Business strategies and manufacturing decisions

An empirical examination of linkages

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Abstract

Purpose – This paper seeks to investigate whether linkages, proposed by previous researchers, among business strategies and structural and infrastructural investment decisions of manufacturing are empirically supported.

Design/methodology/approach – A sample of 101 US manufacturing firms is classified into three groups based on their predominant business strategies. The classification is validated using analysis of variance (ANOVA) tests on the taxons and on the environment in which the firms operate. ANOVA tests on manufacturing investment decisions are then used to address the central question of the paper – whether the three business strategy groups differ in their emphasis on structural and infrastructural areas of manufacturing.

Findings – The three business strategy-based groups of firms, labeled broad-based competitors, differentiators, and price leaders, differ in their emphasis on several of the structural and infrastructural areas of manufacturing, thus supporting the contention of linkages among business strategy and manufacturing investment decisions.

Originality/value – The popular notion of linkages among business strategies and investments in structural and infrastructural areas of manufacturing is empirically tested.

Keywords Management strategy, Strategic manufacturing, United States of America

Paper type Research paper

Introduction

In his seminal article, Skinner (1969) called for the manufacturing function to have a proactive role in the pursuit of business strategy goals. Subsequently, Hayes and Wheelwright (1984) and Hill (2000) pointed out that linkages between manufacturing operations and business strategy are manifested by structural and infrastructural investment decisions related to manufacturing. The regular emergence of novel initiatives such as just-in-time or JIT (Schonberger, 1982), flexible manufacturing (Goldhar and Jelinek, 1983), TQM (Hall, 1987), lean manufacturing (Womack *et al.*, 1990), mass customization (Pine *et al.*, 1993) and supply chain management (New, 1996)

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in the last three decades provides evidence of the growing recognition of manufacturing's strategic role.

However, limited successes from adopting such programs ("only about a third of all the operating improvement programs undertaken were regarded as successful" (Hayes *et al.*, 2005, p. viii) are attributed to the continuing dearth of a strategic outlook for manufacturing. In order to get maximum benefit from such initiatives, it is critical for firms to link their manufacturing decisions with coherent business strategies (Dean and Snell, 1996). This research addresses the issue by focusing on the relationship between business strategies of firms and their realized manufacturing decisions, determined by the managerial emphasis placed on key structural and infrastructural investment areas of manufacturing (Hayes *et al.*, 2005; Schroeder *et al.*, 1986). Specifically, we identify business strategies used by a sample of firms and examine empirically the link between business strategy and the emphasis placed on an array of structural and infrastructural decision areas.

The strategic effectiveness of a firm depends on the existence of fit, which is the compatibility of structures and processes both within the firm and with the environment in which it operates (Miller, 1992). Configuration models, with their multidimensional approach to studying several organizational phenomena simultaneously, are suited to addressing questions of fit (Bozarth and McDermott, 1998). In this paper, we use a configuration scheme of business strategies derived from previous research and a clustering technique to divide our sample of manufacturing firms into three groups. We then use our classification to gain insights into linkages between predominant business strategies of these three groups and their manufacturing investment decisions. While the configurations show the business strategy gestalts followed by the firms in our sample, subsequent analyses of their manufacturing investment decisions make explicit the linkages between their business strategies and manufacturing decisions.

Business strategy configurations

In this section, we review existing business strategy literature in order to identify some popular business strategy classification schemes, which will then be used to support our creation of competitively similar clusters of firms. In this paper, we adopt Hitt *et al.*'s (1997, p. 115) definition of business strategy as "An integrated and coordinated set of commitments and actions designed to exploit core competencies and gain a competitive advantage."

The idea behind configurations based on business strategies is that there exist different routes toward attaining competitive advantage (Kotha and Orne, 1989). Miles and Snow (1978) classified firms into four groups called defenders, prospectors, analyzers, and reactors. Defenders followed conservative strategies and attempted to control narrow niches in their markets. Prospectors fell on the other extreme of the risk-taking continuum, willing to stimulate demand through innovations and creating new opportunities in order to out-perform other firms. Analyzers fell in the middle of the risk continuum; these firms tended to be followers of prospectors in making changes but were not as focused on stability as the defenders. Reactors had no well defined strategy and engaged in reactive decision-making.

Empirical studies of theoretically derived business strategy configurations have supported the argument that business strategy decisions are made in predominant patterns. Hambrick (1983) found that defenders, prospectors and analyzers (three of the four groups in Miles and Snow's classification) performed differently in different environments and on different performance measures. A significant finding of Hambrick's study, particularly relevant to our research question of manufacturing-decision differences among business strategy configurations, was the difference in functional attributes of prospectors and defenders. Prospectors had higher R&D and marketing expenses, while defenders displayed an emphasis on efficiency characterized by high-capital intensity, high-employee productivity and low-direct costs. Desarbo *et al.* (2005) compared Miles and Snow's archetypes with their empirical classification of firms among four groups. They found more support for their empirical typology than for the one following Miles and Snow.

Porter's (1980) view of business strategy was focused on the ability of a firm to influence competitive forces or threats in an industry coming from five sources: new competitors, existing competitors, substitute products, buyer-power, and supplier power. His main idea was that competitive advantage within an industry could be sustained by following a low cost or differentiation strategy either across all segments in an industry or specifically focused on a niche within the industry. Thus, Porter's (1980) typology of business strategies can be represented by a two-by-two matrix with cost and differentiation as two extremes of one axis, and broad- and focused-differentiation as extremes of the second axis. Based on the level of emphases placed on these dimensions, four business strategy classifications are identified as:

(1) industry-wide cost leaders;

(2) industry-wide differentiators;

(3) segment cost-leaders; and

(4) segment-differentiators (Kotha and Orne, 1989).

