Research and application of management accounting in project performance evaluation based on PCA model

Yan Zhu *, Meiyi Xu

Xi'an Jiaotong University City College, 710018, Xi ' an, Shaanxi, China

Abstract: With the development of society and the continuous improvement of market economy, the economic environment of enterprises has changed greatly, the competition between enterprises is becoming more and more fierce, and the survival of enterprises has also been greatly challenged. In this context, the performance evaluation of enterprises has attracted the attention of the whole society, especially the scholars and experts in the business community, and the theory and method of enterprise performance analysis have also been further deepened and developed. With the help of the principal component analysis (PCA) model and management accounting tools, this paper aims to correctly evaluate the performance of enterprises, find the factors that affect the performance of enterprises, and then put forward some suggestions, hoping to provide reference for the performance evaluation of enterprises, improve the core competitiveness of enterprises, and help enterprises develop and grow better under the new situation.

Key words: PCA; Management accounting tools; Performance analysis; SPSS

1. Introduction

And in the 2015 two sessions, Premier Li Keqiang pointed out in the government work report that "mass entrepreneurship and innovation" should be built into one of the "twin engines" to promote China's economy. Nowadays, China has entered a new period of development, so to a large extent, the traditional performance evaluation methods have been difficult to help enterprises develop and grow under the new development situation, so there are not a few researches on enterprise performance evaluation.

At present, there are many studies on enterprise performance evaluation.Zheng Wei et al. [1] proposed that performance evaluation refers to the application of scientific qualitative or quantitative methods to evaluate and assess the actual effect and contribution or value of work behavior according to the work undertaken by each department and employee in the organization.Performance evaluation can not only provide the basis for salary adjustment and personnel change, but also help to improve the performance level by encouraging employees to continuously improve the work effect and improve the performance level.Li Yunda et al. [2] pointed out that the effective use of management accounting tools to comprehensively evaluate projects not only helps to enhance the competitiveness of enterprises, but also promotes the sustainable development of society.

In summary, many scholars have noticed that the application of management accounting in enterprise performance evaluation should be strengthened, but most of them are limited to the perspective of theoretical explanation.Therefore, from the perspective of combining theoretical and empirical analysis, this paper uses PCA model, management accounting tools, SPSS and other software to analyze and process the collected data, quantify the various management accounting indicators that affect enterprise performance, explore the impact of each indicator on performance, and put forward relevant suggestions for improving enterprise performance, hoping to help enterprises better develop.

2. Introduction of PCA model

Principal component analysis (PCA) [3] is a multivariate statistical method that mainly uses the idea of dimension reduction to transform multiple variables into several comprehensive indicators on the premise of losing little information.The comprehensive index generated by transformation is called principal component, in which each principal component is a linear combination of the original variables, and each principal component is uncorrelated with each other, which makes the winner component and the original variables have some superior performance.

The specific method to determine each principal component is as follows. Let Z_i represent the *i-th* principal component, i=1,2,3...,p, then we can set:

* Corresponding author: jdcsxy@126.com

$$\begin{cases} Z_1 = a_{11}X_1 + a_{12}X_2 + \cdots + a_{1n}X_n \\ Z_2 = a_{21}X_1 + a_{22}X_2 + \cdots + a_{2n}X_n \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ Z_n = a_{n1}X_1 + a_{n2}X_2 + \cdots + a_{nn}X_n \end{cases} \quad (1)$$

This paper is mainly based on the principal component analysis to reduce the dimension, and the weight calculation of related indicators.

Calculate the weight of the i-th factor

With x evaluation indicators and y influence factors, the weight of the ith factor is calculated as follows:

$$\omega_i = \frac{f_i}{f_1 + f_2 + \dots + f_i} \quad (2)$$

Where, ω_i represents the weight of the *i-th* factor, and represents the variance contribution rate of the *i-th* factor.

Calculate the weight of the *j-th* indicator:

$$p_j = \sum \frac{\alpha_{ij} \times w_i}{\sqrt{\mu_i}} \quad (3)$$

Where p_j represents the weight of the *j-th* index, the factor loading of the *j-th* index under the influence of the ith factor, and the eigenvalue of the *i-th* index.

3. Index introduction

There are many factors affecting enterprise performance. Based on the existing achievements and theories, this paper mainly starts from the perspective of management accounting tool - Balanced scorecard to evaluate enterprise performance, and divides the main factors affecting enterprise performance into four indicators: finance, internal process, customer, learning and growth.

3.1 Finance

The first factor that enterprises should consider in performance analysis is the financial level, which is not only the main component of the balanced scorecard, but also the necessary factor for enterprises to improve their competitiveness and maintain long-term development.In this paper, the indicators that affect corporate finance are determined to mainly reflect the level of corporate profits as profitability, debt paying ability that reflects the ability to repay loans and credit level, and operating ability that reflects the efficiency and benefit of enterprises [4].

