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Ravi Kathuria

Chapman University, kathuria@chapman.edu

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COMPETITIVE PRIORITIES AS TRADE-OFFS OR MUTUALLY SUPPORTIVE: CAN WE CALL THE QUESTION YET?

RAVI KATHURIA

Argyros School of Business and Economics
Chapman University, One University Drive
Orange, CA 92866

ABSTRACT

As the field of operations strategy matures, we need to refine the theories and abandon weak models through cumulative research. This study contributes to the debate on whether competitive priorities present potential trade-offs or are mutually supportive.

INTRODUCTION

The common characteristic among 'World Class Manufacturers,' lean manufactures, and agile manufacturers is their ability to excel and compete on several aspects of performance simultaneously. Even as a customer, we expect multiple attributes from a product or a service simultaneously, such as high quality at a reasonable price, safety as well as speed, and ease of use with a multitude of features. Thus, both the customer expectations and manufacturers' competitive strategies seemingly defy the notion of trade-offs. The proponents of the trade-offs model, however, continue to maintain that superior performance along one dimension comes at the expense of another.

The trade-offs view has been challenged by many researchers, who believe in the notion of cumulative competence building or simultaneous pursuit of multiple competitive priorities. The debate between the two schools of thought continues. This study was designed to serve as a 'crucial' study, with the intent to help advance the theory building initiative of contemporary operations management researchers. This study specifically tests the prevalence of the cumulative model in the United States, and the implied sequence of competence building: quality, dependability, cost efficiency, and flexibility, as originally proposed by Nakane (1986) and later tested by Noble (1995).

LITERATURE REVIEW

About 25 papers and books have addressed the topic of the trade-offs and cumulative model since the seminal work of Skinner (1969). A comparative analysis of these studies is presented in Appendix A (available from the author). Only one-third of the studies claim support for the trade-offs theory, while the rest support the cumulative model. Further, only three of the eight that seem to favor the trade-offs are empirical and the rest are conceptual. On the other hand, a majority (70%) of those supporting the cumulative model are empirical. It is also worth noting that none of the studies garnered full support for the competence building sequence proposed in Ferdows & De Meyer's sand cone model, which prompted this study to investigate the possibility of a different plausible sequence.

HYPOTHESES

If the manufacturing managers believe the improvement in one capability does not come at the expense of another, then they would be working to simultaneously improve multiple capabilities unless their manufacturing unit is at the bottom of the pyramid where they would be required to improve quality first. Their efforts to simultaneously improve upon a given set of capabilities would require a *high emphasis* on the corresponding competitive priorities. If a significant proportion of manufacturing managers, and hence their units, simultaneously emphasize multiple competitive priorities, it would lend support to the increasing prevalence or adoption of the cumulative model. Thus:

H1: *The proportion of manufacturing units emphasizing multiple competitive priorities will be significantly greater than those emphasizing a single priority.*

If the data reveals a significant proportion of manufacturing units placing a high emphasis on multiple priorities, the next question would be: Are these units equally likely to select a given priority from among the four under study. For example, if manufacturers selected competitive priorities for improvement in a random order, we would not expect any significant difference in the proportion of factories emphasizing different priorities – quality, delivery, cost, and flexibility. The cumulative model, however, suggests a sequence of improvement. Thus,

H2: *There is a relationship between the number of competitive priorities emphasized and the type of priorities emphasized.*

If there is, indeed, a relationship between the type of competitive priorities and the number of priorities emphasized, the next question to address would be: Do factories follow a pattern when improving or emphasizing multiple competitive priorities? For the sake of brevity, the theoretical development leading to subsequent hypotheses has been omitted, but is available from the author upon request.