Porter's classification, which popularized the notion of generic business strategies, has subsequently been critiqued and modified by several management researchers – e.g. Hill (1988), Jones and Butler (1988), Murray (1988), and Wright *et al.* (1991). Miller (1988) used Porter's generic strategies in empirical tests and found significant associations among business strategy, environment, and organization structure.

Mintzberg (1988) proposed the use of five business strategy dimensions – price, quality, design, support, and image. In a way, his configuration expanded on Porter's classification – it subdivided Porter's "differentiation" category into four subgroups – quality, design, support, and image – each focusing on one aspect of differentiation. He also included price differentiation as a fifth business strategy followed by firms focusing on the price dimension. The sixth and last category in Mintzberg's classification, called "undifferentiated," consisted of firms that did not emphasize any of the five dimensions. Using a confirmatory factor analysis approach, Kotha and Vadlamani (1995) compared Porter's three categories model to Mintzberg's six categories model and found that the latter provided better model fit than the former.

Hill (1988) observed that Mintzberg's categorizations were not mutually exclusive. He proposed that a business strategy that combined emphasis on price differentiation with emphases on one or more other dimensions presented a viable strategy as well for achieving competitive advantage. Thus, according to Hill, firms are capable of successfully targeting more than one – even all – of Mintzberg's five dimensions of business strategy.

The studies discussed above sought to classify firms on the basis of their emphasis on business strategy dimensions and to test conceptual typologies. Based on these studies we adopt dimensions of business strategy and apply a classification scheme to our sample in the later section on business strategy classification. Mainly, our classification is built upon Mintzberg's (1988) dimensions of business strategy – price, quality, design, support, and image – resulting in three generic business strategy groups – broad-based competitors, differentiators and price leaders. Before describing our business strategy classification, we review the literature on the focal area of our paper – investment decisions in structural and infrastructural areas related to manufacturing – in the next section.

Manufacturing investment decisions

The importance of building unique competitive advantage by leveraging functional capabilities and acquiring rare and inimitable resources is well recognized in business strategy research (Amit and Schoemaker, 1993; Barney, 1991; Oliver, 1997). As seen in the preceding section, some empirical researchers, in addition to proposing and testing business strategy configurations, have also explored linkages between business strategies and internal/external contextual factors. However, linkages between business strategy and functional level decisions have received relatively little attention in this literature, although Hambrick (1983) pointed out some marked differences in predominant functional emphases of firms in his three business strategy groups.

In order to emphasize the importance of alignment between business strategy and functional decisions, we review some of the conceptual and empirical research on the topic. Following this we review research on configurations of manufacturing strategy and other functional strategies; subsequently this is followed by a review of the classification of manufacturing investment decisions between structural and infrastructural areas (Table I). Thus, in the present section we lay down the theoretical foundations for the relationships between business strategy and manufacturing investment decisions that are the focus of this paper.

Alignment between business strategy and manufacturing decisions

Several authors have stressed the importance of alignment between overall business strategy and functional strategies (Berry *et al.*, 1999; Hausman *et al.*, 2002; Menda and Dilts, 1997). Wheelwright and Hayes (1985) emphasized the importance of manufacturing/operations in business strategy for gaining a competitive edge.

Table I. Manufacturing strategy decision areas

Structural	Infrastructural
Capacity	Resource allocation and capital budgeting systems
Sourcing and vertical integration	Human resource systems
Facilities	Work planning and control systems
Information and process technology	Quality systems
	Measurement and reward systems
	Product and process development systems
	Organization

Source: Based on Hayes and Wheelwright (1984)

Kim and Arnold (1996) explored linkages of business strategy with manufacturing related decisions and proposed a model for aligning manufacturing decisions with business strategy.

Empirical evidence also supports the criticality of positioning manufacturing initiatives in tandem with business strategy (Gupta and Lonial, 1998; Vickery *et al.*, 1993). Joshi *et al.* (2003) assessed alignment between General Managers' and Manufacturing Managers' perceptions of strategic priorities. Obtaining responses from both levels of respondents on similar questions, they calculated an alignment score (Venkatraman, 1989), which significantly predicted manufacturing unit performance. Devaraj *et al.* (2001) consolidated the product-process matrix (Hayes and Wheelwright, 1984) and Kotha and Orne's (1989) generic manufacturing strategies, and showed that performance is predicted by alignment. Papke-Shields and Malhotra (2001) found significant relationships between the role and involvement of manufacturing executives and alignment between business and manufacturing strategy, and in turn, business performance. Using data collected from firms in ten European countries, Acur *et al.* (2003) identified the prominent competitive priorities of firms, followed by correlation analyses to assess relationships between competitive priorities and how manufacturing strategies were implemented. Their results supported the notion that firms that had systematic and proactive manufacturing strategies were successful in translating strategic business objectives into related investments.

