

Strategic Performance Appraisal Based on BSC and SEM

Wang Bing, Deng Mingran, Zhao Fuqiang

School of Management, Wuhan University of Technology, Wuhan, P. R. China, 430070

(E-mail: wb@bnbm.com.cn, dengmr@whut.edu.cn, zhaofq@whut.edu.cn)

Abstract: The strategic performance appraisal is almost the most difficult problem for most organizations especially under the circumstance of speedy growth of economy. To solve this problem, the paper aims to research the strategic performance appraisal problem based on the principle of BSC and the statistic method of SEM. Beginning with indicating two key problems, this paper conceived a strategic performance appraisal model; then, we designed the strategic performance indicators according to the principle of BSC. Moreover, the weight of each indicator was determined according to SEM. Finally, we conduct an empirical research on the strategic performance appraisal as well made relevant conclusions.

Keywords: Strategic performance appraisal; BSC (Balanced Score Card); SEM (Structural Equation Model); Innovation on performance appraisal

1 Introduction

With the rapid development of the global economy, the new business strategy and the competition reality require the enterprise to have the counter-measures to evaluate their strategic performance^[1]. Thus it becomes the most important project to accurately evaluate the organizational performance both in theory and practice (Simerly&Li, 2000). The traditional strategic performance appraisal analyzed the data in the financial statement based on the principle of the history cost, the core indicator of the equity capital's net profit rate. So its advantage lies on the objective explicit data source and being easy to verify, acquiring and operating. However, because its evaluation scope focused on the organizational past performance, it didn't respond the process but the result and neglected the nonfinancial indicators^[2]. Therefore, these performance appraisals made the managers pay more attention to the short-term interest and it some how jeopardized the long term development of the organization^[3]. The speedy economy requires the managers to pay more attention to the realization of the strategic objects, so the strategic performance appraisal emphasized the financial and nonfinancial objects at the same time. As we all know that the scientific performance appraisal needs to resolve two core problems to establish the reasonable indicators and determine the weights scientifically. Based on above, the paper aims to conceive the strategic performance appraisal system based on BSC and SEM and to verify its feasibility with the reality of the enterprise. Therefore, part one indicated two key problems of the scientific according to the real situation. Part 2 conceived the strategic performance appraisal model based on the principle of BSC and SEM. Part 3 designed the strategic performance indicators according to the principle of BSC. Part 4 determined the weight of each indicator according to the method of SEM. Part 5 made an empirical research on the strategic performance appraisal model. Finally, part 6 made relevant conclusions.

2 Theoretical Base of Strategic Performance Appraisal Based on BSC and SEM

2.1 The principle of SEM

Structural Equation Modeling (SEM), is a kind of statistics method to analyze the relationship among the different variables based on the covariance matrix. In 1970s, Karl G.Jorekog put forth SEM. Since then, SEM is widely employed in social science field. There are two kinds of variables such as the latent variable and the manifest variable in SEM. the manifest variable can be measured directly in reality but the latent variable cannot. A latent variable is almost relevant to many manifest variables, the latent variable can be taken as the abstract and conclusion of the manifest variables, and the manifest variables can be taken as the observe indicators of the latent variable^[4].

SEM can be divided the measure equation and the structural equation, the measure equation describe the relationship between the latent variable and the manifest variables, and the structural equation is the relationship among the latent variables. The measure equation can be expressed as equation (1).

$$\begin{aligned} X &= Ax + \zeta + \delta \\ X &= Ay\eta + \varepsilon \end{aligned} \quad (1)$$

Here, x is the exogenous vector ($q \times 1$), y is the endogenous vector ($p \times 1$), ζ is the exogenous latent

variable $(n \times 1)$, η is the endogenous variable $(m \times 1)$, Ax is the factor loading matrix of the exogenous indicator in the exogenous latent variable $(q \times n)$, Ay is the factor loading matrix of the endogenous indicator in the exogenous latent variable $(p \times m)$, δ is the error of the exogenous indicator $(q \times 1)$, ε is the error of the endogenous indicator $(p \times 1)$. The structural equation can be expressed Equation (2)

$$\eta = B\eta + \Gamma\zeta + \zeta \quad (2)$$

Here, B is the influence matrix among the endogenous latent variables $(m \times m)$, ΓB is the influence matrix that the exogenous latent variables affect the endogenous latent variables $(m \times n)$, ζ is the residual of the structural equation $(m \times 1)$ that respond the non-explanation part in the equation. The relevant hypothesizes of SEM are as follows. Firstly, the average of δ , ε and ζ are all 0. Secondly, δ and ε are irrelevant to and η , meanwhile δ is irrelevant to ε . Thirdly, ζ is irrelevant to ζ , η and ε .