H3a: *Emphasis on flexibility will be positively and significantly correlated with the emphasis on cost, delivery, and quality.*

H3b: *Emphasis on cost will be positively and significantly correlated with the emphasis on delivery as well as quality.*

H3c: *Emphasis on delivery will be positively and significantly correlated with the emphasis on quality.*

If units follow the sequence and dynamics of improvement suggested by the cumulative model, one would expect to see more units emphasizing priorities at the base of the model and fewer as we move atop. Thus,

H4: *There is a significant difference in the relative frequency of each competitive priority or combination of priorities emphasized as we progress through the sequence of the cumulative model.*

Another way to glean the implied sequence of improvement in competitive priorities would be to compare the emphasis of those units at higher layers of the cumulative model with those at lower layers. Thus,

H5-2-1a. *Layer 2 Emphasis on Delivery > Layer 1 Emphasis on Delivery*

H5-3—a. *Layer 3 Emphasis on Cost > Layer 2 and Layer 1 Emphasis on Cost*

H5-4—a. *Layer 4 Emphasis on Flexibility > Layer 3, Layer 2, and Layer 1 Emphasis on Flexibility*

Further, considering the dynamic aspect of the sand cone model, a manufacturing unit progressing toward the top of the sand cone must continue to improve upon the underlying capabilities. Thus,

H5-2-1b. *Layer 2 Emphasis on Quality > Layer 1 Emphasis on Quality*

Again, per the dynamism of the sand cone model, the units at layer 3 will continue to improve upon the competitive priorities that they have mastered at the lower levels in the model—delivery and quality—more so than the units currently operating at the lower echelons (layers 2 and 1). Thus,

H5-3—b. *Layer 3 Emphasis on Delivery > Layer 2 and Layer 1 Emphasis on Delivery*

H5-3—c. *Layer 3 Emphasis on Quality > Layer 2 and Layer 1 Emphasis on Quality*

If manufacturing units at layer 4 continue to follow the dynamic aspect of the sand cone phenomenon, they should continue to maintain a higher emphasis on cost, delivery, and quality as compared to the units at the lower echelons in the model (layers 3, 2, and 1). Thus,

H5-4—b. *Layer 4 Emphasis on Cost > Layer 3, Layer 2, and Layer 1 Emphasis on Cost*

H5-4—c. *Layer 4 Emphasis on Delivery > Layer 3, Layer 2, and Layer 1 Emphasis on Delivery*

H5-4—d. *Layer 4 Emphasis on Quality > Layer 3, Layer 2, and Layer 1 Emphasis on Quality*

The implied sequence of improvement suggested in the cumulative model should also manifest through multiple clusters in the data. If the cumulative model were prevalent and a sample of manufacturing units from the population were cluster-analyzed, one would expect to see clusters of manufacturers placing a high emphasis on all four, three, two, one and may be none of the competitive priorities. The combination of priorities emphasized by two- and three-priority clusters would provide crucial evidence in favor of the sequence of the cumulative model; this can be stated as follows:

H6a: *The four-priority cluster of factories will place a high emphasis on quality, delivery, cost, and flexibility simultaneously.*

H6b: *The three-priority cluster of factories will place a high emphasis on quality, delivery, and cost simultaneously.*

H6c: *The two-priority cluster of factories will place a high emphasis on quality and delivery simultaneously.*

To further test the implied sequence of improving manufacturing capabilities, this paper looks into the mediating effects of the base level priorities on the relationship between any two adjacent priorities at the upper echelons of the pyramid. Thus,

H7a. *Delivery will mediate the relationship between cost and flexibility.*

H7b. *Quality will mediate the relationship between delivery and cost.*

Since this study considered two aspects of the cumulative model—the synergistic and the dynamic—the performance hypotheses are developed separately for the two features. First, considering the synergistic component:

H8-2-1a. *Layer 2 Performance on Delivery > Layer 1 Performance on Delivery*

H8-3—a. *Layer 3 Performance on Cost > Layer 2 and Layer 1 Performance on Cost*

H8-4—a. *Layer 4 Performance on Flexibility > Layer 3, Layer 2, and Layer 1 Performance on Flexibility*

Further, considering the dynamic aspect of the sand cone model:

