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Full Length Research Paper

A taxonomy of manufacturing strategies: A study of the Turkish automotive industry

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The aim of this study is to explore the existence of different patterns of manufacturing strategies and the relationship between these patterns and firm performance in the Turkish automotive industry. Apart from the scarce taxonomic studies in the operations strategy literature, this research focuses on a single industry and examines the relationship between the firm ownership and strategic types. Three different strategic types (differentiators, intermediators and low emphasizers) are identified based on taxonomy of 31 international and leading automotive firms operating in Turkey. The three types do not differ from each other in terms of ownership, but they do differ significantly in terms of growth performance. Furthermore, it is observed that the findings partially support the sand cone model and the underlying dimensions that described West European manufacturers.

Key words: Manufacturing strategy, taxonomy, performance, ownership, automotive industry.

INTRODUCTION

Since Skinner (1969) has emphasized the importance of a strategic alignment of the manufacturing function, manufacturing strategy has received significant attention among researchers from strategic and operations management. Although many studies have been carried out on manufacturing strategies, relatively little research has focused on the identification of taxonomies of manufacturing strategies (Frohlich and Dixon, 2001; Zhao et al., 2006). The aim of taxonomies is to classify and name many different items into groups that share common features. Taxonomies provide a parsimonious description of strategic groups, which is practical in discussion, research and pedagogy, and reveal some insights into the underlying structures of competition from the viewpoint of manufacturing function (Miller and Roth, 1994). The complexities of the phenomena might be effectively understood, evaluated and analyzed since a useful taxonomy reduces the complexity of the empirical phenomena to few and 'simple to remember' types (De Jong and Marsili, 2006). Taxonomies also serve as an aid to theory building and a tool to meaningfully capture the complexities of organizational reality (Frohlich and Dixon, 2001). The identification of strategic groups relying on taxonomies is a significant research theme in the strategy literature (Bozarth and McDermott, 1998; Miller and Roth, 1994). Porter (1980) describes strategic groups as a group of firms following similar strategies along strategic dimensions and denotes that this provides a reference framework between observing the industry as a whole and considering each firm individually. Hence, performance differences between firms in the same industry could be explained on the basis of the strategic group model. Moreover, the model provides an opportu-nity for the examination of differences between the outcomes of various organizations with equal sizes (Martin-Pena and Diaz-Garrido, 2008).

Although taxonomies have attracted an increasing attention after the studies of Bozarth and McDermott (1998) and Frohlich and Dixon (2001), researches dealing with taxonomy in manufacturing strategy are fairly recent and still relatively sparse (Kathuria, 2000; Sum et al., 2004; Zhao et al., 2006). Miller and Roth's taxonomy published in 1994 is one of the most influential frame-works in the manufacturing strategy literature (Frohlich and Dixon 2001; Zhao et al., 2006). Miller and Roth (1994) conducted an empirical study based on a sample of 188 manufacturers from different industries in the USA, using eleven competitive capabilities, defined as manufacturing task. A cluster analysis was run and three strategic groups of manufacturers were identified according

to their manufacturing strategies: caretakers, marketeers and innovators. Frohlich and Dixon (2001) and Zhao et al. (2006) replicated Miller and Roth's taxonomy. Kathuria (2000), Christiansen et al. (2003) and Sum et al. (2004) also developed a taxonomy based on the emphasis given to several competitive priorities such as cost, quality, flexibility and delivery. The taxonomies identified by these researchers are quite different from both the findings of Miller and Roth together and Miller and Roth separately.

Nevertheless, these results strongly confirm the views of Frohlich and Dixon (2001) that the manufacturing stra-tegies could change over time, and that firms in different locations of the world can adopt different manufacturing strategies.

Furthermore, taxonomic studies on manufacturing stra-tegy rely on the multi-industry surveys (Martin-Pena and Diaz-Garrido, 2008). Porter (1980) emphasizes that the strategies which firms utilize can differ in a wide range in order to compete in the same industry. Kathuria (2000), Miller and Roth (1994) and Sum et al. (2004) findings also confirm that different manufacturing strategic groups are present within the same industry.

It is possible that, besides the country context, the different results may be due to industry related factors, such as competition intensity and predominant process structure. Therefore, existing taxonomies may not be applicable to all countries and manufacturing industries. As a result of this dynamic nature of manufacturing stra-tegy, authors (Frohlich and Dixon, 2001; Miller and Roth, 1994) encouraged researchers to identify taxonomies of manufacturing strategies over time and in different settings.

This study attempts to extend the existing studies by identifying taxonomy of manufacturing strategies empha-sized by firms, in a specific industrial sector, located in a newly industrialized country, that is, Turkish automotive industry.

Many researchers have argued that firms' strategies and implementations may differ according to their ownership structure (Amoako-Gyampah, 2003; Kotha and Swamidass, 1998; Schroder and Sohal, 1999). Considering the fact that the impact of firm ownership on manufacturing strategies has not been investigated both in the taxonomy studies and automotive industry, this study also aims to examine the relationships between the performance and ownership structure of the firms and strategic groups obtained.

This study makes two major contributions, even though the previous studies do not provide adequate specific information about manufacturing strategic groups in the automotive industry. Moreover, to have a better under-standing of the relationship between strategic types, ownership and performance in the industry, the results of this study contribute to the manufacturing strategy literature in that a preliminary taxonomy of competitive capabilities in the automotive industry is identified.

LITERATURE REVIEW

Manufacturing strategy and industry

Hayes and Wheelwright (1984) describe manufacturing strategy as the pattern of decisions by the manufacturing function that guides structural and infrastructural choices to support the overall firm objectives. Manufacturing stra-tegy consists of two components: process and content. Manufacturing strategy content refers to the competitive capabilities and the strategic decision categories, while manufacturing strategy process focuses on the develop-ment and implementation of manufacturing strategies in order to increase the competitive capabilities (Hallgren and Olhager, 2006; Leong et al., 1990; Safsten et al., 2007).

