

The Development of Manufacturing Strategy

Evidence from a Developing Country

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Abstract

This paper presents findings of an empirical study conducted in Pakistan. The data from 162 manufacturing companies, top executives and managers, was collected to develop an understanding of factors influencing their manufacturing strategy. The factors considered important for the development of manufacturing strategy are culled from literature after extensive review, and their association with manufacturing strategy was tested in addition to discerning their impact on firm's performance. The influencing factors - market orientation, manufacturing capability, environmental dynamism and innovation orientation demonstrate statistically significant association with one or more dimensions of manufacturing strategy. However, manufacturing capability seems to be the main predictor for the development of manufacturing strategy followed by market orientation. Manufacturing capability and innovation orientation are strong predictors of both financial and non-financial performance.

Introduction

Manufacturing strategy is defined as “the competencies that a firm develops around the operations function (Amoako-Gyampah, 2003, p 577). These competencies are meant to achieve competitive advantage (Anderson *et al.*, 1989). Skinner (1969) defined manufacturing strategy as the “set of manufacturing system design aspects managers (must) decide on” (Cagliano, Acur, and Boer, 2005).

There has been a steady stream of research in this area focusing mainly on two aspects of manufacturing strategy: content and process (Dangayach and Deshmukh, 2001). The content literature focuses mainly on the significance of the manufacturing function for improving product competitiveness through setting and accomplishing long-term goals in terms of cost, quality, flexibility, delivery, reliability and innovation etc. The process of manufacturing strategy addresses the method used to develop and implement the manufacturing strategy (Hurreeram, 2007). Process relates to the development and implementation of strategic plan (O'Regan and Ghobadian, 2002) or “how these decisions and actions come about” (Pun, 2005).

Skinner (1969) and Hill (1985) emphasize the importance of the process of manufacturing strategy formation and implementation. However, most of manufacturing strategy literature is focused on the content aspects. Dangayach and Deshmukh (2001) conducted an extensive review of the manufacturing strategy literature, a total of 260 articles from 31 refereed international journals and conferences, and divided the entire literature into content and process-

related issues. They concluded that process-related articles accounted for less than 10 percent of the literature, indicating that research on manufacturing strategy formulation is limited.

This paper addresses this gap in the literature. The objective of this paper is to empirically test a comprehensive list of variables that can influence development of manufacturing strategy and subsequently examine the impact of influencing variables on firm's performance.

Literature Review

Skinner (1969) introduced the concept of manufacturing strategy in his seminal and famous Harvard Business Review article titled, "Manufacturing - missing link in corporate strategy". A steady stream of research, mainly conceptual in nature, followed Skinner's article. The large amount of research has intensified with increasing sophistication in last two decades. A number of studies in the literature have tested Skinner's arguments and refined their conceptualization (e.g., Dangayach and Deshmukh, 2001; Swamidass and Newell, 1987; Ward and Durray, 2000).

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It has been emphasized that firms should develop manufacturing strategy (or operations strategy) within the broader context of organizational level strategy. The manufacturing strategy is expected to align a company's capabilities and resources with its competitive strategy. The manufacturing strategy dimensions are generally classified as quality, cost, delivery and flexibility (Skinner, 1978; Sweeney, 1994). The choice of specific strategy dimensions is influenced by the customer demands and competitors (Pun, 2004). The companies which develop and implement manufacturing strategy are known to have significantly higher return on sales, the ratio of profit before tax to sales (Miltenburg, 2008).

Factors Influencing Manufacturing Strategy

There are two opposing views with respect to the development of manufacturing strategy – market-based view and resource-based view. The market-based view, which takes an external perspective, regards manufacturing strategy as a derivative of business strategy and emphasizes the consideration of market requirements at the manufacturing level. Market orientation is defined as "the organizational culture that most effectively and efficiently creates the necessary behaviours for the creation of superior value for buyers and thus, continuous superior

performance for the business” (Narver and Slater, 1990, p.21). Market orientation aims to keep the firm close to its competitors. The focus of resource orientation is internal while market orientation is external (Paladino, 2007). The external environment comprising of economic, technological, political, environmental and social issues is relevant but the real emphasis is on the industry.

Though the literature points to the increasing use of resource orientation influencing the manufacturing strategy, market orientation is still considered vital, since knowledge of customer requirements and competitors’ actions is necessary to compete effectively in today’s highly competitive environment where customers are exposed to numerous product choices. It is posited, therefore, that market orientation will also have an impact on the development of manufacturing strategy.