H8-2-1b. *Layer 2 Performance on Quality > Layer 1 Performance on Quality*

H8-3—b. *Layer 3 Performance on Delivery > Layer 2 and Layer 1 Performance on Delivery*

H8-3—c. *Layer 3 Performance on Quality > Layer 2 and Layer 1 Performance on Quality*

If they continue to follow the sand cone phenomenon:

H8-4—b, —c, —d. *Manufacturing companies at the top of the cumulative model that simultaneously place a high emphasis on multiple competitive priorities will perform better on cost-related, delivery-related, and quality-related performance measures than those below them that emphasize fewer priorities.*

METHODOLOGY

The unit of analysis for this study was a manufacturing unit. Data for the study came from two levels of managers in the 98 participating units. The non-response bias for the sample was ruled out by comparing the average number of employees and annual sales of the participating units with those of a random sample of the non-participating units. The Cronbach's alpha coefficients for the competitive priority scales based on manufacturing and general managers' responses were satisfactory. The performance of manufacturing managers was measured based on the information provided by their superiors on a total of seven items, if relevant. The potential incidence of Common Methods Variance (CMV) was tested using the Harman (1967) one-factor test. The potential problem of CMV due to mono-respondent bias was countered by getting data on the two study variables, competitive priorities and performance, from as many respondents. Another common criticism of such measures is the lack of variability, since according to Boyer and Pagell (2000) no company would want to say that they don't emphasize certain priorities. In this study, however, responses for several items ranged between 1 and 5 for the competitive priorities. The performance data also showed sufficient variability with four of the seven items ranging between 2 and 7, and the remaining three between 3 and 7. Further, high ranking respondents—manufacturing managers and general managers—used in the study also helped overcome the potential problem of CMV, since they are considered to be more reliable sources of information (Phillips, 1981).

ANALYSIS AND RESULTS

The composition of the sample was similar to the U.S. population by two-digit SIC codes. The frequency analysis shows that 57% of the manufacturing units in the sample place a high emphasis on two or more competitive priorities, as compared to 23% that emphasize exactly one priority. The proportion of manufacturing units simultaneously emphasizing multiple competitive priorities is found significantly different from zero ($Z = 11.40$, $p < 0.0001$), and also significantly different from the proportion emphasizing exactly one priority ($Z = 6.87$, $p < 0.001$). These results lend support to Hypothesis 1.

Using a chi-squared likelihood ratio test with equal priors, Hypothesis 2 is also supported (Chi-square statistic = 18.43, df =9, p = 0.03). Hypothesis 3a is supported since the emphasis on flexibility is positively and significantly correlated with the emphasis on the other three priorities – with cost ($r= 0.24$, $p<0.01$); with delivery ($r= 0.62$, $p<0.0001$); and with quality ($r=0.40$, $p<0.0001$). Similarly, Hypothesis 3b is also supported. Surprisingly, Hypothesis 3c is not supported because the manufacturing units emphasizing delivery do not seem to place a significantly high emphasis on quality ($r=0.12$, $p=0.12$).

In order to further test the sequence and dynamics of competence building, frequency analyses were conducted, which support all sub-hypotheses (H4a-d). The results based on ANOVA and Post Hoc Scheffe's tests, provide support for all six of Hypotheses 5 with a suffix "a". Hypotheses H5-4-3d and H5-4-1d were supported, but Hypotheses H5-2-1b, H5-3—c were not supported. Based on the cluster analysis, Hypotheses H6a and H6b were supported, but 6c was not supported. The mediating effects model supports Hypotheses H7a and H7b. The performance results support five of the six Sub-hypotheses related to the synergistic aspect of the cumulative model. The results regarding performance differences due the dynamic aspects lend minimal support in favor of this phenomenon.