The competitive priorities have been identified as the dimensions of manufacturing strategy (Swamidass and Newell, 1987), as a consistent set of goals for manu-facturing (Leong et al., 1990) or as strategic preferences in which a firm chooses to compete in the market (Hayes and Wheelwright, 1984). Several other terms have been used in the literature to refer to competitive priorities such as manufacturing tasks (Skinner, 1969), competitive capabilities (Ferdows and De Meyer, 1990), production competences (Cleveland et al., 1989) or order winners and qualifiers (Hill, 1993). Despite semantic differences, the competitive priorities most commonly mentioned in the relevant literature are cost (price), quality, flexibility and delivery (Ferdows and De Meyer, 1990; Hayes and Wheelwright, 1984; Kathuria, 2000; Ward and Duray, 2000). In most of the taxonomic studies (Miller and Roth, 1994; Zhao et al., 2006), in addition to these capabilities, after-sale services are also included. Even in this study, competitive capabilities which have been utilized in the previous taxonomy studies and presented in Table 1, have been employed in determining manufacturing strategies in the Turkish automotive industry.

Porter (1980) denotes that different strategic groups may exist within the same industry. Similarly, Hayes and Wheelwright (1984) stress that, within a particular industry, different firms differ in the emphasis given to each capabilities. Kathuria (2000) and Sum et al. (2004) find that firms use different competitive priorities so as to compete in the same industry. Miller and Roth (1994), in a detailed examination of their sample at the three digit SIC, find that at least one competitor uses a substantially different basis to compete than its primary competitors. These clearly show that there are different strategic groups in every industry.

On the other hand, taxonomic studies in the operations strategy literature have identified different groups with the collected data from very different industries (Martin-Pena and Diaz-Garrido, 2008). Though manufacturing firms take place in industrial sectors, they might have diverse industrial activities. In other words, there have been se-parate predominant process structures in manufacturing

Table 1. Common competitive capabilities employed in taxonomic studies.

Competitive capabilities		Definition
Price	Low price	The capability to compete on price
Quality	Performance quality	The capability to provide high performance products
	Conformance quality	The capability to offer consistent quality
Flexibility	Broad product line	The capability to deliver a broad product line
	Volume flexibility	The capability to respond to swings in volume
	Design flexibility	The capability to make rapid design changes
Delivery	Delivery speed	The capability to deliver products quickly
	Delivery dependability	The capability to deliver on time (as promised)
Service	After-sales service	The capability to provide after sales service

firms. Therefore, their inherent advantages could exist in obtaining competitive capabilities in terms of process structure (Hayes and Wheelwright, 1979). Swamidass and Newell (1987) point out that process type and industry are two variables which could profoundly in-fluence manufacturing strategies. Safizadeh et al. (1996) find that there is a strong correlation between process structure and competitive priorities. Therefore, the lessons from multi-industries such as textile and garment, chemicals and petroleum, machinery and equipment, metal product etc. may not be applicable to the auto-motive industry. In other words, the existing taxonomy studies do not provide adequate specific information about manufacturing strategic groups in that industry.

Also, the taxonomic studies in the operations manage-ment (Miller and Roth, 1994; Kathuria, 2000; Frohlich and Dixon, 2001) also encouraged researchers to test the taxonomies over time and in different settings. The questions of whether or not there are different types among automotive firms, in terms of their manufacturing strategies and their strategic patterns that are different or similar to those of previous taxonomic researches, will be examined in the first hypothesis:

H_1: Turkish automotive firms can be classified into different strategic groups based on their emphasis on competitive capabilities.

Ownership

Schroder and Sohal (1999) observe that principal ownership of firms by a country reflects the differences in management styles, strategies and practices based on a country or national culture. Bates et al. (1995), in the work carried out in American-owned and Japanese-owned plants located in the US, denote that there is a relationship between manufacturing strategies and organizational culture. Kotha and Swamidass (1998) stress that there is a strategic bias towards cost and quality in Japanese firms in contrast to the US firms' short term oriented low cost strategies. Robb and Xie (2001) conducted an empirical study based on a sample of 46 enterprises (13 foreign and 33 local owned firms from a variety of industries in China). The authors reported fundamental differences in terms of manufacturing prac-tices and priorities between two ownership structures. Amoako-Gyampah (2003) stated that joint venture firms are more likely to have easier access to capital and other resources. Also, Amoako-Gyampah monitored that manufacturing strategies emphasized by joint venture firms are different from those emphasized by local owned firms, especially when business environment is getting harsh. These show that heterogeneity in diverse resource endowments, competition perceptions and parent country's culture have impact on the manufacturing strategies. The relationship between ownership structure and strategic groups, however, is not examined in the previous taxonomy studies.

Automotive firms compete in a complex and uncertain environment with growing global competition. Turkish firms have been facing serious competition since the beginning of the economical reforms in the 1980's and joining the Customs Union of the EU in 1996. Currently, there are over 40 firms, competing in Turkish automotive industry. Furthermore, as a result of global competition and EU membership process, there has been increased collaborative arrangements and strategic partnerships between the Turkish and foreign manufacturers in the automotive industry (Wasti et al., 2005). There are currently 17 assemblers, 11 of which are foreign owned or joint ventures operating in Turkey, while there are approximately 200 foreign partnerships in the industry (OSD, 2010; TAYSAD, 2008).

The automotive industry is an industry where custo-mers and suppliers from different countries are in close

relationships (Burgess and Gules, 1998; Liu et al., 2004). Turkish automotive firms have improved their manufacturing capabilities such as quality, delivery and flexibility in order to respond to the requirements of foreign partners and the pressures of global competition (Burgess and Gules, 1998).

Therefore, it is possible that the relationship between ownership and manufacturing strategies may not be valid for the automotive industry due to its specific nature. Nonetheless, this study has explored if the manufacturing strategy of automotive firms differ in accordance with their ownership structure given by hypothesis 2.

H_2: There is a significant difference among manufacturing strategic groups in terms of firm ownership.

Performance

In fact, there are considerable numbers of theoretical and empirical studies showing that capabilities such as quality, cost, service, delivery and flexibility, either used alone or collaborating with other capabilities, lead to improved performance (Hayes and Upton, 1998; Tracey et al., 1999). However, the adverse results have been reported as well in the literature (Diaz et al., 2003; Swamidass and Kotha, 1998).

In the taxonomy studies, Sum et al. (2004) have reached that there are significant differences among strategic groups identified in terms of the overall firm performance. Youndt et al. (1996), however, report that the strategic clusters do not directly have an impact on manufacturing performance. Kathuria's (2000) strategic groups are different from each other in terms of only customer satisfaction and quality of work from seven managerial performance variables. Zhao et al. (2006) find that their strategic types are not significantly different in any of the financial performance measures.

