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When the Sand Cone Model Meets SMEs

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Abstract

The Sand Cone Model in operations strategy claims that firms following the unique sequence of the Sand Cone Model outperform those with other sequences. However, the previous empirical focus was on large firms. With the flexibility and financial constraints that Small Medium Enterprises (SMEs) have, this paper attempts to explore the possibility that SMEs and large firms are suitable for different types of strategies and SMEs are able to construct different strategic priorities without following the sequence suggested by the Sand Cone Model. We hope, through this paper, more research effort will be put in examining SMEs as they play an important role in the global economy.

Keywords: Small Medium Enterprises, SMEs, Manufacturing Strategy, Operations Strategy, Sand Cone Model, Flexibility, Competitive Priorities

INTRODUCTION

Operations strategy has been evolving and has been integrated with corporate strategies since Skinner (1969) first brought attention to operations strategy. Ferdows and De Meyer (1990) observed the phenomenon that conventional thoughts on the trade-offs among competitive capabilities (Hayes & Wheelwright, 1984; Hill, 1985; Schmenner, 1987) could be overcome through following a particular sequence of strategic priorities, called the Sand Cone Model. They used data from the European Manufacturing Futures Survey to test their model. However, the survey subjects were all large European manufacturers. It is questionable whether or not small firms can accumulate all four competitive capabilities, and moreover, if they are able to have these capabilities, will the Sand Cone Model sequence apply to them? Do small firms have to follow the sequence suggested in the Sand Cone Model? The goal of this paper is to examine these questions by developing several propositions.

SMEs have played critical roles in the global economy (Barad & Gien, 2001; Chen, 1999; Fiegenbaum & Karnani, 1991; Sherman, 1999; Sum, Kow, & Chen, 2004). The U.S. Commerce Department defines an SME as a company with less than 500 employees (Clark, 2005). Almost half of the U.S. workforce is employed by SMEs and two-thirds of all employees in Europe work in SMEs. 97% of U.S. exporters are SMEs, and SMEs are responsible for more than one-fourth of U.S. exports. The number of SME exporters grew twice as fast as large exporters from 1992 to 2002 (Clark, 2005).

Despite the importance of SMEs to the global economy, however, academia has not paid much attention to SMEs. Dangayach and Deshmukh (2001) suggest more research should be done on the “relevance of manufacturing strategy to SMEs”. In the

260 articles they reviewed, less than 1% (2 articles) focused on the manufacturing strategies of SMEs. Therefore, this paper intends to contribute to the discussion on manufacturing strategies for SMEs.

The Sand Cone Model suggests firms can develop all four sustainable competitive advantages through following a particular sequence of strategic priorities, while the conventional trade-off theory suggests firms will be better off if they focus on one priority or a few priorities instead of all. The suggested sequence is: quality, dependability/flexibility[1], speed, and cost efficiency. If firms follow this sequence of focus, they will build up their advantages concerning all the elements. There is no trade-off needed. On the contrary, if firms do not follow this sequence, it will be costly or difficult to enjoy all four competitive advantages at the same time (Ferdows and De Meyer, 1990).

Ferdows and De Meyer (1990) developed this model observing the performance of large Japanese manufacturers and then tested the model using data from large European firms. SMEs are considered weaker in the marketplace because of lack of managerial expertise, small bargaining power with suppliers and customers, few financial resources, but they are usually more flexible than large firms and their decision-making process is typically efficient and effective (Ebben & Johnson, 2005; Fiegenbaum et al., 1991; Jarillo, 1989; Sherman, 1999). Some researches have generally concluded that strategies not only function differently in small firms than in large ones but also have different impacts (Fiegenbaum et al., 1991; Jarillo, 1989). This leads us to ask the following research questions: Without following the suggested sequence by the Sand

[1] In Ferdows and De Meyer's (1990) paper, flexibility and dependability are used interchangeably. Later on, most scholars used flexibility.

Cone Model, can SMEs accumulate all four manufacturing capabilities to gain competitive advantage? Are there any performance differences between the SMEs using the Sand Cone Model sequence and those using other sequences?

