$\lambda_{\max} = \frac{1}{n}\sum_{i=1}^{n} \frac{\left(\sum_{j=1}^{n} a_{ij} W_j\right)}{W_i}, (i = 1,2,\cdots,n) \tag{3}$$

(2) Find the consistency indicator CI :

$$CI = \frac{\lambda_{\max} - n}{n-1} (n > 2) \tag{4}$$

(3) Check that the consistency ratio is reasonable CR :

$$CR = \frac{CI}{RI} \tag{5}$$

The query for the value of RI is as follows:

$CR > 0.1$, the matrix fails the consistency test; $CR \le 0.1$, the matrix passes the consistency test. The smaller the value of CR , the higher the consistency of the judgment matrix.

III. B. Calculation process of fuzzy comprehensive evaluation method

1) Determine the rubric set

In this paper, five indicator evaluation levels are delineated, and the set of rubrics is $P = [P_1, P_2, P_3, P_4, P_5] = [100, 80, 60, 40, 20]$, which represent excellent performance, good average, poor, and poor.

2) Construct affiliation matrix

(1) According to the ratings, the set of all ratings normalization process to form a matrix R_i , the formula is as follows:

$$R_i = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{n1} & \cdots & r_{nn} \end{bmatrix} \tag{6}$$

(2) Evaluate the modeling that has been done to derive the affiliation vector S_i , calculated as follows:

$$S_i = \omega_i \circ R_i = [\omega_1, \omega_2, \cdots, \omega_n] \circ \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix} = (A_1, A_2, \cdots, A_n) \tag{7}$$

(3) Combined with the set of rubrics P , the quantitative dimension indicator score is calculated as D_1 and the qualitative dimension indicator score is calculated as D_2 with the following formula:

$$D_1 = S_1 \circ P^T = (A_1, A_2, \cdots, A_n) \circ \begin{pmatrix} P_1 \\ \cdots \\ P_n \end{pmatrix} \tag{8}$$

IV. Analysis of the comprehensive financial evaluation of company A

Established in 1993, Real Estate Company A is a subsidiary of a state-controlled enterprise in Shandong Province, China, with a registered capital of RMB 1 billion. Company A was listed on the Shanghai Stock Exchange on January 13, 2000, with a total market capitalization of RMB 4.014 billion. As a state-owned listed company, Company A has more than 40 branches, mainly operating services related to real estate industry. This chapter takes the 2022-2024

financial report of Agricultural and Commercial Bank of A as the main source of data, and applies the comprehensive evaluation model of multidimensional financial indicators proposed in this paper to conduct a comprehensive financial evaluation of Company A.

IV. A. Determination of weights of multidimensional financial evaluation indicators

IV. A. 1) Hierarchical Analysis Structure Establishment

When this paper adopts the hierarchical analysis method to construct the index weights for Company A, the financial indexes of Company A are divided into three levels, namely, target level, guideline level, and index level, and the indexes between each level affect each other and the levels also affect each other. Combined with the multidimensional financial indicators comprehensive evaluation index system proposed in this paper, the corresponding design of Company A's multidimensional financial indicators comprehensive system is shown in Table 2.

Table 2: A company's multidimensional financial index comprehensive system

Target layer (C)	Criterion layer (C_i)	Indicator layer (C_{ij})
A company multidimensional financial evaluation (C)	Profitability (C_1)	Net asset interest rate (C_{11})
		Net profit margin on sales (C_{12})
		Cost rate (C_{13})
	Operating capacity (C_2)	Inventory turnover rate (C_{21})
		Accounts receivable turnover rate (C_{22})
		Total asset turnover (C_{23})
	Solvency (C_3)	Flow ratio (C_{31})
		Quick ratio (C_{32})
		Asset-liability ratio (C_{33})
	Development capacity (C_4)	Growth rate of operating income (C_{41})
		Net profit growth rate (C_{42})
		Growth rate of total assets (C_{43})

IV. A. 2) Expert scoring to construct judgment matrices

Each data in the judgment matrix represents the degree of interaction between two or two indicators, and then the corresponding data are found according to the influence degree score table, thus constructing the judgment matrix. Combined with the multidimensional financial indicator synthesis system of Company A proposed in the previous section, a questionnaire was designed to allow internal financial personnel and experts and scholars of Company A to score the interaction between many indicators subjectively. The questionnaire was distributed to 30 internal financial staff of Company A, and 10 certified public accountants and auditors in charge of the company's auditing work were also selected as external respondents. Through the organization and analysis of the recovered data, the expert scoring table for financial risk evaluation of Company A is derived, as shown in Table 3.