The resource-based view, on the other hand, takes an internal perspective and considers a firm’s internal assets, resources and capabilities to be the main determinant of the manufacturing strategy (Thun, 2008). The resource-based view of the firm stresses that its performance is driven by its resources. The objective of the firm is to develop and deploy a bundle of resources which are difficult for the competitors to imitate (Paladino, 2007). Bates *et al.* (2001) highlight the significance of developing manufacturing resources and capabilities by stating that the “manufacturing process is a result of a firm’s long-term commitment to build manufacturing capabilities and resources.”

In addition to the market and resource based view, this study posits that there are three other variables that influence the development of manufacturing strategy – manufacturing capability, innovation orientation and environmental dynamism.

The manufacturing strategy literature borrowed the term ‘capabilities’ from business strategy literature focused on resource-based view of the firm (Corbett and Claridge, 2002). Manufacturing capability is defined as “the ability of a production system to compete on basic dimensions such as cost, flexibility and time” (Sarmientom *et al.*, 2007, p. 368). Bates *et al.* (2001) emphasize the role of resources in building manufacturing capability which, aligned with business strategy, serves as a source of competitive advantage. Since the dimensions of manufacturing strategy – cost, quality, flexibility, dependability, and so on, are firmly dependent on capabilities of the firm, it is posited that manufacturing capability will have a direct impact on manufacturing strategy.

Innovation is defined as “the search for and the discovery, development, improvement, adoption, and commercialization of new processes, products, organizational structures and procedures” (Dosi, 1988, p. 1122). A number of authors have stated that, in the face of rising competition, investments in innovation are likely to give firms competitive advantage in global and international markets (Brown and Eisenhardt, 1995). Akman and Yilmaz (2008) consider innovation as a vital success factor in a highly competitive, global economy. Qian, Qi, and Yu-cheng (2008) also emphasize that an increasingly competitive world and highly demanding customers make it imperative for firms to develop strategies based on innovation. Innovation seems to have a significant impact on a firm’s productivity and on the overall performance of the organization (Yamina *et al.*, 1997).

Innovation, for the purpose of this study, is limited to technological innovation. An innovation orientation is a characteristic of the corporate culture and is normally considered as a component of a broader innovation culture. For this study it is defined as “openness to new types of technologies, the ability to search for these technologies proactively, being able to recognize them early on, and reacting to them appropriately, as well as an attempt to use these technologies

purposefully for innovation to develop technologically first-class products that are superior to those of the competitors” (Herrmann, Gassmann, and Eisert, 2007).

Management decisions are guided by the overall corporate strategy. It is imperative for firms to continually monitor their environment for changes in buyer preferences, rapid environmental changes, and increased competition. Such changes could make the firm’s current positioning outdated and/or offer new growth opportunities. Scanning of the environment provides an effective basis for linking corporate strategy to marketing strategy (Cravens, 1975).

There is no consensus amongst the researchers as to the best way to conceptualize and measure external environment. However, environmental dynamism is one of the most frequently used measures of external environment. It is defined as the “rate of environmental change and unpredictability of that change” (Bierly and Daly, 2007, p. 498). This change can be caused by the entrance of new competitors, changes in customer preferences and variations in the firm’s technological capabilities (Bierly and Daly, 2007).

Manufacturing Strategy Dimensions

Competitive priorities of manufacturing strategy, also called competitive strategy or manufacturing strategy in the literature, are defined as the dimensions on which the firm competes in the marketplace (Hayes and Wheelwright, 1984). A number of studies in the literature propose manufacturing strategy dimensions. Fang and Wang (2006), however, conducted a systematic and an extensive review of the literature to develop taxonomy of manufacturing strategy dimensions from the literature. They reviewed thirty-seven studies over a period of twenty years. They found cost, quality, reliability and flexibility to be the most frequently used dimensions. Since their analysis was limited to 1995, the most recent studies, starting from 1996 onward, were scanned to identify the manufacturing strategy dimensions currently being proposed in the literature. Based on extensive literature review the dimensions of manufacturing strategy were classified as quality, cost, flexibility, delivery and innovation.

Organizational Performance

Organizational performance is a widely used construct and a number of studies in varying disciplines measure organizational performance for different objectives. There are two types of measures, objective and subjective, that are used in the literature to capture organizational performance. Objective measures are more tangible but are constrained to financial data only and thus are limited in scope. The standard measures of financial performance - revenue and profitability growth - are used by most of the studies. Subjective measures, on the other hand, are less concrete but provide a different and richer perspective about organizational effectiveness, especially in comparison to the competitors. The subjective measures, however, vary depending upon the precise objective of the study. It is recommended that researchers should consider multiple indicators of the performance to get a more comprehensive assessment of the performance (Allen *et al.*, 2008). The organizational performance measure for this study comprise of financial - market share, sales growth, return on investment, overall profit and profit growth and non-financial, customer satisfaction and customer loyalty.