2.2 The principle of BSC

BSC evaluate the organizational performance from the view of the finance, the customer, the operation process and the learning and growth^[5]. From the aspect of finance, the financial performance appraisal is valuable to the past behavior, which can meet the demand of the shareholders and direct the organizational strategy and verify the contribution of the managers. So the financial objects are often relevant to the interests such as the sale revenue, the capital return and EVA and so on; while the customer performance means how they think about us, weights the extent that the strategy is carried out, and includes the customer satisfaction, the customer retention, the new customer, the interest customer and the market share^[6]. As to the operation process, the internal operation determined the advantage of the organization, and its performance appraisal aims to meet the demand of the customer and the finance, so the process includes all processes from the innovation to the service. Finally, the learning and growth determines whether the organization can keep the sustainable advantage, it is the most key factor to the future success, and it is from the staff, the system and the ability. Therefore, there are the cause-consequence and logic relations among four aspects^[7].

The financial performance is the response of the past performance; the other aspect can respond the future performance appraisal and can compensate for the defects of the financial performance appraisal. As we all know that the excellent financial performance can meet the demand of the shareholders, but they come from the satisfactory and loyal customers. If the organizations want to ensure the satisfaction and loyalty of the customer, they have to establish the accurate and reliable process. What's more, the effective and efficient process depends on the passionate, innovative and professional staff. However, the passionate, innovative and professional ability of the staff depend on the organizational support of the learning and growth. Their mutual action relations are shown in Figure 1.

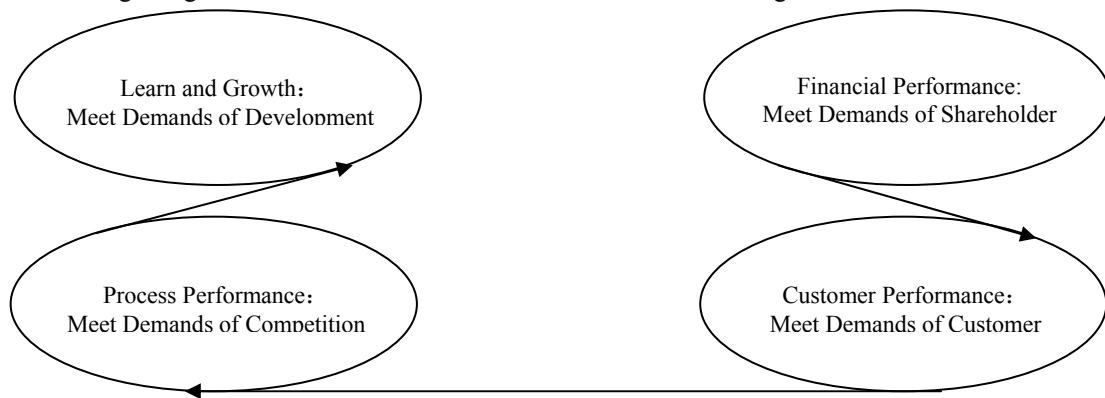


Figure 1 Mutual Action Model among Strategic Performance Factors of BSC

3 Indicators of Strategic Performance Appraisal Based on BSC and SEM

In 1992, Robert S. Kaplan and David P. Norton put forth Balanced Score-card firstly. This appraisal combined the past financial performance with the drive of the future performance, the financial indicator with the non-financial, and the traditional performance appraisal with the competitiveness, the management performance and the future development^[8]. BSC provided us with a strategic method to observe the value creation from the four different aspects, so it is not only a comprehensive performance appraisal system, but also a kind of management method. Therefore, the paper designed the organizational strategic performance indicators based on the four aspects such as the financial performance ζ_1 , the customer performance ζ_2 , the process performance ζ_3 , and the leaning and growth

performance ξ_j . Because the four indicators can't be measured directly, they need to be responded by other specific indicators that can be taken as the exogenous latent variables.

The financial performance is a performance appraisal system based on the result financial indicators. It can be evaluated from the four indicators such as the profitability a_1 , the competitive ability a_2 , the debt-paying ability a_3 , and the development capacity a_4 . The customer performance is to respond the value creation and the external change. It can be evaluated from the two indicators such as the market share b_1 and the customer satisfaction b_2 . The process performance is to respond the main process influencing the customer satisfaction and the financial objects. In the market competition, the base of the strategy is not the product but the process. The core competence lies in the business process. The realization of the financial and customer objects is supported by the key business process. The process performance can be measured by the plan control c_1 , the production utilization c_2 , and the internal management c_3 . The learning and growth performance respond the situation of the organizational sustainable development. It evaluates the organizational ability to keep the innovation, the change and the progress. It can be measured by the staff quality d_1 , the manager quality d_2 , the new product Sale d_3 , and the R&D input d_4 .