Table 3: Expert scoring table

Project	Profitability	Operating capacity	Debt solvency	Development capacity
Profitability	1	1/3	1/5	1/5
Operating capacity	5	1	3	1/5
Debt solvency	3	5	1	3
Development capacity	3	1/5	1/3	1
Index layer: profitability				
Indicators	Net asset interest rate	Net sales margin	Cost rate	-
Net asset interest rate	1	1/3	1/5	-
Net sales margin	3	1	1/2	-
Cost rate	3	3	1	-
Indicator layer: operational capacity				

Indicators	Inventory turnover rate	Accounts receivable turnover rate	Total asset turnover rate	-
Inventory turnover rate	1	1/2	1/3	-
Accounts receivable turnover rate	2	1	1/2	-
Total asset turnover rate	3	2	1	-
Indicator layer: solvency				
Index layer	Flow ratio	Fast ratio	Asset-liability ratio	-
Flow ratio	1	1/3	1/2	-
Fast ratio	3	1	1/4	-
Asset-liability ratio	2	4	1	-
Indicator layer: development capacity				
Index layer	Growth rate of operating income	Net profit growth rate	Growth rate of total assets	-
Growth rate of operating income	1	1/3	1/5	-
Net profit growth rate	3	1	1/2	-
Growth rate of total assets	5	2	1	-

IV. A. 3) Calculation of maximum characteristic root

For the constructed judgment matrix, its eigenvectors are to be calculated, considering the conciseness and accuracy, the square root method is used to calculate the eigenvectors in this paper. It is divided into the following steps:

First, the numerical product of each row in the judgment matrix is calculated:

$$M_i = \prod_{j=1}^{n} a_{ij} \left(a_{ij}\right)(i = 1,2,3\ldots n) \tag{9}$$

Second, compute the nth root of M_i:

$$\overline{W} = \sqrt[n]{M_i}(i = 1,2,3\ldots n) \tag{10}$$

Again, the vector $\overline{W} = \left(\overline{W_1}, \overline{W_2}, \overline{W_3}\ldots\overline{W_n}\right)^T$ is normalized, i.e:

$$W_i = \frac{\overline{W_i}}{\sum_{i=1}^{n} \overline{W_i}}(i = 1,2,3\ldots n) \tag{11}$$

Get $W = \left(W_1, W_2, W_3\ldots W_n\right)^T$, the eigenvectors.

The data in the one-row matrix thus obtained are the respective weights of the indicators.

The value CW of the matrix $C - C_i$ and the eigenvector W is then calculated:

$$CW = \begin{bmatrix} 1 & c_{12} & \ldots & c_{1n} \\ 1/c_{12} & 1 & \ldots & c_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ 1/c_{1n} & 1/c_{2n} & \ldots & 1 \end{bmatrix} \begin{bmatrix} W_1 \\ W_2 \\ W_3 \\ W_4 \end{bmatrix} \tag{12}$$

This subsequently yields the maximum eigenroot value, i.e:

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(CW)_i}{nW_i} = \frac{1}{n} \sum_{i=1}^{n} \frac{\sum_{j=1}^{n} c_{ij} W_j}{W_i} \tag{13}$$

IV. A. 4) Judgment matrix consistency test

In the process of judgment matrix construction, expert scoring may be more subjective, there are certain defects in the design of the questionnaire content, statistical errors These factors will affect the data in the judgment matrix, in order to make the weighting order more scientific, it is necessary to conduct a consistency test of the judgment matrix. Here the consistency test of the judgment matrix is taken as an example of Company A's criterion level C matrix.

First of all this judgment matrix is a 4th order matrix, where $n=4$, calculate the consistency indicator CI:

$$CI=\frac{\lambda_{\max}-n}{n-1}=\frac{4.0824-4}{4-1}=\frac{0.0824}{3}=0.0275 \tag{14}$$

According to $n=4$, it can be known that $RI=0.89$, and next, the consistency ratio CR is calculated according to Equation (15):

$$CR=\frac{CI}{RI}=\frac{0.0275}{0.89}=0.0309<0.1 \tag{15}$$

If the result value of CR is less than 0.1, like the above calculation results, it indicates that the consistency test is passed, and the value in the judgment matrix, although subject to a large subjective factor, does not affect the following risk evaluation, if the result is greater than 0.1, it indicates that there will be a large impact on the evaluation results, so that the evaluation results will deviate from the actual situation. In this case, it is necessary to correct the coefficient of the consistency test value and construct a revised judgment matrix. Similarly, the test of the indicator layer is also the same, the specific process is not listed, the specific calculation results are shown in Table 4 below. It can be seen that the guideline layer and indicator layer of Company A have passed the consistency test.