Configurations of functional strategies

Researchers have applied the idea of configurations to manufacturing firms with the intention of classifying them on the basis of their manufacturing strategy positions. Miller and Roth (1994) developed an empirical taxonomy of manufacturing strategies. Frohlich and Dixon (2001) replicated Miller and Roth's research to provide a longitudinal analysis. These authors found the same configurations of manufacturing strategy (caretakers, marketeers, and innovators) as Miller and Roth. In similar studies, Christiansen *et al.* (2003), Kathuria (2000) and Youndt *et al.* (1996) analyzed manufacturing firms on the basis of their manufacturing competitive priorities – mostly using the list of four generic manufacturing priorities of cost, quality, delivery, and flexibility. Each of these studies found support for the notion that clusters of manufacturing firms target these generic manufacturing priorities in different combinations. Devaraj *et al.* (2004) empirically tested and found significant effects on operational performance (cost, quality, delivery, and flexibility) for firms following eight generic manufacturing strategies of Kotha and Orne (1989). Cagliano *et al.* (2005) longitudinally traced changes in combinations of manufacturing competitive priorities.

In addition to seeking configurations of manufacturing strategy, some of these studies also addressed the question of whether manufacturing firms target manufacturing strategy dimensions of cost, quality, delivery and flexibility individually or in some combination. Thus, the underlying objective of these studies was also to contrast the view that firms make tradeoffs in targeting manufacturing strategy objectives versus the view that some firms target combinations of cumulative capabilities (Narasimhan *et al.*, 2005; Rosenzweig and Roth, 2004).

Using a configurations approach researchers have explored relationships between business and functional strategies other than manufacturing. Among a sample of 20 firms from two industries, Heijltjes and van Witteloostuijn (2003) identified firms with "coherent profiles" of environment, competitive strategies, manufacturing technologies, and human resource management that outperformed "incoherent profile" firms. Vorhies and Morgan (2003) studied configurations on the basis of business strategy classifications of Miles and Snow: prospectors, defenders, analyzers and reactors (the reactors classification was skipped (McKee *et al.*, 1989)). Using the top 5 percent performers in each of the strategic types as the "ideal" they computed profile deviation scores (Venkatraman, 1989) across marketing organization variables, which significantly predicted marketing performance.

With few exceptions, the manufacturing configuration literature cited above is targeted primarily on dimensions and clusters of manufacturing strategy. By-and-large, this literature does not assess linkages between business strategies and manufacturing investment decisions. Encouraged by the empirical support that researchers have found for linkages between business strategy and the human resource and marketing functions, we examine linkages between business strategy and manufacturing functional decisions.

Manufacturing investment decisions

The role of infrastructural and structural manufacturing decisions has been studied in a fragmented way in the literature, with limited emphasis on how these decisions are aligned with business strategy. Dividing their sample of manufacturing firms into four clusters based on manufacturing practices, Narasimhan *et al.* (2005) discovered that these groups of firms targeted different dimensions of manufacturing performance. Gilgeous (2001) found that emphasis on technology and people was critical in determining the strategic effectiveness of manufacturing. Swamidass and Newell (1987) found that in dynamic environments the role of manufacturing managers and emphasis on manufacturing flexibility resulted in better performance. Safizadeh *et al.* (1996) presented empirical support for the association between competitive priorities and process choice. Boyer *et al.* (1996) classified approaches to investment in advanced manufacturing technologies (AMTs), supporting the idea that groups of firms display different propensities to invest in different types of AMTs. Utterback and Abernathy (1975) emphasized the importance of an ability to invest in new technologies for firms operating in fast changing environments.

In an empirical study, Hayes *et al.* (1988) found that less than half of the performance variation in 12 plants with the same parent company could be attributed to traditional structural variables of equipment and technology. The majority of the variation is explained by differences in the softer areas of policies, procedures, and systems. Wu and Ellis (2000) studied the link between manufacturing information systems and manufacturing strategy in a UK company where the application of a synergistic approach had gained them an award for their application of computer technology to manufacturing. The main insight gained from the case study was that manufacturing information systems design was coordinated and performed in tandem with the company's strategic manufacturing goals for the future. Miller and Roth (1994) found that the three clusters that they identified in their taxonomy differed in their emphasis on improvements in quality and new product development (NPD). Miller (1988) provided evidence of a significant relationship between business strategy and elements of organization structure.

We build on this body of configurational research through an examination of the relationships between competitive business strategies and manufacturing investment decisions. Common to many of these studies is the examination of a small subset of the entire range of manufacturing structural and infrastructural decision areas. Our research extends this literature by incorporating a wider range of the relevant decision areas in manufacturing. This provides a broader view of the constellation of manufacturing choices made by competitively similar firms.

Business strategy classification

In this section, we propose a classification based on a synthesis of existing typologies and dimensions of business strategy as described earlier. This classification scheme is used to categorize our sample of manufacturing firms using cluster analysis. We then use the resulting clusters to test whether these distinct groups of firms make different manufacturing investment decisions.

For our classification, we adopt the dimensions of business strategy used by Mintzberg (1988) – price, quality, design, support, and image. Our business strategy typology is founded on Mintzberg's (1988) classification, with Hill's (1988) modification to recognize that firms may emphasize more than one strategic dimension simultaneously. Accordingly, we combine the business strategy dimensions to create three business strategy types: broad-based competitors, differentiators, and price leaders.