Previous studies seldom focused on manufacturing capabilities of SMEs when arguing which manufacturing strategy paradigm is the most appropriate, trade-offs or synergy. This paper will contribute to the field by first extending the Sand Cone Model to SMEs. Second, we will focus on manufacturing strategy for SMEs specifically. We aim to explore the unique characteristics that SMEs have to differentiate themselves from large firms and stay competitive. Third, through this paper, we hope to propose strategies more customized for SMEs.

THEORETICAL BACKGROUND

Manufacturing Strategy

Skinner (1969) is considered the first one to define manufacturing strategy and called for attention to manufacturing in developing corporate strategy. After that, many scholars presented different views on manufacturing strategy. Voss (1995) stated that there are three main streams in the manufacturing strategy literature: "competing through manufacturing," "strategic choices in manufacturing strategy," and "best practice." In addition to those three, Gagnon (1999) added one more, a resource-based view of manufacturing. Flynn, Schroeder and Flynn (1999) used competitive priorities as their criteria to categorize manufacturing strategies into two main streams, the "trade-offs" and "synergy" streams. We will adopt this categorization in this paper.

It is well-known that Porter (1980) suggested trade-offs in his low cost and differentiation strategies. Interestingly, the traditional trade-off manufacturing strategy originated from Skinner (1969). He suggested the need for focused factories where management should prioritize certain manufacturing advantages based on corporate strategies and expect "compromises or trade-offs to be made." Hayes and Wheelwright (1984) presented four main process choices and suggested managers focus on one of them in order to create competitive advantages for firms. Hill (1985) also emphasized "focused factories" while promoting order-winner and order-qualifier ideas. After identifying a firm's order winners and qualifiers, the firm should attempt to synchronize process and infrastructures with strategic priorities (Hill, 1985). All these are related to the concept of "trade-offs," where firms have to "focus" or "prioritize" their pursuit of capabilities in order to create competitive advantages, and if they try to have more than one priority, they will lose focus and then lose their edge.

As global competition gets fierce, firms with the trade-offs strategy cannot hold sustainable competitive advantages for long. Therefore, firms have to create new competitive advantages (Gagnon, 1999). This is where "best practice" strategy comes in. A highly competitive firm might accumulate all strategic advantages instead of trading off priorities such as cost, quality, or delivery speed, as suggested by trade-offs theory (Schonberger, 1986). "Best practice" strategy is also known as synergy strategy because in a globalized economy, firms have to build more than one competitive priority and if firms focus on one priority, it would eventually have to build more than one priority to be competitive enough to survive, especially in mature industries (Hill, 1988). Discussion on "best practice" strategy includes world class manufacturing, JIT (Just in Time), TQM

(Total Quality Management), concepts from MRP (Materials Requirements Planning), OPT (Optimized Production Technology), FMS (Flexible Manufacturing Systems), and lean production. It is considered the most recent stream in manufacturing strategy (Voss, 1995). As long as firms perform "the best" they can outperform their competitors.

It is still under debate whether synergy or trade-offs strategies lead firms to better performance. Is it possible to develop multiple capabilities? Are firms competitive enough if they have one focused capability? The capabilities defined here refer to the "realized" capabilities. It could be intended or unintended based on Resource-based View (RBV). Previous studies used large firms to empirically support their arguments. If it is questionable for large firms to develop multiple capabilities, how would this argument apply to small firms? The disadvantages small firms usually face are little bargaining power over suppliers and customers, fewer financial resources and less managerial expertise (Ebben et al., 2005; Fiegenbaum et al., 1991; Jarillo, 1989; Sherman, 1999). With these disadvantages, can small firms build multiple capabilities? In our opinion, these disadvantages shape SMEs to be more agile in responding to environmental changes effectively. In order to survive in the competitive environment where large firms have more resources, SMEs are able to develop unique characteristics that help them to survive and accordingly to build multiple capabilities.

Proposition 1: SMEs are capable of accumulating all four manufacturing capabilities (cost, dependability, speed, and quality).

The Sand Cone Model is the bridge between traditional trade-offs strategy and the synergy strategy. The Sand Cone Model does not completely eliminate the possibility of trade-offs, while it claims that firms will be able to develop and retain the four main

competitive advantages if they follow the rigid sequence of priorities: quality, dependability, speed, and cost. This does not mean that other sequences are not possible, but it will be costly to build up all advantages through other sequences, or it will be more difficult to hold the four advantages stably for long duration (Ferdows and De Meyer, 1990). Ferdows and De Meyer (1990) gathered data from 167 large manufacturers in Europe and the data supported their arguments for the Sand Cone Model. However, they did not obtain data from small and medium manufacturers, and therefore, the results cannot be extended to include SMEs. Rosenzweig and Roth (2004) supported the arguments proposed by the Sand Cone Model in their empirical study of high-tech manufacturing firms. In their sample, they included small firms but their focus was not on small firms but on the competitive progression theory and therefore, the Sand Cone Model effect for large firms and small firms was not distinguished.