Table 4: Consistency calculation table of each judgment matrix check

Project	Profitability	Operating capacity	Debt solvency	Development capacity	Weight
Profitability	1	1/3	1/5	1/5	0.0691
Operating capacity	5	1	3	1/5	0.2678
Debt solvency	3	5	1	3	0.527
Development capacity	3	1/5	1/3	1	0.1361
CI=0.0275 RI=0.89 CR=0.0309<0.1 Consistency test passed					
Index layer: profitability					
Indicators	Net asset interest rate	Net sales margin	Cost rate	-	Weight
Net asset interest rate	1	1/3	1/5	-	0.1635
Net sales margin	3	1	1/2	-	0.297
Cost rate	3	3	1	-	0.5395
CI=0.029 RI=0.58 CR=0.05<0.1 Consistency test passed					
Indicator layer: operational capacity					
Indicators	Inventory turnover rate	Accounts receivable turnover rate	Total asset turnover rate	-	Weight
Inventory turnover rate	1	1/2	1/3	-	0.1635
Accounts receivable turnover rate	2	1	1/2	-	0.297
Total asset turnover rate	3	2	1	-	0.5395
CI=0.0045 RI=0.58 CR=0.008<0.1 Consistency test passed					
Indicator layer: solvency					
Index layer	Flow ratio	Fast ratio	Asset-liability ratio	-	Weight
Flow ratio	1	1/3	1/2	-	0.1591
Fast ratio	3	1	1/4	-	0.2627
Asset-liability ratio	2	4	1	-	0.5782

CI=0.0184 RI=0.58 CR=0.0317<0.1 Consistency test passed					
Indicator layer: development capacity					
Index layer	Growth rate of operating income	Net profit growth rate	Growth rate of total assets	-	Weight
Growth rate of operating income	1	1/3	1/5	-	0.1095
Net profit growth rate	3	1	1/2	-	0.309
Growth rate of total assets	5	2	1	-	0.5815
CI=0.0015 RI=0.58 CR=0.0026<0.1 Consistency test passed					

IV. A. 5) Construction of weighting tables for evaluation indicators

In the previous section, after the consistency test of the criterion layer and the indicator layer, it is found that all indicators have passed the consistency test and are qualified values. In this section, the fuzzy evaluation work will be carried out to calculate the composite weights of the guideline layer and the indicator layer and sort them, and the sorting results are specifically shown in Table 5. First from the criterion layer of the four major aspects to analyze, solvency>operating capacity>development capacity>profitability, the weight level corresponds to 52.70%, 26.78%, 13.61%, 6.91%. Analyzing the data of the 12 indicators, the indicator with the greatest financial impact on Company A is the gearing ratio, with an impact weight level as high as 30.47%. This is followed by total asset turnover, quick ratio, and current ratio, which account for 14.45%, 13.84%, and 8.38%, respectively.

Table 5: A company's financial risk evaluation index weight table

Criterion layer	Criterion layer weight	Index layer	Index layer weight	Comprehensive weight	Sortin g
Profitability	6.91%	Net asset interest rate	11.17%	0.77%	12
		Net sales margin	31.53%	2.18%	10
		Cost rate	57.30%	3.96%	9
Operating capacity	26.78%	Inventory turnover rate	16.35%	4.38%	7
		Accounts receivable turnover rate	29.70%	7.95%	5
		Total asset turnover rate	53.95%	14.45%	2
Debt solvency	52.70%	Flow ratio	15.91%	8.38%	4
		Fast ratio	26.27%	13.84%	3
		Asset-liability ratio	57.82%	30.47%	1
		Growth rate of operating income	10.95%	1.49%	11
Development capacity	13.61%	Net profit growth rate	30.90%	4.21%	8
		Growth rate of total assets	58.15%	7.91%	6

IV. B. Fuzzy Comprehensive Evaluation of Multidimensional Financial Indicators

In order to compare the industry level in which Company A's finance is located, that is, to form a horizontal comparison of the results, listed here together with the industry average level of each indicator efficacy coefficients, industry averages based on the average of the standard value of real estate enterprise performance evaluation indicators in 2024 for the efficacy coefficients of the transformation of the results of the comparison is specifically shown in Table 6.