The first category, "broad-based competitors," (Table II: Column 1) is inspired by Hill's (1988) assertion that a strategy that calls for a strong emphasis on both low cost and differentiation on other bases is not a special case of "stuck-in-the-middle" or other rarely occurring industry-wide phenomenon (Porter, 1980). Instead, such a strategy can be viable one for attaining sustainable competitive advantage and might therefore be pursued by firms on an ongoing basis. Ward *et al.* (1996) use a similar categorization labeled lean competitors. Thus, this category emphasizes (depicted by " + ") all five dimensions of business strategy – price, quality, design, support, and image.

Our second category called "differentiators" (Table II: Column 2) consists of firms that de-emphasize (depicted by " − ") price and moderately emphasize (depicted by "0") the other four dimensions – quality, design, support, and image. Firms in this group, similar to Porter's (1980) "differentiation" category, pursue some combination of competency in dimensions other than price. This category can also be considered a combination of Mintzberg's (1988) individual "differentiator" categories of quality, design, support, and image.

The third category labeled "price leaders" (Table II: Column 3) is similar to Mintzberg's (1988) price differentiators and Porter's (1980) and Ward *et al.*'s (1996) cost leaders, in that these firms emphasize (depicted by " + ") price and de-emphasize (depicted by " − ") the other four dimensions of quality, design, support, and image.

	Broad-based competitors	Differentiators	Price leaders
Taxons			
Price	+	−	+
Quality	+	0	−
Design	+	0	−
Support	+	0	−
Image	+	0	−

Table II. Business strategy configurations and signs representing expected emphasis

The five business strategy dimensions and hypothesized signs of emphasis on each dimension for the three proposed business strategy groups are presented in Table II. Ward *et al.* (1996) developed a comprehensive classification of business strategy, environment and manufacturing investment decisions. We expect to find similar patterns of linkages between these three elements in our empirical analysis. Mainly, firms in the "broad-based competitors" category are expected to operate in highly dynamic environments (Miller, 1988) and place the highest level of emphasis on multiple structural and infrastructural areas of manufacturing in order to adapt to rapidly changing conditions (Meredith, 1987). Conversely, "price leaders" are expected to operate in static environments (Miller, 1988) and emphasize investments in manufacturing capacity to gain economies of scale (Hayes and Schmenner, 1978). In between these two extremes, "differentiators" are expected to operate in moderately dynamic environments where advanced price competition has not yet taken hold and where a variety of differentiated product offerings are valued in the market.

Data

Existing data obtained from a survey of privately and publicly owned US manufacturing firms are used for the study (Ward and Duray, 2000). Firms targeted for the survey were sampled from three sectors: fabricated metal products, electrical devices, and electronic controls (SIC codes 34, 36 and 38), and excluded locations with less than 150 employees. The unit of analysis was the primary product line of the plant to which the survey was mailed. Respondents were instructed to refer to a product line representative of what was being produced by the business unit. Following initial telephone contact to identify the highest ranking executive on location and to request his or her participation, consenting executives were asked to provide names and addresses of three other executives:

(1) plant manager;

(2) marketing manager; and

(3) engineering manager.

Four distinct survey forms were mailed to each firm with each item appearing on two forms. In this way, each question on the survey was put to two respondents at each plant, with specific questions matched to those individuals most likely to have expert knowledge of the question's content area. About 101 usable responses were obtained, resulting in a response rate of 37 percent.

To address non-respondent bias, sales volume and number of employees for non-respondent firms were compared by industry with those of the respondent firms. The results of these *t*-tests confirmed that the non-respondent firms did not differ substantially from firms responding to the survey. As a further check, post survey telephone calls revealed that lack of time and the possibility of revealing proprietary information were the most common reasons for non-participation. Similar reasons for non-response have been reported in earlier empirical studies (Miller and Roth, 1994; Vickery *et al.*, 1993).

The survey was designed to elicit paired responses. Interclass coefficient scores are used to assess inter-rater reliabilities (Boyer and Pagell, 2000). These scores are shown in Tables III-VI, which also include other scale diagnostics described in the following section. Note that seven of the 19 scales had interclass coefficient scores

Table III.
Business strategy constructs: scale items and PCA results

Business strategy	Cronbach's α	Eigen-value	Percent var. explained	Interclass correlation
Price	0.58	1.69	56.18	0.71
Operating efficiency				
Procurement				
Competitive pricing				
Quality	0.87	4.33	54.12	0.58
Product performance				
Features				
Product reliability				
Conformance to specifications				
Product durability				
Product serviceability				
Design	0.80	2.82	56.32	0.73
Refining existing products				
Processes innovation				
New product development				
Products or services innovation				
Time-to-market				
Support	0.70	1.90	63.22	0.74
Customer service				
Delivery speed				
Dependable delivery				
Image	0.81	3.09	51.43	0.64
Broad product range				
Brand identification				
Innovative marketing				
Distribution channel control				
Advertising usage				
Forecasting market growth				

Notes: Seven-point Likert scales assessing emphasis on strategy variables; eigenvalues from single construct principal component analysis (PCA); each PCA resulted in extraction of a single component

Manufacturing strategy structural decision areas	Cronbach's α	Eigen-value	Percent var. explained	Interclass correlation
Capacity	0.64	1.75	58.36	0.73
Expansion				
Plant relocation				
Plant reconditioning				
Sourcing and vertical Integration	0.62	1.94	48.58	0.58
Electronic data interchange				
Purchasing management				
Supplier base reduction				
Component reduction				
Facilities/manufacturing technology	0.75	2.79	49.83	0.76
Computer-aided design				
Robotics				
New process development				
Group technology				
Flexible manufacturing systems				
New product development (features)	0.74	2.34	58.59	0.46
Product performance enhancement				
Improved features				
Additional features				
Product attractiveness				
New product development (quality)	0.84	3.44	57.25	0.34
Elimination of design errors				
Product reliability				
Conformance to specifications				
Product durability				
Product serviceability				
Product manufacturability				

Notes: Seven-point Likert scales assessing importance on developing capabilities in manufacturing areas; eigenvalues from single construct PCA; each PCA resulted in extraction of a single component

Table IV. Constructs for manufacturing strategy structural decision areas: scale items and PCA results

lower than the recommended cut-off of 0.60. In light of this limitation, subsequent empirical tests should be interpreted with caution for these scales.