SME Manufacturing Strategy

As mentioned above, SMEs have gradually become a vital part of the global economy (Barad et al., 2001; Chen, 1999; Fiegenbaum et al., 1991; Sherman, 1999; Sum et al., 2004). Little research is available discussing SME manufacturing strategy. Fiegenbaum and Karnani (1991) found that SMEs have different competitive advantages than large firms based on the data from more than 3000 companies that operated during 1979-1987. They conclude that firm size is negatively correlated with output flexibility and in certain industries output flexibility is a more useful strategy.

Ebben and Johnson (2005) specifically studied efficiency and flexibility in small firms, and using data from 200 firms, they found that small firms with focus on efficiency or flexibility outperform those that mix these two manufacturing priorities. Both

efficiency-focused and flexibility-focused firms perform better than non-focused ones. However, there was not enough evidence to show which strategy was the best for small firms as there was no significant difference in firm performance between the efficiency-focused and flexibility-focus strategies (Ebben and Johnson., 2005).

Chen (1999) investigated 33 published case reports on SME operations in Taiwan and generated relationships between competitive priorities and strategic decisions. Sum et al. (2004), on the other hand, looked into Singapore's high performing SMEs to develop a taxonomy of operations strategies. They formed three strategic clusters: *all-rounders*, *differentiators*, and *efficient innovators*. *All-rounders* do not contain any operational advantage and rely on marketing more than operations for competitive advantages. *Differentiators* put quality as their strategic priority but suffer in high cost. *Efficient innovators* focus on innovations and cost efficiency and perform best financially among the three clusters (Sum et al., 2004). Kathuria (2000) conducted a similar study with 196 SMEs in the U.S. His study labels four clusters: *starters*, *efficient conformers*, *speedy conformers* and *do all*. *Efficient conformers* with strategic focus on quality and cost perform the best among all. He also points out that *do all* cluster puts a relatively high emphasis on all four priorities compared to other clusters. The author suggests these firms might have progressed through the Sand Cone Model sequence and that is why this cluster can emphasize and enhance all four priorities simultaneously. However, when he measured the capabilities of SMEs, he actually applied the concept of "intended strategies". He asked firms to rate how important they perceived each capability. Therefore, the direct relationship between the Sand Cone Model sequence and the ability to develop all four capabilities was not explicitly considered.

SME Flexibility

Most manufacturing strategy scholars mention flexibility in their studies. In manufacturing strategy literature, flexibility refers to output flexibility. It is defined as the ability of a firm to introduce new designs or products into production quickly, to adjust capacity rapidly, to handle variations in customer orders, or to handle changes in customer delivery schedules. This output flexibility is one of the flexibilities firms could have, especially SMEs. Nevertheless, we are focusing on a broader definition of flexibility here. The flexibility SMEs have is defined as the ability to broadly respond to environmental uncertainty.

Flexibility is considered the most valuable advantage SMEs have (Chen, 1999; Clark, 2005; Ebben et al., 2005; Pagell & Krause, 1999; Rasmusen & Zenger, 1987; Sum et al., 2004). In small firms, decision-making is more responsive to environmental changes compared to large firms (Fiegenbaum et al., 1991). Some researchers also point out that in small firms, there are fewer agency problems than in large ones (Fiegenbaum et al., 1991; Rasmusen et al., 1987). Based on this argument, we think SMEs will be able to accumulate manufacturing capabilities through different sequences other than the one suggested by the Sand Cone Model.

Proposition 2: SMEs accumulating all four manufacturing capabilities need not follow the Sand Cone Model sequence to have all four manufacturing capabilities.