Clearly, the previous studies produced conflicting results regarding the relationship between performance and strategic types, and they do not provide particular information for the automotive firms. In recent years, Turkish automotive industry succeeded to reach the inter-national standards. Its increasing performance rewarded the industry as the Europe's sixth and the world's sixteenth biggest automotive industry (OSD, 2010; TAYSAD, 2008).

In order to understand what strategic types are associated with superior firm performance and provide evidence to the operations management literature from a single industry, the following hypothesis will be examined despite the reciprocal findings between firm performance and manufacturing strategy.

H_3: There is a significant difference among manufacturing strategic groups in terms of firm performance.

RESEARCH METHODOLOGY

Survey instrument

This research is a cross-sectional study based on a questionnaire survey methodology. A survey instrument was developed based on the literature and refined as follows: (i) All items in the questionnaire were adapted from prior studies. (ii) After several internal revisions, the new draft version of the questionnaire was reviewed by two academicians familiar with psychometric measurement, who examined the logic of the questionnaire design. Draft questionnaire was then discussed with academicians who had experience in operations to assess the content validity prior to pilot testing. (iii) A pilot test was conducted with four managers, whose inputs were used to improve the clarity, comprehensiveness and relevance of the instrument.

To measure the manufacturing strategy of firms, competitive capabilities defined by Miller and Roth (1994), used by Frohlich and Dixon (2001) and Zhao et al. (2006) and presented in Table 1, have been utilized. The respondents were asked to indicate the importance degree of each competitive capability. The importance given to each of the capabilities has been measured with a scale ranging from 1 to 5, where '1' represents 'not important', '3' repre-sents 'moderately important' and '5' represents 'critically important'.

Firm performance was measured from a non-financial perspective in the study because firms could be reluctant to answer objective performance questions (Boyer et al., 1996; Ward and Duray, 2000). Firm performance included four common financial and/or marketing indicators: Market share growth, sales growth, return on investment (ROI) and return on sales (ROS). The first two items reflect growth, while the latter two items reflect profitability. These items have been used in previous studies (Boyer et al., 1997; Curkovic et al., 2000; Swamidass and Newell, 1987; Vickery et al., 1993). Performance items based on the managers' asses-sment of the firm performance is relative to its major competitors on a five point Likert scale with '1' representing 'significantly worse than competitors', '3' representing 'about the same sacompetitors' and '5' representing 'significantly better than competitors'. Prior researches indicate that managerial assessments correspond closely to the objective data (Boyer et al., 1997; Powell and Dent-Micallef, 1997) and managers well-acquainted with performance data can provide an accurate subjective assessment (Choi and Eboch, 1998). The study also examined the correlation between perceptual and objective measures. The results showed a high positive correlation (r = 0.772; p<0.001) between the subjective measure of sales growth and the annual sales obtained from ISO 1000 database.

Sample firms and respondents

The survey was conducted among firms whose products were grouped in the ISIC 384 as a 'transport equipment manufacturing' listed in Turkey's leading 1000 industrial enterprises (namely ISO 1000) database. The main reason for choosing ISO 1000 as a sam-ple is to obtain accurate and rich data from reliable and consistent sources. Furthermore, in the study, key informants were used to obtain the necessary data and enhance the likelihood of valid and reliable data. The production or plant managers in the firms were determined as key informants, who were similar to samples used in studies on operations management (Boyer et al., 1996; Zhao et al., 2006).

A total of 74 firms were listed in the ISIC 384 category of the2007 ISO database. In the first stage of the data collection process, the names of plants or production managers have been ascertained from the websites of firms. The questionnaire was then sent out to 74 managers, along with a personalized cover letter explaining the

Table 2. Comparisons between responding firms and non-responding firms.

Characteristic	Respondent	Non-respondent	
No. of employees			
Mean	1289	755	$t = 1.795$
S.E.	289	142	$p > 0.05$
Annual sales ($)			
Mean	434.972.889	118.626.886	$t = 1.999$
S.E.	153.325.472	39.076.027	$p > 0.05$

objective of the study. A pre-addressed and stamped envelope was also enclosed. Nonetheless, 24 fully completed and usable questionnaires were returned within the following six weeks. Although this meant that the response rate was over 32%, reminder mails were sent out to the managers once more and they waited for four more weeks for a response. Moreover, 7 more questionnaires were received over this time. Consequently, the data collection resulted in 31 (42%) usable responses. The sample size is similar to that of the other studies on manufacturing strategy based on the single industry (Diaz et al. 2003; Swamidass and Newell, 1987).

The responding firms included 9 (29%) automobile assemblers and 22 (71%) parts and component manufacturers. Respondents have an average of 1289 employees with the smallest firm employing 233 and the largest having 8000 employees. About 29% of the firms employed were between 233 and 500 employees. Approximately, half (48.4%) of the firms were wholly Turkish owned, 12 (38.7%) were joint venture firms and the rest four (12.9%) were wholly foreign owned firms.

Two methods were used to assess non-response bias. The first method consisted of a comparison between the early respondents and the late respondents. No significant differences were found between them regarding sales figures, manufacturing strategy and firm performance items. The second method involved comparing the annual sales and number of employees of the responding and non-responding firms. The firms' sales and numbers of employees were provided from the ISO 1000 database. The *t*-statistics in Table 2 did not show any significant differences ($p > 0.05$) between the two groups, which means that non-response bias is not a factor.

ANALYSES AND FINDINGS

A taxonomy of manufacturing strategies in the automotive industry

As stated before, the main purpose of this study is to identify whether or not there are different types of taxonomies among Turkish automotive firms in terms of their manufacturing strategies. Cluster analysis is used to develop the taxonomy based on the importance placed on the competitive capabilities. Cluster analysis is frequently employed in the literature to identify classes or clusters of objects because it provides efficient solutions. To develop taxonomy, both hierarchical and non-hierarchical cluster procedures are used in this study as recommended in the literature (Hair et al., 1998; Ketchen and Shook, 1996). Firstly, hierarchical clustering is run by applying Ward's method as cluster method and squared Euclidean distance as distance measure due to its ability to robustly minimize intra-cluster differences and maximize inter-cluster differences among the variables used for clustering (De Jong and Marsili, 2006; Frohlich and Dixon, 2001). However, it is the most often used hierarchical method in strategy researches (Ketchen and Shook, 1996).