Scales

We use seven-point Likert scales to measure the multi-item constructs for our study. Measures for business strategy are based on the dimensions of business strategy used by Miller (1986) and Kotha and Vadlamani (1995) (Table III). The manufacturing strategy structural and infrastructural constructs are based on their descriptions in Hayes and Wheelwright (1984, p. 31) (Tables IV and V). Using a scale adapted from Miller and Friesen (1983), we obtain a measure of the environmental dynamism in which the firms operated (Table VI).

The survey items used to operationally define the constructs are listed in the Appendix and the statistical results supporting their unidimensionality are shown in Tables III-VI. Principal component analyses conducted for each scale individually show that the constituent items load on a single factor for each of the constructs. The eigenvalues of the first components are greater than 1 in all cases and the item loadings are greater than 0.40 (Hair *et al.*, 1998). More than 40 percent of the variance is

Manufacturing strategy infrastructural decision areas	Cronbach's α	Eigen-value	Percent var. explained	Interclass correlation
Human resource (HR) systems: empowerment	0.84	2.29	76.22	0.61
Broader range of tasks				
Planning responsibility				
Inspection/quality responsibility				
HR systems: workforce development progs.	0.72	1.97	0.72	0.70
Labor/management relationships				
Direct labor motivation				
Worker safety				
Planning systems (MPC)	0.73	2.20	55.14	0.66
Production/inventory control systems				
Purchasing management				
Information systems integration (within mfrg.)				
Information systems integration (among depts.)				
Planning systems (efficiency)	0.68	1.83	61.09	0.35
First-pass yield				
Equipment utilization				
Production schedule				
Planning systems (JIT emphasis)	0.79	2.98	49.67	0.62
Lead-time reduction				
Setup time reduction				
Inventory reduction				
Supplier base reduction				
Vendor quality				
Component reduction				
Quality				0.44
Product attractiveness				
Overall, product quality				
Delegation of authority	0.71	2.14	53.59	0.73
Written performance records				
Records used for employee related decisions				
Strict operating procedures				
Approval signatures required				
Cross functional activities	0.82	3.33[a]	47.59	0.34
(Emphasis on cross-functional decisions)				
Interdepartmental committees				
Temporary task forces				
Liaison personnel				
Master plans				
Inter departmental bargaining				
Product or service decisions				
Capital budget decisions				

Notes: [a]PCA for this construct resulted in a two-component solution, eigenvalue of 2nd component was 1.14; seven-point Likert scales assessing importance on developing capabilities in manufacturing areas; eigenvalues from single construct PCA; each PCA resulted in extraction of a single component

Table V. Constructs for manufacturing strategy infrastructural decision areas: scale items and PCA results

explained by the first factor in all the constructs. We also compute Cronbach's α coefficients (Nunnally and Bernstein, 1994) to assess internal consistency of the constructs and find them to be satisfactory. Three scores are between 0.6 and 0.7 and one is 0.58; the rest are above the 0.70 cut-off commonly used in operations strategy research (Devaraj *et al.*, 2004; Koste *et al.*, 2004). We use principal component scores of constructs for the rest of our statistical analysis. Although a multi-scale confirmatory factor analysis would have enabled assessment of the divergent validity of the scales, we were unable to conduct such analyses owing to our limited sample size.

Statistical analysis

The first part of our analysis is aimed at identifying the way manufacturing firms are grouped on the basis of their competitive business strategies. The idea is to divide the firms among groups based on their scores on the five taxons and assess if the three cluster configuration we propose is supported by the data in our sample. We use *k*-means cluster analysis to test the typology on the basis of the five business strategy constructs. Lehmann (1979) suggests a rule of thumb of between $n/30$ and $n/60$ for the number of clusters, n being the sample size. With a sample size of 101 this means employing a two- or three-cluster analysis. On the basis of the theoretical development of our typology discussed earlier, we seek a three cluster solution.

After identifying three clusters with 26, 44, and 31 firms for our broad-based competitors, differentiators and price leaders, respectively, we validate the make-up of these clusters via an analysis of variance (ANOVA) assessing differences in the external environments of these groups of firms. Following this validation for our cluster analysis, we use cluster membership to examine differences on the groups' scores for manufacturing decision variables. ANOVAs and Tukey *post hoc* tests are employed to assess differences between the clusters on these scores.