Table 6: Financial index efficiency coefficient conversion results

Criterion layer	Index layer	2022	2023	2024	Industry mean
Profitability	Net asset interest rate	0.88	0.7	0.77	0.49
	Net sales margin	0.68	0.6	0.64	0.54
	Cost rate	0.21	0.46	0.12	0.53
Operating capacity	Inventory turnover rate	1	0.72	0.43	0.51
	Accounts receivable turnover rate	0.87	0.81	0.76	0.5
	Total asset turnover rate	0.48	0.34	0.41	0.49

Debt solvency	Flow ratio	1	1	1	0.65
	Fast ratio	1	1	1	0.58
	Asset-liability ratio	0.22	0.47	0.41	0.49
	Growth rate of operating income	0.2	0.52	0.59	0.48
Development capacity	Net profit growth rate	0.32	0.45	0.28	0.48
	Growth rate of total assets	0.49	0.62	0.38	0.55

The financial evaluation indicators of Company A are weighted and measured to obtain the comprehensive score of financial performance. In order to further determine the position of Company A's financial performance in the industry, the comprehensive evaluation value of the industry's financial performance is measured by the industry average value of each index in 2024, and the evaluation value of Company A's financial performance in 2024 is compared with the industry average value to form the horizontal comparison results. The weighted evaluation results are shown in Table 7.

Table 7: Financial performance weighted evaluation value

Criterion layer	Index layer	2022	2023	2024	Industry mean
Profitability	Net asset interest rate	0.0182	0.0145	0.0159	0.0101
	Net sales margin	0.0081	0.0071	0.0076	0.0064
	Cost rate	0.0113	0.0247	0.0065	0.0285
Operating capacity	Inventory turnover rate	0.0249	0.0179	0.0107	0.0127
	Accounts receivable turnover rate	0.0532	0.0495	0.0464	0.0306
	Total asset turnover rate	0.0712	0.0505	0.0608	0.0727
Debt solvency	Flow ratio	0.0705	0.0705	0.0705	0.0458
	Fast ratio	0.0257	0.0257	0.0257	0.0149
	Asset-liability ratio	0.0094	0.02	0.0174	0.0208
	Growth rate of operating income	0.0081	0.021	0.0238	0.0194
Development capacity	Net profit growth rate	0.0338	0.0475	0.0295	0.0506
	Growth rate of total assets	0.0899	0.1138	0.0697	0.1009
Comprehensive evaluation		0.4243	0.4627	0.3845	0.4134

IV. B. 1) Analysis of longitudinal comparison results

The financial performance evaluation results of Company A from 2022 to 2024 are specifically shown in Figure 1. 2023 has increased compared to 2022. 2024 financial evaluation result of Company A is only 0.3845, which is a significant decrease compared to 2023. From the overall trend of financial performance in the past three years, the financial performance of Company A shows a downward trend.

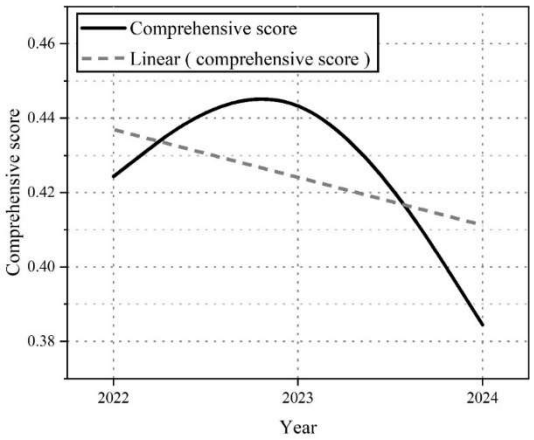

Figure 1: A company's financial performance evaluation results for 2022-2024

IV. B. 2) Analysis of cross-sectional results

From the results of the horizontal comparison of industry benchmarking, the results of the comparison between Company A and the industry average in 2024 are specifically shown in Figure 2. It can be seen that the performance

of profitability and development ability of Company A is not up to the industry average, which further validates the weakness of Company A's comprehensive strength and forms the most critical factor affecting financial performance. From the comprehensive score of financial performance, Company A's financial performance in 2024 is lower than the industry average, which to a certain extent indicates that Company A's comprehensive development ability is poor, and in the future, it should focus its corporate development on improving and upgrading its financial performance.