Theoretical Background

The underlying theory which supports the development of manufacturing strategy is the resource-based view (RBV) though market orientation has also been purported to influence manufacturing strategy.

Resource-based View

Resource Based View (RBV) advocates using the company's internal resources, competencies, and capabilities as essential determinants of strategy. This paradigm argues that differences in the firm's performance can be traced back to heterogeneous assets and capabilities owned by the company. RBV assumes that each firm has unique resources and capabilities (Wernerfelt, 1984) and the growth of the firm is subject to the efficient use of the resources and deployment of capabilities. The RBV states that the firm's resources and capabilities determine its competitive advantage and firms that enjoy superior capabilities relative to their competitors have significant advantage over competitors (Peteraf, 1993; Russo and Fouts, 1997).

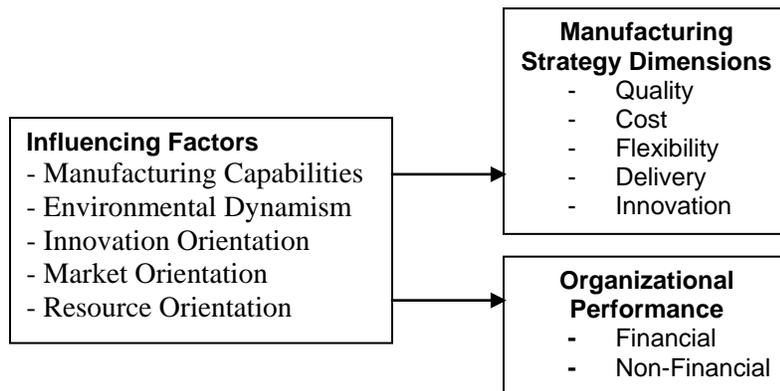
Market-based View

Manufacturing strategy based on market-orientation focuses on external factors. Performance and competitive behaviour are determined by market structure. The external environment, comprising of economic, technological, political, environmental and social issues, is relevant but the real emphasis is on the industry. A company's success is strongly influenced by the competitive forces, measured by Porter's (1980) five forces model. According to this perspective, business environment should be monitored frequently and customers' needs and preferences should be taken into consideration to develop dynamic capabilities (López, 2005).

The Conceptual Framework & Hypotheses

The conceptual framework given below graphically depicts the relationship between factors influencing the development of manufacturing strategy, the dimensions of manufacturing strategy and their subsequent linkage with organizational performance.

Figure 1: Factors Influencing Manufacturing Strategy (A Priori Model)



The above conceptual framework leads to the following hypotheses:

Impact of Influencing Factors on Manufacturing Strategy

H_{1a}: Manufacturing capabilities will have an impact on the choice of manufacturing strategy dimensions.

H_{1b}: Environmental dynamism will have an impact on the choice of manufacturing strategy dimensions.

- H_{1c}: Innovation orientation will have an impact on the choice of manufacturing strategy dimensions.
- H_{1d}: Market orientation will have an impact on the choice of manufacturing strategy dimensions.
- H_{1e}: Resource orientation will have an impact on the choice of manufacturing strategy dimensions.

Impact of Influencing Factors on Organizational Performance

- H_{2a}: Manufacturing capability will have an impact on firm's financial and non-financial performance.
- H_{2b}: Environmental dynamism will have an impact on firm's financial and non-financial performance.
- H_{2c}: Innovation orientation will have an impact on firm's financial and non-financial performance.
- H_{2d}: Market orientation will have an impact on firm's financial and non-financial performance.
- H_{2e}: Resource orientation will have an impact on firm's financial and non-financial performance.

Methodology

The data was collected from top decision makers from manufacturing companies in Pakistan. The companies listed with Lahore Chamber of Commerce and Industry (LCCI) comprised the sampling frame. The data was collected through mail as well as self-administered interviews. A total of 162 usable questionnaires have been received so far and are included in the analysis. The measures taken for the constructs were validated by the existing literature.

Since measures used in the study were validated in the literature, Principal Component Analysis (PCA) was used as a data reduction technique which resulted in removal of 8 items with loading of less than 0.5. None of the items from resource orientation construct loaded so resource orientation was removed from further analysis. Before regression analysis, it is important to determine the reliability of the measures. Cronbach's alpha is generally used to determine the reliability of the measures. This statistic also informs about the internal consistency of the items in measuring the same construct. Some statisticians have suggested a value of 0.7 or higher to be acceptable. The Cronbach's alpha for the constructs in this study ranged from 0.7 to 0.9, thus ensuring the reliability of measures.