One of the key questions in cluster analysis is: how many clusters are to be used? In order to determine the number of clusters, the study considered the dendogram and agglomeration coefficient as the relatively few firms that were surveyed, while the Lehmann's rule (n/30 and n/60) was clearly inapplicable. A large increase or percentage change in the agglomeration coefficient indicates a fairly good cutoff point (Hair et al., 1998; Ketchen and Shook, 1996). As seen from Table 3, the coefficients show rather large increases from three to two clusters (111.4 to 86.9 = 24.5) and two to one cluster (186.1 to 111.4 = 74.7). The largest difference among percentages of change occurs in three clusters. In the visual inspection of the hierarchical dendogram, it has been seen that the firms were clearly differentiated on the basis of their manufacturing strategies into three groups. Eventually, based on the dendogram and the change in agglomeration coefficients, the appropriate number of clusters was found to be three. After specifying the number of clusters as three, the k-means clustering algo-rithm was run to fine-tune the results from the hierarchical procedure. A comparison of the non-hierarchical and hierarchical cluster solution found that 100% of the cases are placed in the same cluster by the two methods. This indicated the reliability and stability of the cluster solution (Hair et al., 1998).

In order to assess the differences among the three clusters, firstly, a one-way ANOVA was performed. Secondly, Scheffe multiple comparison tests were conducted to test for differences between individual pairs of groups. Table 4 presents the cluster means, standard errors and relative rankings of the competitive capabilities within each cluster and the results of the ANOVA and Scheffe tests. The results of ANOVA indicate that the means of all the nine capabilities are significantly different ($p<0.01$ or $p<0.05$) across the three clusters.

Furthermore, the Scheffe pairwise comparison of the

Table 3. Analysis of agglomeration coefficients.

No. of cluster	Agglomeration coefficient	Percentage change in the coefficient	Differences between percentage changes
8	44.619	12.1	1.2
7	50.019	13.3	1.1
6	56.690	14.4	1.9
5	64.857	16.3	-1.1
4	75.488	15.2	12.9
3	86.971	28.1	38.9
2	111.446	67.0	
1	186.193		

mean differences, at the p=0.05 level or below, indicated that while 48% of the group means were different from all of the other two group means, 45% were different from one of the two groups, and only 7% were not different from each other. These results indicate that each cluster is distinct from the others. This finding provides support for H1 which states that Turkish automotive firms can be classified into different strategic groups based on their emphasis on capabilities. The graphical presentation of the relative emphasis given on mean by the members of the three clusters is shown in Figure 1. Each of the three distinct clusters represents unique manufacturing strategy configurations (Figure 1).

Labeling clusters

The three strategic types are named: differentiators (Cluster 1), intermediators (Cluster 2) and low emphasizers (Cluster 3). The interpretation and labeling of the three manufacturing strategies represented by the clusters were based on: (i) the cluster means of the competitive capability among clusters, (ii) the relative importance and relative ranks of a capability within a cluster, and (iii) a comparison of the findings with those of the prior researches.

Differentiators

Nine firms took place in the first cluster known as ‘differentiators’ and they represent about 29% of het entire sample. This group has the strongest emphasis on all of the capabilities (except low price) among the three clusters (Table 4). Besides, if it is taken into consideration that the highest possible rating for the scale is 5, it can be said that differentiators place a critically emphasis on all of the capabilities. On the other hand, differentiators are the cluster that places the lowest importance on price, even below the industry mean. The differentiators place the price was compared to cluster 3. They also place significantly higher emphasis to service, dependability significantly higher emphasis on all of the capabilities, but and broad product line compared to cluster 2. However, price is given significantly lower importance by cluster 2.

The correspondence of this cluster with Porter’s (1985) differentiation strategy is considerably noticeable. The means and the ranks of capabilities in Table 4 show that this cluster aims to supply customer needs through product and market differentiation by placing a critical emphasis on service, quality, delivery and flexibility capabilities. Thus, the first cluster was called differentiators. They also partially resemble the differentiator group of Sum et al. (2004) in terms of the cluster means, even if it is not in terms of the relative ranks.

With respect to the relative rankings of the capabilities, there is a statistical similarity (r_S = 0.717; p = 0.030) with the servers in Frohlich and Dixon (2001). Particularly, both clusters place the highest importance on service and the second highest on performance quality. Nevertheless, the servers place the least importance on the flexibility capabilities (broad product line, design and volume flexibility), whereas differentiators place the least importance on low price. Besides, these two clusters differ from each other with regard to means of all capabilities.

Intermediators

The second cluster is the largest group with 15 firms, accounting for about 48% of the entire sample. Table 4 shows that this cluster places significantly higher em-phasis on all of the capabilities except price and design flexibility when compared to cluster 3 (low emphasizers) and the means of all capabilities change between 3.40 and 4.60. On the other hand, their means that are em-phasized on all of the competitive capabilities (except low price) are lower than that of the differentiators. Hence, this cluster is known as intermediators.

Although the intermediators place the highest im-portance on the price across the three clusters, low price ranks after performance quality within the cluster. Thus

Table 4. Competitive capabilities by cluster: The results of ANOVA and Scheffe tests.

