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Full Length Research Paper

A structural equation modeling (SEM) evaluation of the statistical adequacy of the strategic management model

Kee-Luen Wong[1], Thiam-Yong Kuek[1]* and Seng-Fook Ong[2]

[1]Faculty of Business and Finance, Jalan Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia.
[2]Faculty of Accountancy and Management, Lot PT 21144, Jalan Sungai Long, Bandar Sungai Long, Cheras 43000 Kajang , Selangor, Malaysia.

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This paper attempts to confirm the adequacy of the strategic management model using the structural equation modeling (SEM) method. The model adopted the resource-based view (RBV) approach to identify competitive strength. The RBV method states that organizations with the right resources coupled with the appropriate management skills and capabilities will develop competitive strength and organizational performance. Results generated by AMOS graphics v. 18, an SEM statistical software, confirm the adequacy of the model for companies engaged in the industrial products sector. Financial strength was found to be a better predictor of competitive advantage than management strength. The results also confirm that competitive advantage has a positive impact on the profitability and performance of organizations.

Key words: Strategic management, competitive advantage, resource-based view (RBV), structural equation modeling (SEM).

INTRODUCTION

Porter (1985) introduced the concept of value chain of organizations and argues that understanding value chain analyses (VCA) of organizations and strengthening the activities of the chain could bring about sustainable competitive advantage and improve companies' performance. David (2011) refers value chain analysis (VCA) to "the process whereby a firm determines the costs associated with organizational activities from purchasing raw materials to manufacturing products to marketing those products." However, he cautions that substantial subjective judgment may be required in performing VCA as there may be complex interrelationships between the activities of the value chain. These complexities make costing the value chain activities very difficult and challenging.

Pearce II and Robinson (2011) proposed another method to explore and identify competitive strength by evaluating the capabilities and assets, and the related performances of organizations. This method is called the resource-based view (RBV) of the firm. They explain that the underlying assumption of RBV is that "firms differ in fundamental ways because each firm possesses a unique 'bundle' of resources – tangible and intangible assets and organizational capabilities to make use of those assets. Each firm develops competencies from these resources, and when developed especially well, these become the source of the firm's competitive advantages" (Pearce II and Robinson, 2011). It follows that competitive strength of organizations could be brought about by identifying of their resources and with the skills and capabilities of the management, develop these resources into a distinctive competence. Organizations with distinctive competencies are likely to have sustainable competitive strengths and outstanding performance in the market-place.

This paper attempts to confirm the validity of the RBV method; that organizations with the right resources coupled with the appropriate management skills and capabilities have competitive strengths and good

*Corresponding author. E-mail: kuekty@utar.edu.my. Tel: (+605) 4688888. Fax: (+605) 4661313.

organizational performance.

RESEARCH FRAMEWORK

David (2011) purports the "the resource-based view (RBV) approach to competitive advantage contends that internal resources are more important for a firm than external factors in achieving and sustaining competitive advantage." Proponents of the RBV view contend that organizational performance will primarily be determined by internal resources (Grant, 1991).

According to the RBV method, there are three basic types of resources, and some of these may become the building blocks for distinctive competences: tangible assets, intangible assets, and organizational capabilities (Pearce II and Robinson, 2011). These resources are defined further.

Tangible assets are the easiest resources to identify and are often found on a firm's balance sheet. They include production facilities, raw materials, financial resources, real estate, and computers. Intangible assets are resources such as brand names, company reputation, organizational morale, technical knowledge, patents and trademarks, and accumulated experience within an organization. Organizational capabilities are not specific inputs like tangible or intangible assets; rather, they are skills – the ability and ways of combining assets, people, and processes – that a company uses to transform inputs into outputs (Pearce II and Robinson, 2011).

David (2011) contends that internal resources can be grouped into three categories: physical resources, human resources, and organizational resources. David (2011) further explains them thus: physical resources include all plant and equipment, location, technology, raw materials, machines. Human resources include all employees, training, experience, intelligence, knowledge, skills and abilities. Organizational resources include firm structure, planning processes, information systems, patents, trademarks, copyrights, and databases.

Dess et al. (2010) cautions that, "a firm's strength and capabilities – no matter how unique or impressive – do not necessarily lead to competitive advantages in the marketplace." In addition, they contend that "the ability of a firm's resources to confer competitive advantage cannot be determined without taking into consideration the broader competitive context. A firm's resources must be evaluated in terms of how valuable, rare, and hard they are for competitors to duplicate".