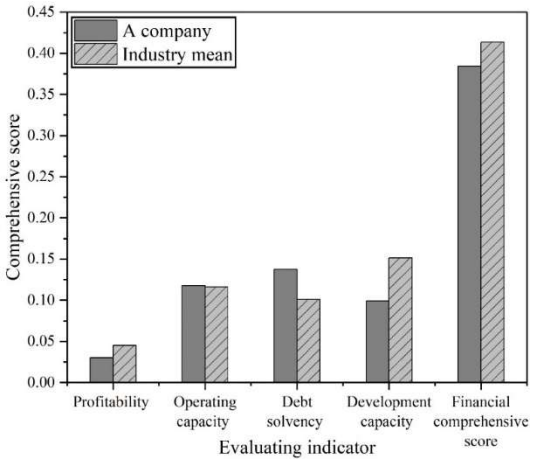

Figure 2: Industry benchmarking results

IV. B. 3) Analysis of evaluation results based on the fuzzy comprehensive evaluation method

In this paper, five-level fuzzy set is used to construct the fuzzy comprehensive evaluation set, i.e., the fuzzy results are excellent, good, medium, qualified and poor, and the domain is [0,1]. The fuzzy parameter set is $V = [0.8, 0.7, 0.6, 0.5, 0.4]$, which is used to construct the affiliation function of the fuzzy set, and the index evaluation matrix is further constructed using the index evaluation value and affiliation function:

$$Excellent(x) = \begin{cases} 0, 0 \le x < 0.7 \\ (x - 0.7)/0.1, 0.7 \le x < 0.8 \\ 1, 0.8 \le x < 1 \end{cases} \tag{16}$$

$$Good(x) = \begin{cases} 0, 0 \le x < 0.6 \\ (x - 0.6)/0.1, 0.6 \le x < 0.7 \\ (0.8 - x)/0.1, 0.7 \le x < 0.8 \\ 0, 0.8 < x \le 1 \end{cases} \tag{17}$$

$$\text{Medium}(x) = \begin{cases} 0, 0 \le x < 0.5 \\ (x - 0.5)/0.1, 0.5 \le x < 0.6 \\ (0.7 - x)/0.1, 0.6 \le x < 0.7 \\ 0, 0.7 < x \le 1 \end{cases} \tag{18}$$

$$Qualified(x) = \begin{cases} 0, 0 \le x < 0.4 \\ (x - 0.4)/0.1, 0.4 \le x < 0.5 \\ (0.6 - x)/0.1, 0.5 \le x < 0.6 \\ 0, 0.6 < x \le 1 \end{cases} \tag{19}$$

$$Bad(x) = \begin{cases} 1, 0 \le x < 0.4 \\ (0.5 - x)/0.1, 0.4 \le x < 0.5 \\ 0, 0.5 < x \le 1 \end{cases} \tag{20}$$

The financial evaluation results of Company A for 2022-2024 and the industry average are calculated separately, as shown in Table 8. The evaluation results based on the fuzzy comprehensive evaluation method show that the financial performance of Company A has a significant downward trend in the past three years, especially the financial performance in 2024 is "poor", and the membership degree is relatively high, reaching 0.5332. Compared with the evaluation results of the industry average, although the evaluation grade of the industry average is "qualified", its membership is relatively high, reaching 0.7432, and the financial performance of Company A still has more room for improvement.

Table 8: Financial evaluation results

Year	Financial performance	Grade of membership
2022	0.2905	Qualified
2023	0.2956	Excellent
2024	0.5332	Difference
Industry average	0.7432	Qualified

In general, using the multidimensional financial indicators proposed in this paper comprehensive evaluation index system, multidimensional financial indicators comprehensive evaluation model, comprehensive evaluation and analysis of Company A's financial performance can be more objective description of Company A's financial performance, to help Company A to find its own financial problems and room for improvement.

V. Conclusion

In this paper, a multi-dimensional comprehensive evaluation index system of financial indicators is constructed with profitability, operating ability, debt repayment ability and development ability as the main indicators, and on this basis, the membership vector is obtained by combining the analytic hierarchy process and the fuzzy comprehensive evaluation method, and the membership degree vector is obtained from the weight and membership matrix, and the multi-dimensional financial index comprehensive evaluation model is constructed. Taking Real Estate Company A as the research object, we will explore its financial situation in 2022-2024. In the longitudinal comparison, the financial evaluation result of Company A in 2024 is only 0.3845, which is a significant decrease compared with 2023. From 2022 to 2024, the overall financial performance of Company A will show a downward trend. From the perspective of horizontal comparison, in 2024, the profitability and development ability of Company A will not reach the industry average, and the overall financial performance will be lower than the industry average, and the comprehensive development ability will be poor. In the evaluation results based on the fuzzy comprehensive evaluation method, the financial performance of Company A has a significant downward trend in the past three years, and the financial performance in 2024 is classified as "poor", and the membership degree is 0.5332, while the industry average evaluation grade is "qualified", and the membership degree is as high as 0.7432. To a certain extent, this shows that Company A has a large room for improvement in financial performance.