Competitive capability	Overall	Differentiators (cluster 1, n=9)	Intermediators (cluster 2, n=15)	Lowers (cluster 3, n = 7)	
1. Low price	3.935[a]	[2][b]	[1]		
Cluster mean		3.111	4.466	3.857	
S.E.		0.200	0.133	0.340	*F*=12.67
Rank		9[c]	2	1	*P*=0.000
2. Performance qua.	4.483	[3]	[3]	[1, 2]	
Cluster mean		4.888	4.600	3.714	
S.E.		0.111	0.130	0.285	*F*=10.29
Rank		2	1	2	*P*=0.000
3. Conformance qua.	4.193	[3]	[3]	[1, 2]	
Cluster mean		4.555	4.266	3.571	
S.E.		0.175	0.118	0.202	*F*=8.08
Rank		5	3	3	*P*=0.002
4.After-sales service	4.129	[2, 3]	[1, 3]	[1, 2]	
Cluster mean		5.000	4.133	3.000	
S.E.		0.000	0.133	0.218	*F*=38.46
Rank		1	5	5	*P*=0.000
5. Broad product line	3.806	[2, 3]	[1, 3]	[1, 2]	
Cluster mean		4.666	3.933	2.428	
S.E.		0.166	0.153	0.202	*F*=32.68
Rank		4	6	8	*P*=0.000
6. Volume flexibility	3.354	[3]	[3]	[1, 2]	
Cluster mean		4.111	3.600	1.857	
S.E.		0.309	0.190	0.142	*F*=19.84
Rank		7	8	9	*P*=0.000
7. Design flexibility	3.419	[3]		[1]	
Cluster mean		4.000	3.400	2.714	
S.E.		0.288	0.190	0.359	*F*=4.79
Rank		8	9	7	*P*=0.016
8. Delivery speed	3.741	[3]	[3]	[1, 2]	
Cluster mean		4.222	3.866	2.857	
S.E.		0.146	0.090	0.142	*F*=26.30
Rank		6	7	6	*P*=0.000
9. Del. dependability	4.193	[2, 3]	[1, 3]	[1, 2]	
Cluster mean		4.777	4.200	3.428	
S.E.		0.146	0.144	0.202	*F*=13.08
Rank		3	4	4	*P*=0.000

Notes: [a] Mean score based on 5-point Likert scale, ‘‘1’’ represents ‘‘not important’’ and ‘‘5’’ represents itically‘‘cr important”. [b] Numbers in brackets indicate the group numbers from which this group was significantly different at the $p<0.05$ level according to the Scheffe pairwise comparison. [c] Indicates rank of competitive capability among all the priorities within the cluster.

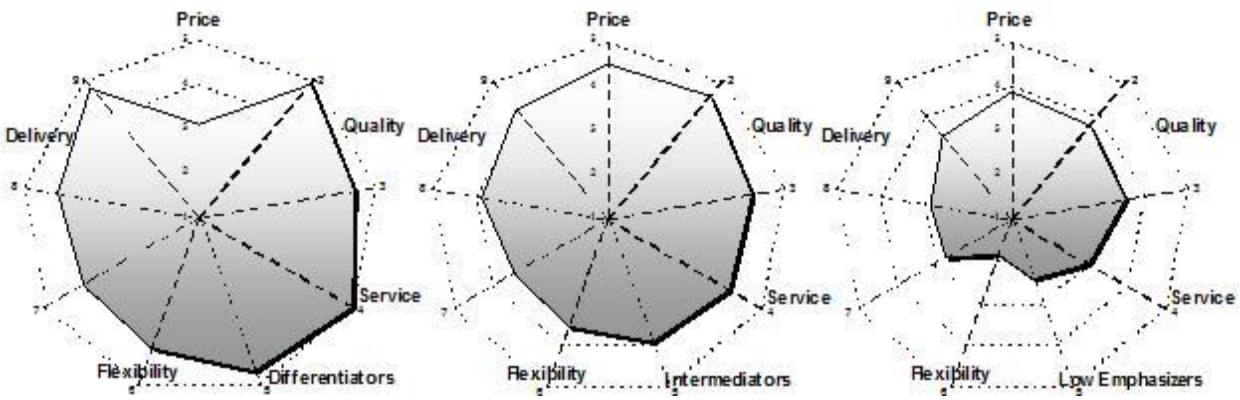

Figure 1. Competitive capabilities by cluster. Numbers by competitive capabilities correspond to numbers in Table 4.

Thus, this cluster has not been considered as low-price manufacturers. However, there is a clear similarity (*rs* = 0.717; *p* = 0.030) between the intermediators and Miller and Roth's (1994). Markeeters with regard to the relative rankings of the capabilities, there is no similarity between them with regard to their means of the capabilities. Markeeters place the highest importance on five capabilities and the price is not among them. Table 4 shows that the most important capabilities for the intermediators are price and quality capabilities. Flexibility capabilities are the least capabilities that are emphasized, though intermediators place the lowest importance on design flexibility (rank 9). However, intermediator group's emphasis on design flexibility is the same as the industry mean. The other eight capabilities are higher than the industry means. It can be stated that the intermediator group's members focus on relatively broad sets of competitive capabilities.

Low emphasizers (Lowers)

The third cluster comprises seven firms and they represent the smallest percentage (22.5%) of the entire sample. This cluster has the lowest importance means among the three clusters for all the capabilities except the low price. The F-values in Table 4 indicate that the cluster statistically differs from at least, one of the other two clusters for all of the capabilities. There is no statistical difference between this cluster and the other two in terms of low price. Even if low price seems to be the dominant capability for this cluster, the relative importance given to quality capabilities is very close to price. Performance and conformance qualities rank second and third, respectively, within the cluster. This cluster places moderate importance on the after-sales service (rank 5) with a mean of 3.00 and delivery speed (rank 6) with a mean of 2.85. They also place consi-derably, low emphasis on capabilities based flexibility. The means of design flexibility, broad product line and volume flexibility are less than 3 (ranking seventh, eighth and ninth, respectively). Table 4 clearly shows that the importance means for this cluster are lower than the overall industry means for all the capabilities.

With regard to their means of the capabilities, this cluster is quite similar to the idlers in Frohlich and Dixon (2001) and to the low emphasizers in Zhao et al. (2006). However, regarding relative rankings, there is only a statistical similarity (r_S = 0.800; *p* = 0.010) with low emphasizers. The most important capabilities for this cluster are low price, performance, conformance and dependability, respectively. Similarly, the most important capabilities for the low emphasizers are performance, conformance, dependability and low price, respectively. In other words, the capabilities in the first four ranks are the same. Since this cluster is similar to low emphasizers of Zhao et al. (2006) in terms of relative means and ran-kings of the capabilities, it is named as low emphasizers (Lowers).

Underlying dimensions

Multiple discriminant analysis was run to provide a more in-depth analysis of the results and to identify the variables that are best discriminated among the clusters. The stepwise procedure (which serves to avoid multicolli-nearity problems) was adopted to select variables from the nine taxons to form the canonical functions. The levels of significance of the *F*-value for entering and removing a variable were 0.01 and 0.05, respectively. Table 5 summarizes the results of the stepwise discriminant analysis used to investigate the relationship between the taxons and cluster membership. Two significant canonical discriminant functions are produced due to three clusters of the dependent variable. Both discriminant functions were significant at the 0.01 level
(χ^2 = 69.98 and *df* = 6; χ^2 = 17.26 and *df* = 2, respectively)

Table 5. The results of the multiple discriminant analysis.