Nevertheless, most authors agree that the RBV method is a useful and integrated tool for internal analysis and help to pin-point those resources that can generate core competencies (David, 2011; Dess et al., 2010; Pearce II and Robinson, 2011). David (2011) continues to comment that "the RBV has continued to grow in popularity and continues to seek a better understanding of the relationship between resources and sustained competitive advantage in strategic management."

David (2011) suggests that internal resources are more important than external resources to sustainable competitive strength and organizational performance. Thomson et al. (2010) argues that financial strength is the most important internal resource that leads to sustainable profitability and outstanding performance of the firm. One of the most important indicators that the company's strategy is working or the company is performing well is the company's overall financial strength and credit ratings are improving (Thompson et al., 2010). The other important resource strength is the competencies or skills that the management employs to transform tangible and intangible resources over time to achieve the desired performance of the organizations (Pearce II and Robinson, 2011).

Thompson et al. (2010) suggested a four-step procedure to perform a competitive strength assessment of an organization. Step 1 is to make a list of the industry's key success factors (KSFs). Step 2 is to rate the firm on each factor. Step 3 involves summing up the strength ratings on each factor to get an overall measure of competitive strength. Step 4 is to use the overall strength ratings to draw conclusions about the size and extent of the company's net competitive advantage. Based on the rationale of the above-mentioned procedure and literature presented earlier, it is logical argument that financial strength coupled with the appropriate management strength of the firm can bring about the overall measure of competitive strength of the firm. This measure of competitive strength is a measure of competitive advantage that further helps to achieve the financial and strategic objectives of the firm. The reasoning can be translated into a graphical model as shown in Figure 1.

We have discussed, argued, and presented the theoretical model of our study. The primary purpose of our study is to confirm the validity of the theoretical model. We will now describe and discuss the research methodology adopted to achieve the objective of the study.

RESEARCH METHODOLOGY

To test the theoretical model, data are needed. As information for financial strength and management strength is required, we sourced for secondary data and reports on the performance of public-listed companies. A guidebook, Stock Performance Guide, March 2010 Edition, published by Dynaquest Sdn. Bhd. Provided the required information and data. The guidebook provides information on over 1,000 public-listed companies covering all business industry and sectors including consumer products, industrial products, construction, trading/services, technology, hotels, properties, plantations, etc. Many strategic management authors contend that the nature of the resources and the relative importance of those resources vary by industry. Due to this reason, we only used data from companies involved in industrial products for our study. There are 104 such companies listed in the Stock Performance Guide.

According to the Stock Performance Guide (2010), four pieces of information were provided on the financial strength of the companies – Net Tangible asset backing per share (NTA), liquid asset per share (LIQ), debt to equity ratio (DERatio), and the Altman's Z-score. The Altman's Z-score is a popular "all-in-one"

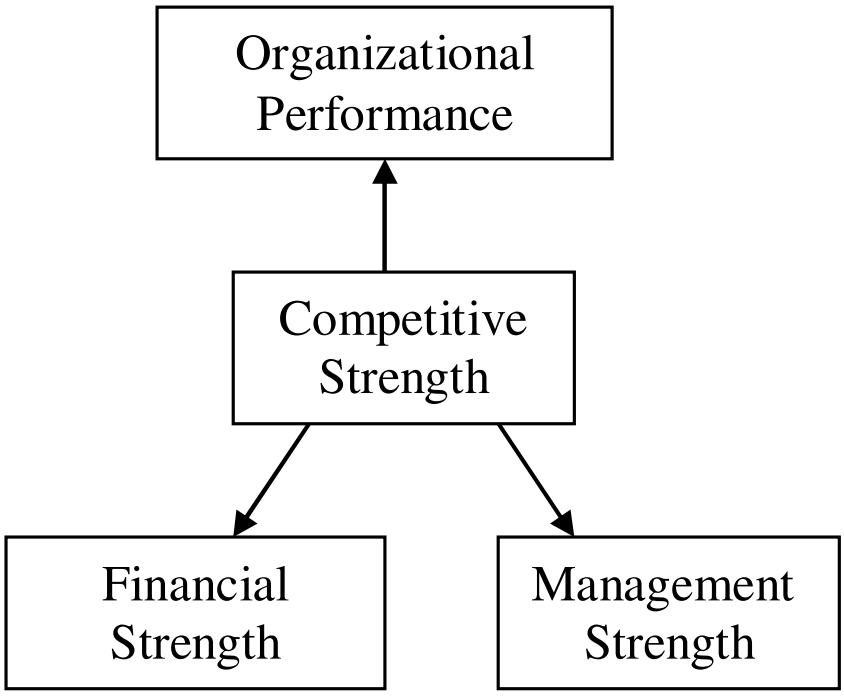

Figure 1. The theoretical model.