Findings

As evident from the cluster centers of the three groups, and based on their scores on the five business strategy variables (Table VII), the results of the ANOVAs, and *post hoc* tests, it is clear that firms in our sample follow three distinct business strategies. We label these clusters broad-based competitors, differentiators, and price leaders to match their descriptions in our conceptual typology. A χ^2 test revealed that none of the three clusters is dominated by any one particular industry. The scores on the five business strategy variables (taxons) broadly match the signs proposed; i.e. the scores differ among the three groups in the expected directions. *Post hoc* test results reveal that for three of the taxons: price, design, and image, there are significant differences among the three clusters. Broad-based competitors and differentiators do not differ

Environmental dynamism	Cronbach's α	Eigen-value	Percent var. explained	Interclass correlation
Products and services becoming outdated	0.86	2.84	70.91	0.80
Innovation of products or services				
Innovation in processes				
Customer tastes and preferences				

Notes: Seven-point Likert scales assessing rate of change in environmental elements; eigenvalue from single construct PCA; PCA resulted in extraction of a single component

Table VI. Constructs for environmental dynamism: scale items and PCA results

Cluster	1 Broad-based competitors		2 Differentiators		3 Price leaders		ANOVA *post hoc* Pairs of clusters 1&2	1&3	2&3
Taxons									
Price	+	0.68	–	−0.53	+	0.18	**	*	**
Quality	+	0.55	0	0.13	–	−0.65		**	**
Design	+	0.80	0	0.28	–	−1.08	**	**	**
Support	+	0.66	0	−0.10	–	−0.41	**	**	
Image	+	0.86	0	0.15	–	−0.91	**	**	**

Notes: Business strategy taxons are measured using first principal component scores for multi item scales; **significant at $\alpha = 0.05$; *significant at $\alpha = 0.10$; Tukey HSD *post hoc* tests conducted for ANOVA results that were significant

Table VII. Cluster wise means on business strategy taxons

significantly on the quality taxon and the differentiators and the price leaders do not differ on the support taxon.

Results comparing the environments faced by firms show that the clusters differ significantly with respect to the degree of environmental dynamism that the three groups encounter (Table VIII). Firms using an all-front business strategy that we call

Cluster	1 Broad-based competitors	2 Differentiators	3 Price leaders	ANOVA *post hoc* comparisons Pairs of clusters 1&2	1&3	2&3
Environmental dynamism	0.57	0.10	−0.61		**	**
Manufacturing strategic decision areas						
Structural decisions						
Capacity	0.07	−0.11	0.08			
Manufacturing technology	0.33	0.04	−0.38		**	
Supplier management	0.40	0.00	−0.50		**	
New product development						
Features	0.39	0.17	−0.62		**	**
Quality	0.64	−0.12	−0.40	**	**	
Infrastructural decisions						
Workforce empowerment	0.64	−0.12	−0.37	**	**	
Workforce development programs	0.40	−0.21	−0.09	**		
Manufacturing planning and control systems	0.36	−0.01	−0.27		**	
Systems efficiency	0.41	−0.13	−0.21		*	
Just in time	0.52	−0.06	−0.35	**	**	
Quality	0.53	0.09	−0.59		**	**
Delegation	0.35	−0.09	−0.16			
Cross-functional activities	0.33	0.09	−0.30		*	

Notes: Environment and manufacturing strategy are measured using first principal component scores for multi item scales; **significant at $\alpha = 0.05$; *significant at $\alpha = 0.10$; Tukey HSD *post hoc* tests conducted for ANOVA results that were significant

Table VIII. Cluster wise means on environment and manufacturing strategy decisions broad-based operate in environments with the highest degree of dynamism. Price leader firms operate in stable environments and differ significantly from the other two categories as indicated by the results of the *post hoc* Tukey tests. The results thus confirm our expectations regarding alignment between business strategy and environmental dynamism that are based on extant literature (Hambrick, 1983; Miller, 1988). This evidence also serves as external validation that the clusters that we derive from our sample represent groups of firms that have different business strategy characteristics as hypothesized in our conceptual typology.

ANOVAs and Tukey tests are conducted to assess differences among the three groups with respect to their manufacturing decision areas (Table VIII). The ANOVA results are significant for all the factors except capacity and delegation, indicating that the three groups differ in their strategic manufacturing decisions on 11 of 13 dimensions. In *post hoc* tests, broad-based competitors and price leaders differ significantly on ten of the manufacturing decision variables (see the column labeled "1&3" in Table VIII). Price leaders have significantly lower scores than differentiators on NPD features, and quality systems (Table VIII: "2&3" column). Firms in the broad-based competitors category distinguish themselves with significantly higher scores than those of the differentiators (Table VIII: "1&2" column) in NPD quality and in the use of JIT and worker empowerment and development programs.

Discussion

Our classification of firms based on business strategy objectives is built upon classifications of previous researchers (Hill, 1988; Mintzberg, 1988; Ward *et al.*, 1996). Mintzberg's (1988) model of generic strategies divided firms into five categories of differentiators on the basis of price, quality, image, product design, and service support, and a sixth category reflecting firms that did not emphasize any single dimension. Our classification differentiates between firms that concentrate on price as a competitive weapon, those that de-emphasize price and distinguish themselves on the other four factors, and those that seek to excel in all five factors.

The main purpose of our study was to assess if the conceptually derived clustering on business strategy dimensions could be used to distinguish between the types of investment decisions made by firms in the different groups in structural and infrastructural areas of manufacturing. Our results show significant differences in almost all content areas of manufacturing decisions between the broad-based and the price clusters, with the broad-based group having the higher scores. We expected price leader firms to have the highest investments in capacity, given that expansions occur in large jumps in such firms. However, we do not find a significant difference on this variable, indicating that the three groups emphasize this area almost equally. Regarding development of new products, price leaders are found to be significantly lower than the other two groups in the variety of features that they seek to develop, while broad-based competitors score significantly higher with respect to the quality of such developments. Firms in the broad-based competitors group also show a higher degree of emphasis than both the other groups on workforce empowerment and development programs, and JIT. Price leader firms score significantly lower than the other two groups on quality. These results point to the significant distinction between firms that seem to be following the principles of lean management (Womack *et al.*, 1990) and those that emphasize low-price mass production.