Based on research done by Fiegenbaum and Karnani (1991), SMEs have different competitive advantages than large firms and usually the flexibility strategy is more suitable to SMEs than to large firms. In addition, when Ferdows & De Meyer (1990)

tested their Sand Cone Model, they only gathered data from large firms. No previous study has applied the Sand Cone Model to SME operations. With insufficient capital, SMEs typically focus on cost saving initially. As firms grow, strategies change to respond to market demand. However, the cost efficiency capability is already built. Even when SMEs try to focus on quality initially, cost efficiency is always part of their concern.

Proposition 3: Cost efficiency is the first capability SMEs would build.

Based on the Sand Cone Model, firms following the special sequence will perform better than those not following the sequence because it is less efficient and therefore cost more for those that do not follow the sequence to accumulate all four capabilities (Ferdows and De Meyer, 1990). Perhaps, large firms are rigid and not flexible enough to cope with the consequences of altering the sequence indicated in the Sand Cone Model. With the flexibility SMEs have, we want to test whether SMEs are flexible enough to ignore the Sand Cone Model to accumulate all four strategic advantages and still perform well.

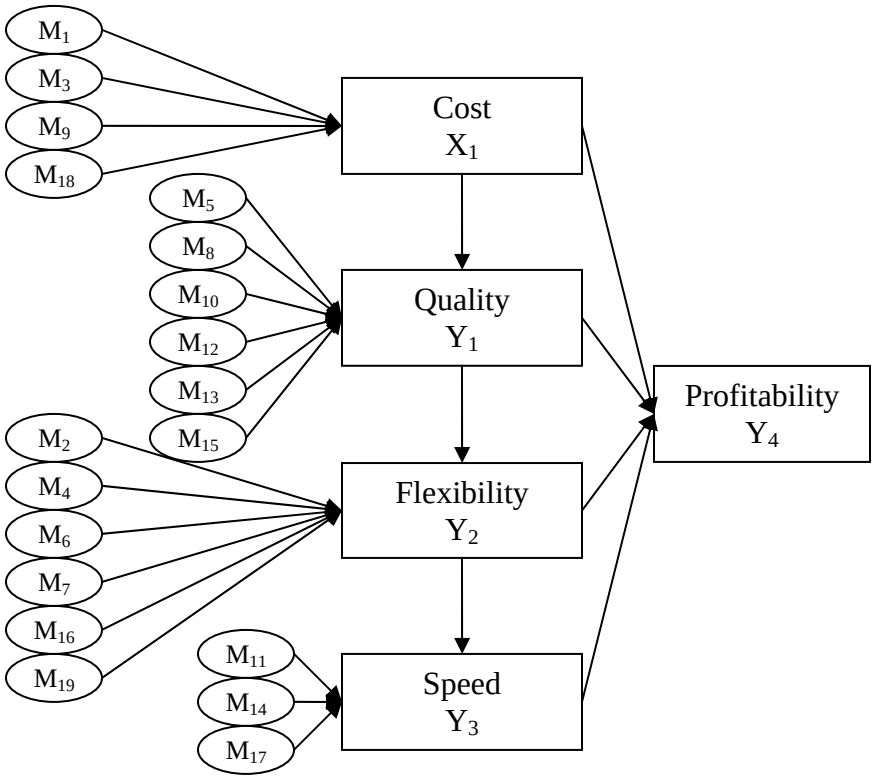
Proposition 4: The performance of SMEs with the Sand Cone Model sequence will be similar to those without the Sand Cone Model sequence

METHODOLOGY

Rosenzweig and Roth (2004) conducted an empirical study to test the Sand Cone Model effect. They used 81 high-tech firms as their sample and Structural Equation modeling (SEM) was adopted to test their hypotheses. We plan to partially replicate their model. Their model included the four manufacturing capabilities, profitability, and two

mediator variables (non-value-added and operational know-how). Our proposed model will not have the mediator variables and only contain the four manufacturing capabilities and profitability (Figure 1). Cost efficiency is the first capability SMEs pursue. There is no significant difference in the sequence of the other three capabilities and therefore, in our model, we arrange them based on the Sand Cone Model sequence after we move the cost efficiency to the first. SEM will be used to test the path model.

Figure 1: Theoretical Model



- Data and Procedure

To test the hypotheses, we plan to use a convenience sample and mail out our survey to operations managers of 1000 SMEs from the list provided by the Chambers of Commerce in Midwestern states. An SME is defined as a company with less than 500

employees according to the Department of Commerce. The questionnaire will be based on Kathuria (2000) and Rosenzweig and Roth (2004) and appropriately modified. After gathering data, we intend to use SEM to compare the base model and the modified models using the goodness of fit criteria and test our argument that the path suggested by the base model is the best compared to others.