3.2 Internal Process

The internal process of an enterprise is the basis to ensure the smooth development of various businesses of an enterprise, and also the condition to ensure the financial level of an enterprise.Therefore, in the performance analysis of an enterprise, the internal process is also one of the important influencing factors.In this paper, the indicators that affect the internal processes of enterprises are identified as the quality management that reflects the smooth progress of internal processes of enterprises and the R&D innovation level that improves the competitiveness of enterprises [5].

3.3 Customers

No matter what level of development the enterprise has reached, the main business objectives of the enterprise are to obtain customer support, meet customer needs and obtain customer recognition.Therefore, customers are also an important component of corporate performance evaluation and balanced scorecard.This paper mainly refines customer indicators into customer complaint rate, customer retention rate and new customer increase rate that affect customer satisfaction.

3.4 Learning and growth

In order to achieve long-term and stable development, enterprises should not limit performance evaluation only to a high financial level, perfect internal process and meet the basic needs of customers to obtain customer satisfaction.It is also necessary to strengthen the learning and growth of enterprises, constantly innovate, improve the core competitiveness and reduce the substitutability.Therefore, in terms of learning and growth indicators, this paper mainly identifies them as enterprise development and employee satisfaction [6]. Specific selected indicators are shown in Figure 1:

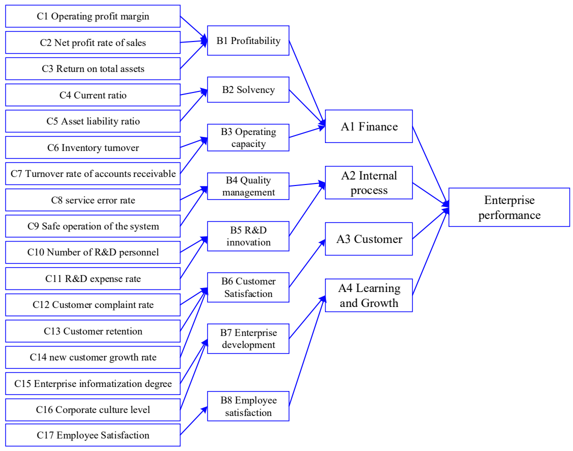

Figure 1 Indicators that affect firm performance

4. Research and application of management accounting in project performance evaluation under PCA model

4.1 Data collection and analysis

Through the distribution of index questionnaires, the number of questionnaires issued is: 60, and the number of valid questionnaires returned is: 53.The results of the questionnaire are analyzed and the weights are calculated, which are shown in Table 1.

Table 1 Weight calculation results

Dimension of evaluation		Index of evaluation				
indicators	The weight	Level 1 indicator	The weight	Secondary index	The weight	Weighted weight

financial (A1)	0.33071	Profitability (B1)	0.38741	Operating profit margin (C1)	0.40993	0.05252
				Net profit margin on sales (C2)	0.30411	0.03896
				Total asset compensation (C3)	0.28596	0.03662
		Ability to pay debts (B2)	0.32082	Current ratio (C4)	0.60989	0.06471
				Asset-liability ratio (C5)	0.39011	0.04139
		Operating capacity (B3)	0.29177	Accounts receivable turnover (C6)	0.54366	0.05245
				Inventory turnover (C7)	0.45634	0.04405
Internal process (A2)	0.26586	Quality Management (B4)	0.55818	R&d expense ratio (C8)	0.50860	0.07547
				Number of R&D personnel (C9)	0.49140	0.07292
		R&d and innovation (B5)	0.44182	Service error rate (C10)	0.56514	0.06638
				System safe operation (C11)	0.43486	0.05107
The customer (A3)	0.22168	Customer satisfaction (B6)	1.00000	Customer complaint rate (C12)	0.41230	0.09139
				Customer retention rate (C13)	0.35436	0.07855
				New customer addition rate (C14)	0.23333	0.05172
Learning and Growth (A4)	0.18175	Development of Enterprises (B7)	0.56104	Degree of Enterprise Informatization (C15)	0.53462	0.05451
				Corporate culture Level (C16)	0.46538	0.04745
		Satisfaction of employees (B8)	0.43896	Employee satisfaction (C17)	1.00000	0.07978

It can be seen from the above table that among the four evaluation dimensions affecting enterprise performance, the highest proportion of financial indicators is (0.33071), the lowest is learning and development (0.18175), and the proportion of internal processes and customers is similar.From the perspective of evaluation indicators, the current ratio, as an important indicator reflecting the financial status of the enterprise, accounts for the highest proportion, indicating that the short-term solvency of the enterprise is more important for the management of performance.Secondly, the R&D expense rate and the number of R&D personnel, as important components affecting the quality management indicators of enterprises, account for a large proportion, indicating that the role of quality management in enterprise performance evaluation cannot be ignored.