All the strategic performance appraisal indicators are shown in Table 1.

Table 1 Strategic Performance Appraisal Indicators

Latent Variable	Manifest Variable	Definition of Manifest Variable
Financial Performance ξ_1	Profitability a_1	Return on Assets
	Competitive Ability a_2	Asset Turnover
	Debt-paying Ability a_3	Assets-liabilities Ratio
	Development Capacity a_4	Sales Growth Rate
Customer Performance ξ_2	Market Share b_1	Market Share
	Customer Satisfaction b_2	Customer Satisfaction
Process Performance ξ_3	Plan Control c_1	The realization rate of the plan
	Production Utilization c_2	The utilization rate of the ability
	Internal Management c_3	The accurate rate of the decision
Learning and Growth Performance ξ_4	Staff Quality d_1	The rate of the college education
	Manager Quality d_2	The time of the professional time
	New Product Sale d_3	The rate of the new product revenue
	R&D Input d_4	The rate of the R&D input

4 Weights of Strategic Performance Appraisal Indicators Based on BSC and SEM

Now there are many methods to determine the weight of the indicator such as Delphi, AHP, Fuzzy Mathematics, and so on. However, the common defect of them is to determine the weight through the expert decision. So it is indispensable for the weights to be subjective and unfit for the accurate evaluation. To avoid the subjective error, the paper will determine the weight through the factor analysis of SEM.

According to SEM, we can get the weight with the factor load; the calculation can refer to Equations (3) and (4).

$$\xi_i = \sum_{j=1}^k \alpha_i \mu_{ij} \tag{3}$$

$$\eta_i = \sum_{i=1}^m \xi_i \theta_i \tag{4}$$

Here, $\mu_{ij} = \gamma_{ij} / \sum_{j=1}^k \gamma_{ij}$, γ_{ij} is the factor load of the different aspects on the indicators. $\theta_i = \lambda_i / \sum_{i=1}^m \lambda_i$, λ_i is the factor load of the performance on the different aspects. According to Tab1, $i=\{1,2,3,4\}$, when $i=1, j=4$; when $i=2, j=1$; when $i=3, j=3$; when $i=4, j=4$; $m=4$.

Thus we can get the structural equation with the indicators and their weights based on BSC and SEM. According to the specific data, we will have a better fit model. Moreover, we can make a comprehensive empirical evaluation to the organizational strategy with the model.

5 Empirical Analysis of Strategic Performance Appraisal Based on BSC and SEM

The sample organizations are all from the construction material industry. The financial data was obtained from their financial report and the non-financial data was collected by the structural questionnaire investigation. We have sent out 300 pieces of questionnaire and taken back 220. The effective questionnaires of them are 212, and the effective rate is 70.7%. Now we got the model with the assistance of SPSS and LISREL, which is shown in Figure 2.