measure of financial strength of a company. The higher the value of the Z-score, the stronger is the company financially. Another four pieces of data on management strength of the companies are also provided – asset turnover (Asset T/O), gross margin, free cashflow to capital, and return on shareholders equity (ROE). We inspected the data provided and found that there is too many missing information on free cashflow to capital. We decided not to use the data and substitute the factor with sales margin, calculated by dividing Sales with earnings before tax, depreciation, and amortization (EBITDA).

The data were keyed-in into a statistical software, statistical packages for social sciences (SPSS) version 17. We intended to use structural equation modeling (SEM) technique to test the validity of the theoretical model. The SEM software used was AMOS Graphics version 18. Byrne (2010) defines SEM: as a statistical methodology that takes a confirmatory approach to the analysis of a structural theory bearing on some phenomenon. The term structural equation modeling conveys two important aspects of the procedure: (a) that the causal processes understudy are represented by a series of structural (that is regression) equations, and (b) that these structural relations can be modeled pictorially to enable a clearer conceptualization of the theory under study. The hypothesized model can then be tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is consistent with the data. If goodness-of-fit is adequate, the model argues for the plausibility of postulated relations among variables; if it is inadequate, the tenability of such relations is rejected.

Within the context of SEM methodology, the measured scores or observed variables serve as indicators of the underlying construct or latent variable. As SEM takes the confirmatory approach, the researcher should have some knowledge of the underlying latent variable structure. Based on knowledge of the theory, empirical research, or both, he/she postulates relations, between the observed measures and the underlying factors a priori and then tests this hypothesized structure statistically.

Jockog (1993) distinguished among three scenarios which he termed strictly confirmatory (SC), alternative models (AM), and model generating (MG). Byrne (2010) contends that the MG situation is the most common of the three scenarios. With the MG scenario, the researcher, having postulated and rejected a theoretically derived model on the basis of its poor fit to the sample data, proceeds in an exploratory manner to modify and re-estimate the model. The primary focus is to locate the source of misfit in the model and to determine a model that better describes the sample data. Our study used both the first-order and the second-order confirmatory factor analysis (CFA) models. We constructed the measurement models (MMs) and the structural model (SM) to develop the general SEM model. The first-order MMs were for financial strength with four observed variables: NTA, LIQ, DERatio, and the Altman's Z-score, and for management strength with three observed variables: Asset T/O, gross margin, and sales margin. The second-order MM was for competitive strength. The SM was between competitive strength, a latent variable and earnings per share (EPS), an observed variable, determining profitability and performance of the company. Following the model generating (MG) procedure, through exploratory manner to modify and re-estimate the models, we managed to determine a model that best describes the sample data. The SEM model created by AMOS Graphics version 18 is presented in Figure 2, complete with path coefficients, estimates and squared multiple correlations (SMCs).

RESULTS

We will discuss the results according to Goodness-of-fit test (normed chi-squared), Parsimony-adjusted index (RMSEA), Confirmatory fit Index (CFI) Parameter estimates, and Proportion of variance explained (SMC=R^2), respectively.

The goodness-of-fit test (normed chi-squared) is the χ^2 statistics divided by the degree of freedom. The normed