Capabilities	Function 1		Function 2	
	Structural correlations	Discriminant function coefficients	Structural correlations	Discriminant function coefficients
After-sales service	0.654[b]	0.918	-0.425	-0.031
Delivery speed	0.557[b]	0.780	-0.011	0.194
Broad product line[a]	0.282		0.049	
Dependability[a]	-0.189		-0.065	
Conformance[a]	0.175		-0.104	
Volume flexibility[a]	0.048		-0.014	
Low price	-0.087	0.407	0.980b	1.009
Design flexibility[a]	0.126		-0.274	
Performance[a]	-0.033		0.211	
Eigenvalue	6.047		0.895	
% of Variance	87.1		12.9	
Canonical Correlation	0.926		0.687	
Wilk's Lambda	0.075		0.528	
X^2	69.98		17.26	
Df	6		2	
P	0.000		0.000	
Clusters	Cendroids		Cendroids	
Cluster 1	2.217		-1.117	
Cluster 2	0.599		0.900	
Cluster 3	-4.135		-0.491	

Notes: [a] Variable was excluded from canonical functions when using stepwise method. [b] Largest absolute correlation between each variable and any discriminant function.

respectively) as measured by the Wilk's lambda and χ^2 statistics. Canonical correlations for the two significant functions were 0.926 and 0.687.

The study used ±0.30 as the cut-off value to identify the capabilities that contributed the largest value to each canonical discriminant function. Although there are no rigid rules about the goodness of these values, Hair et al. (1998) suggest that cut-off values above ±0.30 are considered as acceptable and satisfactory. The standardized discriminant function coefficients, discriminant loadings and group centroids of the multiple discriminant analysis are given in Table 5. The high structural loadings of variables (greater than ±0.30) were depicted with vectors and the group centroids were also plotted in Figure 2. This graphical display of structural loadings and group centroids together highlights the characteristics of the three strategic types.

As indicated by the Wilk's Lambda value and comparison of the group centroids in Table 5, both discriminant functions provide good separation between the three groups. The first function has a high positive correlation with two independent variables: (i) after-sales service and (ii) delivery speed. This function distin-guished the manufacturing strategy groups based on the relative importance given on service and speed capability. Figure 2 indicates that the close corres-pondence between the service and speed vectors and the first function signifies that the emphasis on after-sales service and delivery speed are descriptive of the first discriminant function. This dimension is the same as the third dimension that Frohlich and Dixon (2001) found with Western Europe data. The authors interpreted this function as "after-sales service/delivery" depending on the competitive capabilities emphasized. As such, the study will be called "market reliability". When the centroids at the plot are looked at, the first function is the primary source of difference between clusters 1 and 2 versus cluster 3. High positive coefficients for after-sales service and delivery speed imply that clusters placing a relatively higher importance on these capabilities will be assigned to the high end (positive side) of the "market reliability" dimension. Conversely, the clusters placing less priority on service and speed will be assigned to the lower side (negative) of the dimension. Firms at the high end aim to compete by offering superior after-sales service and building tighter customer relationship with prompt delivery of their products so that they are distinguished from their rivals with these attributes.

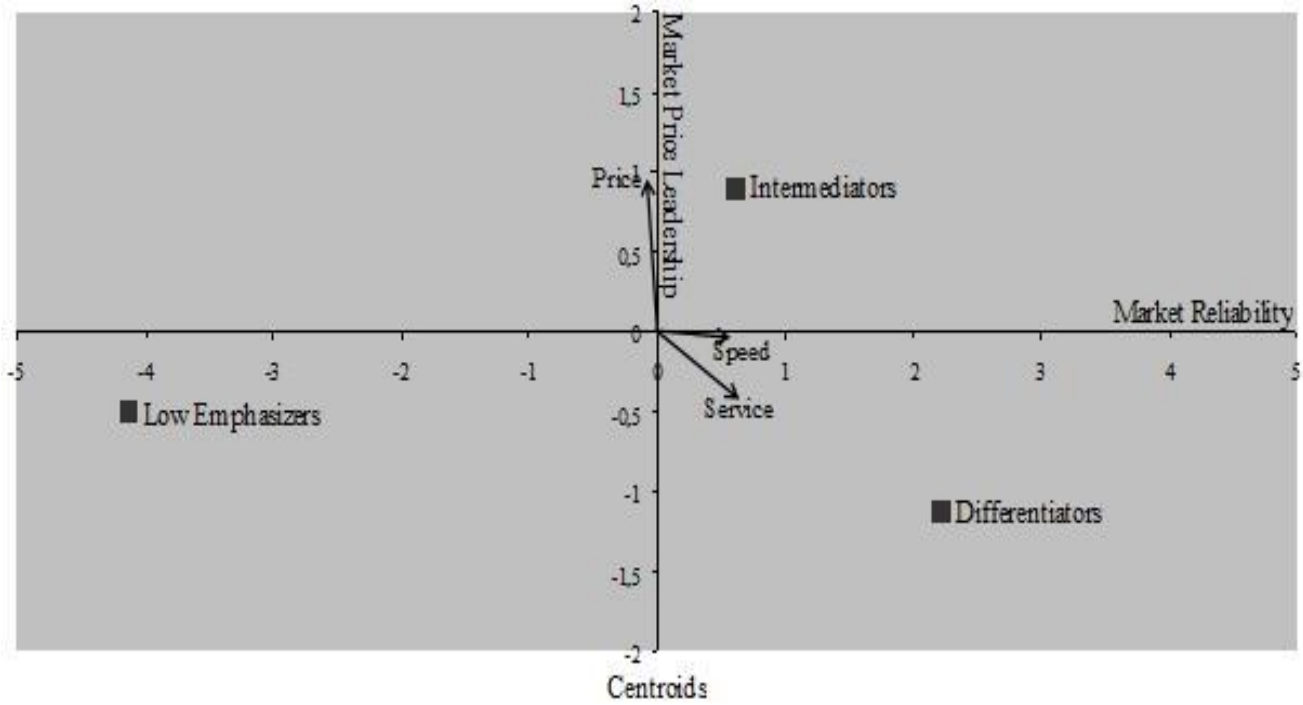

Figure 2. The plot of cluster centroids and structural loadings.