Surprisingly, with regard to the authority structure, we do not find a significant difference between the degrees of delegation among the three groups, although the level of cross-functional activities is significantly higher in broad-based competitor firms than in price leaders. Overall, our empirical results point to differences in emphasis in a larger number of infrastructure areas as compared to structural areas of manufacturing. Our results are consistent with those of Schroeder *et al.* (1986) who found that more attention is paid by manufacturing managers to decisions in softer infrastructure areas than structural areas, and that manufacturing policies do flow from business strategies. The second result is also consistent with Acur *et al.*'s (2003) findings. The limited number of structural manufacturing decision areas in which we found differences among the three business strategy groups may be explained by the fact that firms representing each of the three business strategy gestalts pursue structural investments to similar extents on average. Perhaps, they have realized that sustainable competitive advantage requires building of difficult-to-imitate softer infrastructure areas of manufacturing that deal with building human capital (Hatch and Dyer, 2004) and creating knowledge creation capabilities (Linderman *et al.*, 2004).

Limitations and future research

We were constrained by the size of our sample from deriving performance implications of "fit" between business strategy and manufacturing decisions. Further, research can explore the idea that alignment predicts performance within the business strategy groups. This can be done using separate regressions predicting performance based on strategic manufacturing decisions within each of the clusters, or by dividing high- and low-performing firms within each of the clusters to analyze business strategy – manufacturing decision area relationships.

Further, more extensive measures of the external environment would have enabled us to study their implications for business strategy and manufacturing. We used one environmental variable, dynamism, as a validation check for our business strategy clustering approach. However, the environmental variables munificence and complexity could also be used in conjunction with dynamism to look for configurations of "environment – business strategy – manufacturing decisions." This will allow for a richer examination of how firms configure their internal operating environment to fit their external environmental conditions. In addition, future research should refer to the ongoing stream of research on external environment measurement, to ensure continued validity and reliability of the constructs employed in manufacturing configurational research.

Measures for the infrastructural and structural decision areas in manufacturing also need to be further developed as does the measure for the price variable in business strategy, which had a low-reliability score. Scale development plays an important part in manufacturing strategy research, since firms are often reluctant to provide archival manufacturing-related data. In addition, scales for manufacturing strategy competitive priorities that are adequately divergent from measures of manufacturing investment would increase the specificity of research in the area.

Implications

Notwithstanding these limitations, our study does suggest that firms formulate their strategic decisions and action plans in manufacturing in conjunction with their business strategy. Our empirical findings suggest that manufacturing capabilities are indeed bundled to conform to the strategic direction of the firm as literature and logic suggest. We might also infer that companies that pursue price leadership without other differentiating capabilities appear to be at an operational disadvantage particularly when compared to broad-based competitors. Our data indicate that "pure" price competitors develop no apparent price advantage over their broad-based competitors. Rather, they have serious deficits in their relative efforts to build manufacturing capabilities, both structurally and infrastructurally. More generally, we observe real differences in firms' strategic approaches to manufacturing, and these differences appear to be clearly tied to business strategies.

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Appendix

Business strategy

Rate the following competitive methods based on how important they are in meeting your business strategy

	No important		*Very importantce*			*Absolutely critical*	
Price							
Operating efficiency	1	2	3	4	5	6	7
Procurement of raw materials	1	2	3	4	5	6	7
Competitive pricing	1	2	3	4	5	6	7
Quality							
Product performance	1	2	3	4	5	6	7
Product features	1	2	3	4	5	6	7
Product reliability	1	2	3	4	5	6	7
Product conformance to specifications	1	2	3	4	5	6	7
Product durability	1	2	3	4	5	6	7
Product serviceability	1	2	3	4	5	6	7
Design							
Developing/refining existing products	1	2	3	4	5	6	7
Innovation in manufacturing processes	1	2	3	4	5	6	7
New product development	1	2	3	4	5	6	7
Innovation in products or services	1	2	3	4	5	6	7
Beating the competition to market with new products or services	1	2	3	4	5	6	7
Support							
A high level of customer service	1	2	3	4	5	6	7
Rapid delivery speed	1	2	3	4	5	6	7
Dependable delivery	1	2	3	4	5	6	7
Image							
Broad range of products	1	2	3	4	5	6	7
Brand identification	1	2	3	4	5	6	7
Innovation in marketing techniques and methods	1	2	3	4	5	6	7
Control of distribution channels	1	2	3	4	5	6	7
Extensive use of advertising	1	2	3	4	5	6	7
Forecasting market growth	1	2	3	4	5	6	7

Environmental dynamism

Indicate the rate of change for the following

	Slow						*Rapid*
The rate at which products and services become outdated	1	2	3	4	5	6	7
The rate of innovation of new products or services	1	2	3	4	5	6	7
The rate of innovation of new operating processes	1	2	3	4	5	6	7
The tastes and preferences of customers in your industry	1	2	3	4	5	6	7