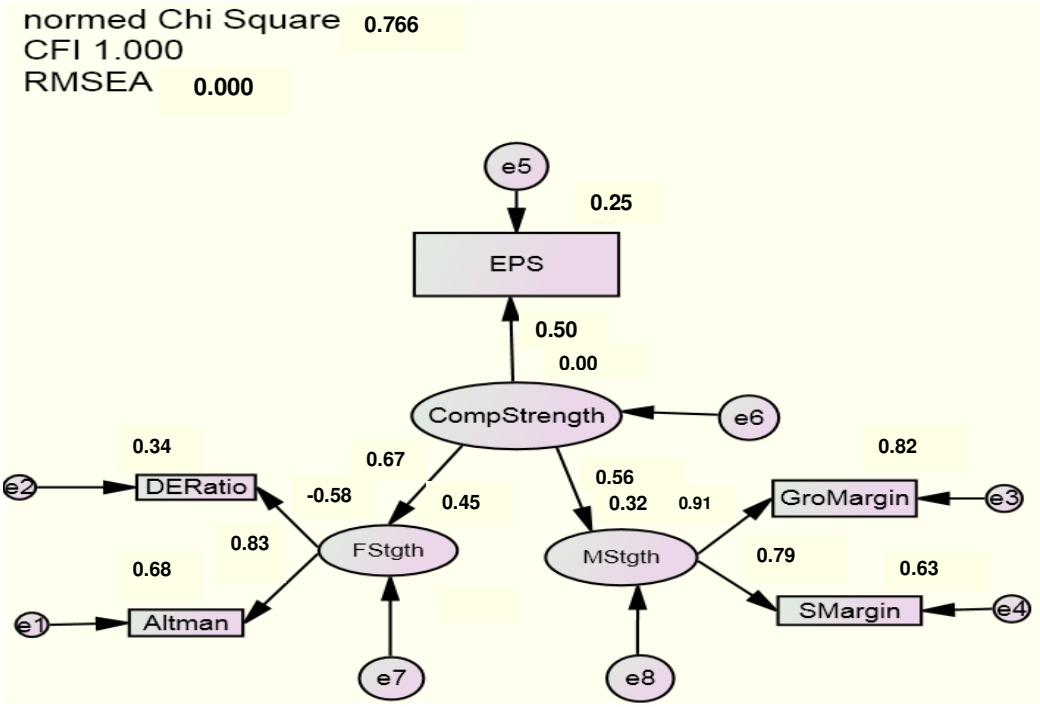

Figure 2. The strategic management theoretical model (created by AMOS Graphics v. 18)

chi-squared result for our model is 0.766. As the result is less than 5.00, the model fits the data. The p-value is 0.513 which is more than 0.05, and indicates non-significance and a fail to reject decision. A "reject of null hypothesis" decision indicates that the hypothesized model lack fit, and that the model is somewhat inconsistent with the data. In our case, the results indicate that the model fits the data.

The parsimony-adjusted index (RMSEA) includes correction for model complexity, approximates the discrepancy that could be expected in the population, and estimates the lack of fit of the hypothesized model to the population covariance matrix. While a RMSEA value of zero indicates the best-fit approximation of the population covariance matrix, a value of less than 0.08 indicates good fit. Our model shows a RMSEA value of 0.00 indicating again the hypothesized model fits the data.

The comparative fit index (CFI) indicates the improvement in fit of the hypothesized model over the base-line model. The cut-score for CFI is greater than or equal to 0.90. A value of less than 0.90 shows inadequacy of the model. In our model, the CFI score is 1.00 indicating a good fit between our model and the sample data.

In order to evaluate the reasonableness of the parameter estimates or path coefficients, we reviewed whether the estimates are statistically significant, whether the factors are practically important to the latent variables, and whether the direction (+ or -) is logical. In order for the estimates to be significant, the critical ratio (CR) results should be more than 1.96. In order for the indicators or factors to be practically important, the value of the estimates should be more than or equal to 0.20. Whether the direction of the estimates is logical or not depends on the hypothesized theory of the model. In our case, the CR for the estimates ranges from 2.185 to 3.719, all above 1.96 indicating significance. There is also no offending estimates as all estimates are more than 0.20: DERatio (-0.58), Altman's Z-score (0.83), gross margin (0.91), sales margin (0.79) in the first-order CFA, and financial strength (0.67), and management strength (0.56). Therefore, all indicators or factors are practically important to the latent variables. Except for DERatio which has a negative estimate (-0.58), the rest of the estimates have positive values and logical direction. As far as DERatio is concerned, the negative direction is logical in theory as an increase in the DERatio estimate indicates decreasing financial strength.

Finally, for the proportion of variance explained (represented by SMC = R^2), the results should be more than 0.30 for good factors. In our model, the SMC results are DERatio (0.34), Altman's Z-score (0.68), gross margin (0.82), and sales margin (0.63). All the SMC values are more than 0.30 indicating that all the indicators or factors of the latent variables are good factors.