The second discriminant function revealed only a strong significant correlation on the low price capability, indicating that function 2 distinguished the manufacturing strategy groups based on their relative importance given on price. While this dimension has a high price coefficient, none of the other capabilities has statistically significant correlation. Hence, the second function can be interpreted as the "market price leadership" dimension. This function separates clusters 1 and 3 from cluster 2 (Figure 2). The clusters that placed high emphasis on low price will tend to fall at the high end of the market price leadership dimension, whereas the clusters that placed less emphasis on low price will fall on the low side. The clusters on the plot indicate the manufacturing strategy group assignment designated by the clustering procedure.

Closer inspection of the group centroids suggests that differentiators and intermediators are to emphasize on customer's orders and rapid responses to their wishes after-sales, and thus appear on the high end of the market reliability. Due to its strong emphasis on price, intermediators are also positioned at the higher end of the market price leadership. In other words, inter-mediators try to compete in both market reliability and market price leadership. The weaker importance that the "lowers" give to service and speed is their position at the lowest side of the market reliability. On the other hand, the low importance given to price is their position at the low side of the market price leadership. Even though the "lowers" have no major manufacturing strategy, it is noticeable that they give a higher importance to price capability than differentiators.

Manufacturing strategic groups and firm ownership

It has been pointed out that there are significant numbers of the joint venture and foreign owned firms operating in Turkish automotive industry. When Table 6 showing the distribution of firms by ownership structure was exa-mined, it can clearly be seen that the total proportion of firms with foreign ownership (4) and joint venture (12) in the sample are 51.6%. The Turkish owned firms (15) account for only 48.4% of the sample. χ^2 tests were run to find out whether there was any significant difference among strategic types in terms of firm ownership structure.

From the results in Table 6, it was seen that while Turkish owned and joint venture firms were distributed roughly in equal proportions across strategic groups, the foreign owned firms were only distributed between dif-ferentiators and intermediators. In other words, there are no foreign owned firms in the lower group. However, as it can be seen in Table 6, the results of χ^2 tests indicated that no significant differences were found at the $p > 0.05$ level between the three strategic groups regarding firm ownership structures. In other words, strategic types and firm ownership are not interrelated. Hence, the H2 claimed that there is a significant difference across strategic groups in terms of the ownership structure that

Table 6. Ownership structures by manufacturing strategic groups.

Ownership structure	Differentiators (n = 9)	Intermediators (n = 15)	Low emphasizers (n = 7)	Total
Turkish ownership	4	7	4	15
Foreign ownership	1	3	0	4
Joint venture	4	5	3	12
Total	9	15	7	31

Notes: A chi-square test of the sample distribution against the expected distribution based on a random distribution does not indicate any significant difference (χ^2 = 1.880; *df* = 4; *p* = 0.758).

This finding contrasts with those of prior studies (Amoako-Gyampah, 2003; Robb and Xie, 2001). Manufacturing strategies consist of structural decisions requiring important capital and infrastructural decisions requiring relatively less capital. The fact that the study sample composed of medium-sized and large firms which have sufficient resources to implement the different types of manufacturing strategies may have led to such a result. Furthermore, in recent years, as a result of global competition and Turkey's EU membership, there has been an increased number of collaborative arrangements and strategic partnerships between the Turkish and fo-reign firms in the automotive industry (Wasti et al., 2005). This result can also be due to the fact that Turkish auto-motive industry improves its quality, delivery and flexibility capabilities in order to respond to the requirements of foreign partners and the pressures of global competition (Burgess and Gules, 1998). It can be stated that firms in the automotive industry formulate their manufacturing strategy according to the global dynamics rather than the local ones.

Manufacturing strategic groups and firm performance

H3 states that there is a significant difference among the manufacturing strategic groups in terms of firm perfor-mance. Firm performance was measured by four items (ROI, ROS, market share growth and sales growth). The first two items measure profitability and the latter two measure growth. In Table 7, the results of ANOVA together with descriptive statistics of firm performance according to strategic groups were reported. The results of the Scheffe test were also provided in the table in brackets.

The F-values given in the first row of Table 7 reveal that there are statistically significant differences among the strategic groups at the $p < 0.01$ level. The result of the Scheffe test also shows that the differentiators and intermediators have a better overall performance than the lowers. In other words, no significant differences in firm performance were found between the differentiators and intermediators. These results imply that a relationship exists between firm performance and strategic groups. Therefore, H_3 is supported. This finding is important in that it implies that firms that placed higher importance on competitive capabilities can have better overall performance.

In order to investigate the issue further, a one-way ANOVA and Scheffe tests were repeated on each of the four variables used to measure firm performance. The results of the analysis reveal that the differences among the strategic groups are not significant in ROI and ROS. However, the differences among the groups are significant in market share and sales growth (Table 7). In other words, while strategic groups were not different in terms of the profitability, they were significantly different in terms of growth. All results regarding the firm performance are entirely similar to those reported by Sum et al. (2004). No statistically significant differences were found among groups in terms of profitability. The study consider it so, because the existence of lowers consists of a relatively small number of firms, and that places a relatively lower emphasis on the competitive capabilities in the automotive industry. As the samples were leading the automotive firms, the study believe that the firms in the groups have competitive visions, and their executives have also more understanding of manufacturing strategies, contrary to Zhao et al.'s (2006) firms in the "low emphasis" group.

It is possible that the differences in the quality of the im-plementation of the emphasized competitive capabilities could cause similar profitability across groups. However, in this opinion, the lowers place a relatively higher emphasis on functions such as marketing and financing rather than manufacturing, and therefore a relatively similar profitability level is achieved by differentiators and intermediators. The reason for this stems from the fact that differentiators' and intermediators' growth performance is statistically better than that of the lowers, though the Turkish economy experienced a contraction in the market related to instabilities peculiar to the economy shortly before the survey period. In the Turkish automo-tive industry, total sales decreased about 25% in the second half of 2006 as a result of the contraction (TAYSAD, 2009). In spite of this decrease, the growth of their market share and sales of differentiator and interme-diator firms could be explained by the manufacturing

Table 7. Firm performance by manufacturing strategic groups.