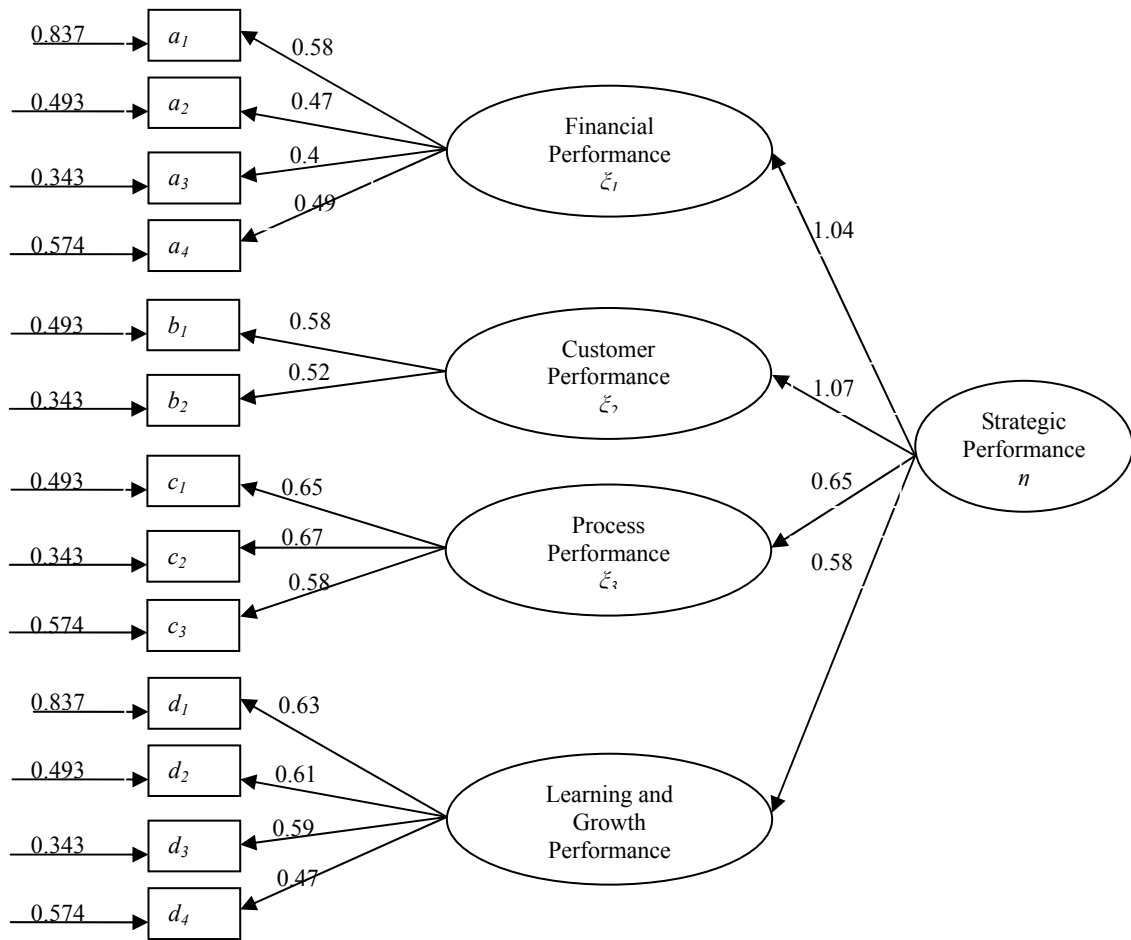


Figure 2 Organizational Strategic Performance Appraisal Model Based on BSC and SEM

The fitness indicators are shown in Table 2. RMSEA is 0.067, CFI is 0.89, and AGFI is 0.93, so the fitness of the model is good. According to Table 3, t values of the parameters are all more than 2, so the significance of the parameter is better. Based on above, the path coefficient is effective in the reference aspect.

Table 2 Simulation Index of Structural Equation Model

Indicator	CFI	RMSEA	AGFI
Value	0.89	0.067	0.93

Table 3 T Value of Parameter in Structural Equation Model

Parameter	γ_{11}	γ_{12}	γ_{13}	γ_{14}	γ_{21}	γ_{22}	γ_{31}	γ_{32}	γ_{33}	γ_{41}	γ_{42}	γ_{43}	γ_{44}	λ_1	λ_2	λ_3	λ_4
T Value	6.69	6.13	5.87	5.63	6.34	7.31	7.23	7.41	6.76	6.93	7.32	7.51	6.53	7.65	9.91	7.17	7.09

According to Figure 2, the factor loads of the performance are respectively 1.04, 1.07, 0.65 and 0.58 in the four aspects such as the financial, the customer, the process, the learning and growth. Therefore, the percentage of the financial performance and the customer are respectively 31.1% and 32.1%, which are more than other aspects. The sum of the process and the learning and growth is 36.8%. Based on Fig2, we can know that the importance of the financial performance has already reduced significantly though it is important for the strategic performance appraisal. The enterprise became to pay more attention to the non-financial performance appraisal especially for the customer performance. In the financial aspect, the path coefficients of the four indicators are 0.58, 0.47, 0.43 and 0.49 respectively, which indicated that the profitability is most important and the debt-paying ability is least important. In the customer aspect, the market share is more important than the customer satisfaction. In the process

aspect, the importance of the three indicators is similar. In the learning and growth aspect, the staff quality and the manager quality are more important, so the human resource is the first productivity.

6 Conclusions

Based on above, we can get the conclusions. Firstly, the scientific performance appraisal needs to resolve two core problems to establish the reasonable indicators and determine the weights scientifically. Secondly, the strategic performance appraisal system based on BSC and SEM can effectively resolve the combination problem of the indicator and the weight. Thirdly, the importance of the financial performance has already reduced significantly though it is important for the strategic performance appraisal, the non-financial performance appraisal especially for the customer performance become more important. Fourthly, in the financial aspect, the profitability is most important; in the customer aspect, the market share is more important than the customer satisfaction; in the process aspect, the importance of the three indicators is similar; in the learning and growth aspect, the staff quality and the manager quality are more important.

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