CONCLUSIONS

The general findings of this study lend support to the notion of World Class Manufacturers, lean manufacturers and agile manufacturers, and their ability to simultaneously emphasize and perform well on multiple competitive priorities. There is strong evidence that a significant proportion of manufacturing units in the U.S. emphasize multiple competitive priorities, including certain combinations of quality, delivery, cost, and flexibility. It is also evident that over one-half of the sampled manufacturing managers view competitive priorities as mutually supportive, as opposed to viewing the emphasis of one priority to be at the expense of another. Further, when companies emphasize multiple priorities they do not do so in a random order, but appear to pick a certain combination of priorities somewhat consistent with the cumulative model.

The cluster analysis revealed further evidence in favor of the cumulative model—groups of factories that emphasized four, three, two, and one priority respectively, based on their respective position along the pyramid. The two aspects of the cumulative model—synergistic and dynamic—were supported using multiple methodologies, such as frequency analysis, correlation analysis, ANOVA, cluster analysis, and hierarchical regression (mediating effects) analysis. The performance impact of the two aspects (synergistic and dynamic) of the cumulative model was supported through the use of competitive-priority-specific performance measures.

The performance results offer an important insight. It appears that when manufacturing units start to emphasize a new priority, they put all of their energy and resources into excelling on that dimension. The emphasis is so high on this new priority that they are as good as the manufacturing units on a layer immediately above them and certainly better than those at the lower layers. As they move upward, adding new priorities to their portfolio, they continue to follow this pattern with respect to the newly added priority. They still continue to maintain higher performance at the supporting priorities when compared with manufacturing units at lower layers, given that the supporting priority is not the newly added priority for the lower layers. This finding provides a whole new perspective to the dynamic aspect of the cumulative model.

With the help of a mediating-effect hierarchical regression model, it was determined that the direct relationship between cost and flexibility (priorities at the top of the cumulative model) is facilitated by a corresponding high emphasis on delivery. The results also indicate that a high emphasis on quality facilitates the direct relationship between delivery and cost. It is surprising, however, that quality and delivery were not significantly correlated as one would expect under the cumulative model. The cluster analysis also failed to identify a group that simultaneously emphasized quality and delivery. This prompted a fresh look at the base of the cumulative model in that the U.S. manufacturers may follow different paths for building capabilities. This use of alternate routes to the top of the pyramid is consistent with the findings of some recent studies. For example, Flynn and Flynn (2004) didn't find support for the sand cone sequence, but suggested the prevalence of alternative sequences, with dependability at the base. Similarly, Corbett and Claridge (2002) did not find the sand cone sequence to occur either, but the two most common triplets in their sample were quality-delivery-flexibility and quality-cost-flexibility.

This study has contributed to the field of operations strategy research, especially to this topic of trade-offs versus cumulative competence building in the following manner. First, multiple methodologies were deployed, including a novel application of the hierarchical model, to unravel the sequence of improvement, and the results from various methods were concordant. Second, the study found strong support in favor of the cumulative model using the North American data. Third, a comprehensive test of the cumulative model was conducted by considering its two aspects—synergistic and dynamic. Fourth, the performance effects of the cumulative model were also studied. Though the performance results for the dynamic aspect of the cumulative model were not as strong, the extensive list of testable hypotheses in this study should serve as a benchmark for future research endeavors on this topic. It is noteworthy that the performance measures used are consistent with the competitive priorities emphasized. Finally, the use of matched pairs of high-ranking respondents from each manufacturing unit minimized the problem of mono-respondent bias and reduced the incidence of a common methods variance problem.

The findings of this study also have important implications for practitioners. First, the manufacturing managers should view competitive priorities as mutually supportive rather than as potential trade-offs. A suitable combination of priorities to be emphasized depends upon how far their respective organizations have traversed along the pyramid, among other factors. Emphasis on quality is, undoubtedly, an important first step in the right direction. It is also important to note that unit performance is also superior for those that pursue multiple priorities in a particular sequence. Knowing which model, trade-offs or cumulative, to pursue is an important first step, but the real challenge for manufacturing managers is to implement the operations strategy. The findings of this study will provide the basis for the next level where decisions related to aligning the structural and infrastructural elements with competitive priorities are made.

REFERENCES AVAILABLE FROM THE AUTHOR

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