References

[1] Bogićević, J., Domanović, V., & Krstić, B. (2016). THE ROLE OF FINANCIAL AND NON-FINANCIAL PERFORMANCE INDICATORS IN ENTERPRISE SUSTAINABILITY EVALUATION. Ekonomika, 62(3).

[2] Costa, M. A. S., Guerino, G. C., Leal, G. C. L., Balancieri, R., & Galdamez, E. V. C. (2022). Exploring performance measurement practices in Brazilian startups. Total Quality Management & Business Excellence, 33(5-6), 637-663.

[3] Awan, M. H., Bhatti, M. I., & Razaq, Z. (2015). Financial Management: The impact of performance indicators on the organisational profitability. Corporate Governance & Performance, 13(1), 84-96.

[4] Tan, R., Zhu, X., & Mei, L. (2021, March). Multi dimensional model construction of enterprise performance evaluation system based on EVA Perspective. In 2021 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS) (pp. 567-570). IEEE.

[5] Barykin, S. E., Strimovskaya, A. V., Kapustina, I., Kadyrova, O. V., Senchin, P. K., & Golubetskaya, N. P. (2024). Model-Based Holistic Multidimensional View on Digital Engineering Investments Appraisal. Engineered Science, 31, 1187.

[6] Gao, A., Li, S., & Yuan, P. (2024, October). Multi-dimensional Analysis and Algorithm in Enterprise Information System Assessment. In 2024 3rd International Conference on Data Analytics, Computing and Artificial Intelligence (ICDACAI) (pp. 707-713). IEEE.

[7] Dokiienko, L. (2021). Financial security of the enterprise: an alternative approach to evaluation and management. Business, Management and Economics Engineering, 19(2), 303-336.

[8] Wang, Z. (2025). Construction of Enterprise Financial Performance Evaluation System. Asia Pacific Economic and Management Review, 2(2).

[9] Borisova, V. V., Demkina, O. V., Mikhailova, A. V., & Zieliński, R. (2019). The enterprise management system: evaluating the use of information technology and information systems. Polish Journal of Management Studies, 20.

[10] Golovkova, A., Eklof, J., Malova, A., & Podkorytova, O. (2019). Customer satisfaction index and financial performance: a European cross country study. International Journal of bank marketing, 37(2), 479-491.

[11] Klapalová, A., & Suchánek, P. (2018). Business performance and its relationship to customer satisfaction and enterprise quality management. of Business Economics, Management and Marketing 2018, 130.
[12] Petr, S., Simona, Č., Hana, K., & Stanislava, D. (2021). Business Financial Performance In The Context Of Customer Satisfaction Management. Quality-Access to Success, 22(185).
[13] Lin, Y. C., Chen, C. L., Chao, C. F., Chen, W. H., & Pandia, H. (2020). The study of evaluation index of growth evaluation of science and technological innovation micro-enterprises. Sustainability, 12(15), 6233.
[14] Petare, P. A., Muthulakshmi, R., Bhattacharjee, I., Sharma, S., & Kumar, S. M. (2023). The impact of financial innovation on corporate financial performance. Journal of Survey in Fisheries Sciences, 10(1s), 6245-6254.
[15] Nascimento, L. D. S., Trizotto, R. C. A., Pufal, N. A., Camboim, G. F., & Zawislak, P. A. (2025). Which innovation capabilities are relevant for technological and non-technological innovation? Implications for manufacturing firms' financial performance. Journal of Manufacturing Technology Management, 36(2), 406-430.
[16] Linglin Zhao. (2024). Construction of Comprehensive Evaluation Model for Financial Risk Management in Colleges and Universities Based on Fuzzy Logic. Applied Mathematics and Nonlinear Sciences,9(1).
[17] Xu Lianyun & Kong Jianhua. (2020). Financial Risk Assessment of Marine Enterprises Based on Analytic Hierarchy Process. Journal of Coastal Research,112(sp1),171-173.
[18] Tiantian Lv. (2024). Optimization of Teacher Incentive Mechanism and Policy Supply in Rural China Based on Judgment Matrix. Applied Mathematics and Nonlinear Sciences,9(1).