- Measurement

Manufacturing Capabilities

The measurement of manufacturing capabilities is a modified version of Kathuria's (2000) questionnaire. The original design had 17 items and we added 2 more items (M18, and M19 in Appendix A) to better represent our definition of strategic priorities as presented in Appendix A. In addition, we revise the wording from "perceived importance" to "capability" to capture the idea that perceived importance does not necessarily lead to capability. Rosenzweig and Roth's (2004) measurement asked respondents to compare the four capabilities with the firm's primary competitors. However, they only asked one question for each capability. We think Kathuria's (2000) instrument is more suitable for SMEs since many of them are not familiar with academic strategy terms. Therefore, we combine these two instruments by including 19 questions and asking respondents to rate the relative capabilities of their firms in comparison on their main competitors.

Profitability

Measuring firm performance has been one of the biggest challenges in strategy study. Conventionally, there are two measurements used: profitability and productivity

(Devaraj & Kohli, 2003). Most researchers evaluate firm performance through different ratios regarding profitability, such as return on assets (ROA), return on sales (ROS), operating income to asset (OI/A), operation income to sales (OI/S) etc. (Bharadwaj, 2000; Santhanam & Hartono, 2003; Wade & Hulland, 2004).

However, SMEs are not as transparent in profit disclosure as the large firms. Researchers of SMEs, therefore, adopted another method in evaluating firm performance, perceived performance (Chen, Chong, & Chen, 2000; Cragg, 2006; Ebben et al., 2005; Kathuria, 2000). Perceived performance information can be gathered through surveys. CEOs or senior managers are asked to rate performance improvement after certain strategy is implemented or to rate perceived performance compared to industry average or main competitors (Chen et al., 2000; Cragg, 2006; Ebben et al., 2005; Kathuria, 2000). Ketokivi and Schroeder (2004) conducted a comparison study of perceived performance and financial performance and concluded that as long as common method variance (single respondent bias) can be avoided, perceived performance measurement is as representative as the financial figures. Based on the above reasons, we decided to use a perceived measurement of performance. In addition, Rosenzweig and Roth's (2004) measurement of financial performance will be used.

Discussion and Conclusion

As information technology (IT) has evolved, the managements of SMEs are able to get information more easily than before on how large firms could run their business better. However, strategies suitable for large firms do not necessarily fit SME environments. Because of the importance of SMEs to the global economy and the

growing interest in entrepreneurship, this study attempts to provide direction for both academicians and practitioners of SMEs whether they should follow the mainstream strategies. Prevalent strategies do not necessarily help SMEs achieve better performance. We hope this paper will draw more attention to issues pertaining to operations strategies in SMEs and more research will provide SMEs "customized" strategies.

This paper serves both practitioners and academics. Managerially, we provide relevant discussion for SME practitioners to build their strategies. Academically, the generalizability of the Sand Cone Model and its applicability to SMEs is examined.

Appendix A:

Please indicate for each question how strong you feel your business unit is relative to your primary competitors in the same markets (1=lower, 3=average, 5=market leader).

Strategic priority survey	1	2	3	4	5
• *Cost efficiency*					
M1 Controlling production costs					
M3 Improving labor productivity					
M9 Running equipment at peak efficiency					
M18 We plan our spending carefully					
• *Quality*					
M8 Ensuring conformance of final product to design specifications					
M10 Ensuring accuracy in manufacturing					
M12 Ensuring consistency in manufacturing					
M5 Manufacturing durable and reliable products					
M13 Making design changes in the product as desired by customer					
M15 Meeting and exceeding customer needs and preferences					
• *Flexibility/Dependibility*					
M4 Introducing new designs or new products into production quickly					
M6 Adjusting capacity rapidly within a short period					
M7 Handling variations in customer delivery schedule					
M2 Handling changes in the product mix quickly					
M16 Customizing product to customer specifications					
M19 Responding to market change faster than competitors					
• *Delivery*					
M14 Reducing manufacturing lead time					
M11 Meeting delivery dates					
M17 Making fast deliveries					

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