Manufacturing strategy decision areas

Capacity

Indicate the degree of emphasis which the business unit plans to place on the following activities over the next two years

	No emphasis		*Moderate emphasis*			*Extreme emphasis*	
Capacity expansion	1	2	3	4	5	6	7
Plant relocation	1	2	3	4	5	6	7

(continued)

Table AI. Scales

Reconditioning of physical plants	1	2	3	4	5	6	7
Sourcing and vertical integration							
Indicate the degree of emphasis which your manufacturing plant plans to place on the following activities or areas in the next two years							
	No emphasis			*Moderate emphasis*			*Extreme emphasis*
Electronic data interchange (EDI)	1	2	3	4	5	6	7
Purchasing management	1	2	3	4	5	6	7
Reducing the number of suppliers	1	2	3	4	5	6	7
Reducing the number of parts and components	1	2	3	4	5	6	7
Facilities/manufacturing technology							
Indicate the degree of emphasis which your manufacturing plant plans to place on the following activities in the next two years							
	No emphasis			*Moderate emphasis*			*Extreme emphasis*
Computer-aided design (CAD)	1	2	3	4	5	6	7
Robotics	1	2	3	4	5	6	7
Developing new processes for new products	1	2	3	4	5	6	7
Group technology (GT)	1	2	3	4	5	6	7
Flexible manufacturing systems (FMS)	1	2	3	4	5	6	7
New product development (features)							
Indicate the importance of the following reasons for undertaking new product development							
	No importance			*Very important*			*Absolutely critical*
Improve product performance	1	2	3	4	5	6	7
Improve features offered to customers	1	2	3	4	5	6	7
Increase the number of features offered to customers	1	2	3	4	5	6	7
Increase product attractiveness	1	2	3	4	5	6	7
New product development (quality)							
Eliminate design errors	1	2	3	4	5	6	7
Improve product reliability	1	2	3	4	5	6	7
Improve product conformance to specifications	1	2	3	4	5	6	7
Improve product durability	1	2	3	4	5	6	7
Improve product serviceability	1	2	3	4	5	6	7
Improve product manufacturability	1	2	3	4	5	6	7
Human resource systems: empowerment							
Indicate the degree of emphasis which your manufacturing plant plans to place on the following activities in the next two years							
	No emphasis			*Moderate emphasis*			*Extreme emphasis*
Giving workers a broader range of tasks	1	2	3	4	5	6	7
Giving workers more planning responsibility	1	2	3	4	5	6	7
Giving workers more inspection/quality responsibility	1	2	3	4	5	6	7
Human resource systems: workforce development programs							
Changing labor/management relationships	1	2	3	4	5	6	7
Improving direct labor motivation	1	2	3	4	5	6	7
Improving worker safety	1	2	3	4	5	6	7
Planning systems (manufacturing planning and control: MPC)							
Indicate the degree of emphasis which your manufacturing plant plans to place on the following activities or areas in the next two years							

(*continued*)

Table AI.

	No emphasis			*Moderate emphasis*		*Extreme emphasis*	
Production/inventory control systems	1	2	3	4	5	6	7
Purchasing management	1	2	3	4	5	6	7
Integrating manufacturing information systems	1	2	3	4	5	6	7
Integrating information systems across departments	1	2	3	4	5	6	7
Planning systems (efficiency)							
Increasing first-pass yield	1	2	3	4	5	6	7
Increasing equipment utilization	1	2	3	4	5	6	7
Improving performance in meeting the production schedule	1	2	3	4	5	6	7
Planning systems (JIT emphasis)							
Lead-time reduction	1	2	3	4	5	6	7
Setup time reduction	1	2	3	4	5	6	7
Inventory reduction	1	2	3	4	5	6	7
Reducing the number of suppliers	1	2	3	4	5	6	7
Improving vendor quality	1	2	3	4	5	6	7
Reducing the number of parts and components	1	2	3	4	5	6	7
Quality							
Product attractiveness as perceived by the customer	1	2	3	4	5	6	7
Overall product quality as perceived by the customer	1	2	3	4	5	6	7
Delegation of authority							
Answer the following statements pertaining to production workers at your plant							
	Strongly disagree			*Neutral*		*Strongly agree*	
The organization keeps a written record of employee's job performance	1	2	3	4	5	6	7
The employee's written record is considered seriously when making employee related decisions	1	2	3	4	5	6	7
Employees are to adhere to strict operating procedures at all times	1	2	3	4	5	6	7
Approval signatures are needed for work to proceed from one stage to the next	1	2	3	4	5	6	7
Cross functional activities							
In assuring the compatibility among decisions in one area (e.g. marketing) with those in other areas (e.g. production), to what extent are the following used?							
		Rarely			*Frequently*		
Interdepartmental committees which allow departments to engage in joint decision making	1	2	3	4	5	6	7
Temporary task forces to facilitate interdepartmental collaboration on a specific project	1	2	3	4	5	6	7
Liaison personnel to coordinate the efforts of several departments on a specific project	1	2	3	4	5	6	7
Master plans used as coordinating devices	1	2	3	4	5	6	7
Bargaining among department heads	1	2	3	4	5	6	7
To what extent are the following decisions based on participative, cross-functional discussions?							
		Rarely				*Frequently*	
Product or service decisions concerning production, marketing, and R&D strategies	1	2	3	4	5	6	7
Capital budget decisions: the selection and financing of long-term investments	1	2	3	4	5	6	7

Table AI.