Results - Tests of Hypotheses

The regression analysis with manufacturing strategy as dependent variables and influencing factors as independent variables was used to test the first set of hypotheses. The findings of the analysis are given below:

Table 1: The Impact of Influencing Factors on Manufacturing Strategy

Independent Variables	Dependent Variables				
	Quality	Cost	Flexibility	Delivery	Innovation
Manufacturing Capability	.425***	.252***	.278***	.427***	
Environmental Dynamism				-.127*	.296***
Innovation Orientation					.269***
Market orientation	.277***	.161*			
R Square	0.312	0.094	0.104	0.219	0.252
F Statistics	17.236***	3.962***	4.403***	4.150***	12.790***

Standardized regression coefficients are shown

*** p< .01, ** p< .05, * p< .10

There is a strong support in the literature for dominance of resource orientation over market orientation as the major paradigm for manufacturing strategy development. The items for resource orientation did not load in PCA but market orientation seems to a statistically significant predictor for quality and cost manufacturing strategy. Innovation orientation supports innovation manufacturing strategy while environmental dynamism also positively impact innovation strategy. However, environmental dynamism has a negative relationship with delivery strategy. The most important finding of the above analysis is the importance of manufacturing capability for the development of manufacturing strategy. Manufacturing capability is statistically significant for all the dimensions of manufacturing strategy except innovation. Manufacturing capability has the strongest impact on delivery, followed by quality, flexibility and cost manufacturing strategy. Hypotheses H_{1a}, H_{1b} and H_{1c} and H_{1d} are partially supported. The second set of hypotheses was tested with financial and non-financial performance as dependent variable and influencing factors as independent variables. The results are given below in Table 2.

Table 2: The Impact of Influencing Factors on Firm's Performance

Independent Variables	Dependent Variables	
	Performance Financial	Performance NON-Financial
Manufacturing Capability	.150*	.165*
Environmental Dynamism		
Innovation Orientation	.436***	.158*
Market orientation		.159*
R Square	0.253	0.165
F Statistics	12.851***	7.500***

Standardized regression coefficients are shown

*** p< .01, ** p< .05, * p< .10

Market orientation has a positive and statistically significant impact on non-financial performance. Manufacturing capability and innovation orientation, however, have positive and statistically significant impact on both financial and non-financial performance. Hypotheses H_{2a} and H_{2c} are fully supported, hypothesis H_{2d} is partially supported, but hypothesis H_{2b} is not supported.

Conclusion

The objective of this study was to identify the factors that influence the choice of a particular or a set of manufacturing strategy dimensions adopted by a firm. The impact of influencing factors on firm's performance was also examined. A sample of 162 Pakistani manufacturing concerns, top executives and managers, forms the basis of analysis. An extensive literature review was conducted to discern the factors influencing manufacturing strategy, dimension of manufacturing strategy and measures of organizational performance. The measures validated by the previous studies were further refined by PCA. The Cronbachs alpha was computed to ensure high reliability. This paper presents findings using regression analysis to test the hypotheses.

The influencing factors - market orientation, manufacturing capability, environmental dynamism and innovation orientation, exhibit statistically significant association with one or more dimensions of manufacturing strategy. However, manufacturing capability seems to be the main predictor for the development of manufacturing strategy followed by market orientation. Manufacturing capability and innovation orientation are strong predictors of both financial and non-financial performance, thus highlighting the role of innovation in organizational performance. Market orientation, on the other hand, impacts only non-financial performance.

Theoretical and Managerial Implications

This is the first study which looks at comprehensive set of variables that can influence the development of manufacturing strategy as well as firm's performance. No other study has empirically tested more than two antecedents of manufacturing strategy within a single framework. This study also introduces a new construct, innovation orientation, which has not been previously deliberated in manufacturing strategy literature. Innovation orientation has a significant impact on both manufacturing strategy as well as firm's financial performance. By identifying the factors taken into consideration by managers while developing manufacturing strategies, it leads to better understanding of what specific factors must be considered by the firms to develop successful manufacturing strategies. It will thus provide practical guidance to companies who wish to implement manufacturing strategies for their firms.

Limitations

Singly key informants were used as respondents in this study. Also single-item indicators were used to measure manufacturing strategy. Future studies could use multiple respondents in the firm and develop multi-item scales to measure manufacturing strategy. Since this is the first study to use the constructs of manufacturing capability and manufacturing strategy within the same model, the nature of relationship between the two constructs needs to be further explored with quantitative and qualitative research.

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