DISCUSSION

The results of the three indices, namely the normed chi-square, RMSEA, and CFI, indicate the hypothesized model fit the sample data and prove the adequacy of the model. They show that the theoretical under-pinning of

the model shown in Figure 2 is sound. The two valid indicators or factors of the first-order latent variable, financial strength are DERatio and Altman's Z-score. The other two factors, namely NTA and LIQ are excluded from the model. For the other first-order latent variable, management strength, the two valid factors are gross margin and sales margin. The other factor, namely asset T/O is excluded from the model. As for the second-order latent variable, competitive strength, the two valid factors are financial strength and management strength. This theory found support in most strategic management literature such as David (2011), Pearce II and Robinson (2010), Thompson et al. (2010), etc.

Many strategic management authors agree that the RBV method helps to pin-point the resources that can generate core competencies (David, 2011; Dess et al., 2010; Pearce II and Robinson, 2011). In our model, the factors or resources that can generate financial strength are DERatio and Altman's Z-score, and the resources that can be used to generate management strength are gross margin and sales margin. In the second-order CFA, financial strength and management strength can be used to generate competitive strength and sustainable competitive advantage. Thus, to generate financial strength, the firm should focus on building good scores in DERatio and Altman's Z-score. Similarly, to determine management strength, the firm should look specifically for high gross margin and sales margin scores.

Byrne (2010) states that the SEM approach can simultaneously analyzed the entire system of variables. Thus, AMOS graphics simultaneously analyzed the two first-order measurement models (MMs) related to financial strength and management strength and another second-order measurement model related to competitive strength. The resultant path coefficients are actually regression weights or Beta coefficients. Looking at the financial strength MM, the Beta coefficients for DERatio and Altman's Z-score are -0.58 and 0.83 respectively. SMC for DERatio and Altman's Z-score are 0.34 and 0.68 respectively. DERatio can explain 34% of financial strength and Altman's Z-score can explain 68%, and Altman's Z-score is more important to financial strength than DERatio. This means Altman's Z-score is a better predictor of financial strength than DERatio. Turning to the management strength MM, the Beta coefficients for gross margin and sales margin are 0.91 and 0.79 respectively. SMC for gross margin and sales margin are 0.82 and 0.63 respectively. This means gross margin can explain 82% of management strength and sales margin can explain 63% of management strength. Gross margin is more important to management strength than sales margin. Therefore, gross margin is a better predictor of management strength than sales margin. We now turn to the second-order MM related to competitive strength. The Beta coefficients for financial strength and management strength are 0.67 and 0.56 respectively. SMC for financial strength is 0.45 and for management strength is 0.32. This means financial strength can explain 45% of the variances of competitive strength and management strength can explain 32% of competitive strength. Financial strength is more important to competitive strength than management strength. Therefore, financial strength is a better predictor of competitive strength than management strength. This finding found support in Thompson and Strickland (2010) who argue that financial strength is the most important resource that leads to profitability and outstanding performance of the firm.

Based on the results generated by AMOS graphics, competitive strength has positive influence on earnings per share (EPS), a measure of profitability and performance of the organizations. R is 0.50 and R^2 is 0.25. As competitive strength is the only variable, R is also the Pearson's correlation coefficient (r). Competitive strength has a moderate positive impact on the profitability and performance of the organizations. This finding forms the basis of strategic management theories; that in order for companies to have sustainable profitability, they must have competitive advantage in the marketplace. Synthesizing this finding with another finding, that is financial strength is a better predictor of competitive advantage, we suggest that companies with outstanding performance and profitability normally has good financial strength.

Conclusion

This study attempts to evaluate the adequacy of the strategic management model using the structural equation modeling (SEM) approach. Based on the results generated by AMOS Graphics v. 18, the strategic management model shown in Figure 2 is adequate and the model fits the sample data.

As we have only used data from companies involved in the industrial products sector, we intend to further evaluate the model with data from companies engaged in consumer products as well as those from the trading and services sectors. We will take the metric invariant approach to determine the strategic management model is business sector-invariant. In other words, we intend to determine whether business sectors have a moderating effect on the model.

In the interim, based on the results obtained, we conclude that the strategic management model is statistically adequate for companies engaged in the industrial products sector. We also confirm that financial strength is a better predictor of competitive strength than management strength, and that competitive advantage is a good platform to build sustainable profits and outstanding performance of organizations.

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