As a secondary indicator, the customer complaint rate accounts for the highest proportion among all the studied indicators, which indicates that the rapid development of the Internet has led to diversified shopping methods and more open and transparent data.Finally, among the learning and growth indicators with the lowest proportion, the indicator of employee satisfaction accounts for the highest proportion, which shows that although enterprise managers play a decisive role in the development of enterprises, the role of employees in enterprise performance evaluation and enterprise development should not be underestimated.Overall analysis shows that the selected indicators in this paper have a certain degree of differentiation according to the proportion [7].

4.2 Outlook

4.2.1 Establish a scientific performance evaluation system

In recent years, the rapid economic development of China has brought not only good prospects for the development of enterprises, but also many challenges.Performance evaluation is an important factor affecting the development of enterprises nowadays.Because the majority of enterprises in our country also copy the performance evaluation methods of successful enterprises in the industry, but not combined with their own development reality, as a result, some indicators that affect performance have not formed a unified quantitative standard, resulting in a very serious quality analysis loopholes.In the increasingly fierce competition environment, enterprises should quickly establish a perfect and scientific performance evaluation system suitable for themselves [8].

4.2.2 Focus on the combination of financial indicators and non-financial indicators

The impact of financial indicators on business performance is undeniable and extremely important.However, it also has certain limitations. For example, the financial status of enterprises is mainly obtained from various statements of enterprises, and these statements have certain limitations in preparation, timeliness, reliability and other aspects.At this time, the role of some non-financial indicators is particularly important, which can reflect the production and operation, enterprise development, enterprise customers, enterprise employees and many other information that has an important role in performance evaluation that cannot be reflected by financial indicators.Only by comprehensively analyzing financial indicators and non-financial indicators can we systematically and comprehensively understand enterprises and evaluate their performance [9].

4.2.3 Enrich attention to customers and improve customer satisfaction

With the gradual improvement of China's economic system, market competition has become more and more fierce.The development of science and technology has promoted consumers' demand for products and services provided by enterprises to gradually upgrade.In addition, the emergence of new sales methods such as network new retail leads to customers' evaluation of the enterprise, their satisfaction with the goods and services provided by the enterprise, or their dissatisfaction with the goods and services can be intuitively acquired by all customers. Therefore, enterprises should enrich their attention to customers, raise their satisfaction with the enterprise, and reduce complaints against the enterprise. Only in this way can it have a positive promotion effect on enterprise performance evaluation and enterprise development [10].

5. Conclusion

This paper uses management accounting tools to determine four indicators that affect enterprise performance, refines and quantifies each indicator, takes the form of questionnaire survey as the main source of data, uses PCA model to reduce the dimension of each indicator, and uses SPSS and other software to calculate the proportion of the impact of each weight index on performance, and finally concludes that financial indicators are the most important indicators that affect enterprise performance. With the continuous development of Internet technology, the customer complaint rate of enterprises has also become a conclusion that can not be ignored as an indicator affecting enterprise performance.

References

1. Xiao Hua. Discussion on the application of management accounting in project management of construction industry [J]. Study of Finance and Accounting,2017(5):14-15.
2. Shi, Z., Wang, Q. & Zhang, X. Research on the application of management accounting in project management of construction enterprises [J]. Tax Payment,2017(13):17-18.
3. WANG R M. A brief discussion on the problems and countermeasures of construction project budget work [J]. Architectural Engineering Technology and Design,2018(22):1623.
4. Jiang Lishun. Analysis of Project Performance Appraisal System of State-owned construction enterprises [J]. Talent and Wisdom,2015(23):348.
5. Huang, J., Wang, Q. & Sun, H. The application of management accounting tools in the control of scientific research funds in colleges and universities [J]. Wealth Life,2022(14):178-180.
6. Yang M. Discussion on Performance Appraisal of Public welfare Projects based on management accounting tools [J]. Accountants,2018(14):34-35.
7. Han Y X. Using management accounting to strengthen the management of Scientific research funds in colleges and universities [J]. Finance and Accounting,2017(08):66.
8. Li, Y. & Wen, Subin. Management accounting tools and application cases: Application of BSC in project performance evaluation [J]. Friends of Accounting,2016(23):130-133.
9. Zhang, Z. On the Construction and Application of Government Management Accounting (Government Management Accounting).
10. Zhou, W. Engineering Project Performance Evaluation Based on BSC [D]. Wuhan University of Technology,2006.