Firm performance	Differentiators (n = 9)	Intermediators (n = 15)	Low emphasizers (n = 7)	
Overall performance	[3]	[3]	[1, 2]	
Cluster mean	3.916	3.750	2.964	F = 5.718
S.E.	0.220	0.144	0.221	P = 0.008
Market share growth	[3]	[3]	[1, 2]	
Cluster mean	3.888	3.533	2.666	F = 5.331
S.E.	0.200	0.191	0.333	P = 0.011
Sales growth	[3]	[3]	[1, 2]	
Cluster mean	4.111	3.866	2.857	F = 6.248
S.E.	0.200	0.165	0.404	P = 0.006
Return on investment				
Cluster mean	3.888	3.666	3.285	F = 0.789
S.E.	0.260	0.270	0.359	P = 0.464
Return on sales				
Cluster mean	4.250	3.933	3.428	F = 2.134
S.E.	0.163	0.206	0.368	P = 0.138

Notes: Numbers in brackets indicate the group numbers from which this group was significantly different at the from $p < 0.05$ level according to the Scheffe pairwise comparison procedure.

explained by the manufacturing strategies implemented by these firms.

DISCUSSION AND CONCLUSIONS

The results confirm that different manufacturing strategic groups exist in the Turkish automotive industry within the same industry as asserted in the literature (Hayes and Wheelwright, 1984; Porter, 1980). These groups that represent a distinct strategic type or pattern with regard to the manufacturing strategy are labeled as differentiators, intermediators and lowers. Differentiators place critical importance on all of the competitive capabilities except price, and the most important capabilities for the group are after-sales service, performance quality and delivery dependability. Intermediators place the highest importance on quality and low price and their distinguishing characteristics are emphasized over industry means to all capabilities. The top capabilities of lowers are price, performance and conformance quality, respectively, while their emphasis levels for all the capabilities are lower than the industry means.

Moreover, the ownership structure of the firms does not have any impact on strategic types. This result seems to contradict previous reported associations between the ownership of a firm and its manufacturing technologies or practices. The contradictory result may be attributed to the sample consisting of the firms having adequate resources for structural and infrastructural decisions that support different manufacturing strategies and increased inter-firm partnership between organizational and national borders in addition to the harsh competition in the automotive industry.

A discriminant analysis was used to find out which capabilities differentiated the strategic groups. Two discriminant functions were produced with good classification accuracy. The first of the two underlying dimensions obtained is market reliability, which is concerned with the ability of firms to offer superior after-sales service and prompt delivery of their products. The second is market price leadership which is concerned with the ability of firms to offer their products at low price. The market reliability characterized by service and speed is one of the three underlying dimensions that Frohlich and Dixon (2001) identified but did not named for the West European firms. The authors stressed that the European firms had a legendary unique service culture and were the first to confirm this empirically. The results thus support the findings of Frohlich and Dixon (2001) and the claim of the authors about service culture of the European firms. It has been observed that there is a close association between the strategic groups and Porter's (1985) generic strategies. In the differentiation

strategy, a firm produces and delivers products or services

by unique and value features at an acceptable cost to attract consumers. The sustainability and success of differentiation strategy generally depends on the ability to continuously and consistently upgrade the differentiated features that come from multiple sources instead of a single source (Porter, 1985). It can be stated that the approach of the differentiator group, which placed a critical importance on all of the competitive capabilities except for price which has a moderate importance that appeals to customers to compete in the marketplace, is in unison with the differentiation strategy.

The small group that was highlighted by Porter (1985) and supported by the findings of Frohlich and Dixon (2001), which achieved a competitive advantage through cost reductions emphasis on low price and its existent in every industry, has arisen in the present study too. Porter also emphasizes that the firms, following a low cost strategy, must maintain quality that is close to, or equal to, that of the competitors. It can be stated that the lowers' strategy which emphasized performance and conformance quality after low price (which is their dominant competitive capability), is consistent with the cost leadership business strategy. However, the intermediators' strategy, which places a relatively high emphasis on all capabilities including price in order to compete in the marketplace, disagrees with the Porter's view in which a firm must make a choice between low price and differentiation strategies. According to Porter (1985), a firm that fails to achieve one of the business strategies will be stuck in the middle and below the average performance. The intermediators' strategy also contradicts the traditional trade-off model. Nevertheless, this result is similar to the findings of Kathuria (2000), which was used to ascertain a strategic type (in all clusters) that places a relatively high emphasis on all of the competitive priorities. Additionally, there are also some studies showing that firms which follow multiple business strategies have a better performance than firms which follow a single strategy (Miller, 1992; Kim et al., 2004; Spanos et al., 2004). As such, harsh competition has forced firms to improve along all capabilities, and significant advances in manufacturing technology have enabled them to improve multiple competitive capabilities simultaneously, thereby eliminating the need for trade-off (Corbett and Van Wassenhove, 1993; Lewis and Boyer, 2002).

Ferdows and De Meyer (1990), in "sand cone" model, advocated that firms must consider strategies that would build all capabilities sequentially (first seeking quality, advancing to delivery, flexibility and finally low cost), and eventually competing with all capabilities. Intermediators place a relatively high emphasis on all capabilities but emphasize delivery and flexibility after low price. Therefore, they may follow a different model other than the sand cone model. However, differentiators place a higher emphasis on quality, delivery and flexibility respectively, as compared to low price. These firms might have progressed through the sand cone model sequence. Hence, differentiators and intermediators have better performance than lowers. Thus, it can be stated that the results obtained support Ferdows and De Meyer's sand cone model. The analysis confirms that a relationship exists between the overall performance and strategic types. However, there is a significant difference in terms of growth, but no statistically significant differences in terms of profitability among groups. In other words, lowers, which place a lower emphasis on all capabilities (except cost) than the other two groups, achieved similar profitability performance with other groups. These results are entirely similar to those found by Sum et al. (2004). Porter (1985) and Frohlich and Dixon (2001) have showed that in every industry, there is a small group of firms that earn high profits through successfully implementing low price strategy. Lowers are the smallest and the only group which places the first rank emphasis on low price across all clusters. In other words, the existence of the lowers is consistent with the explanations of Porter (1985) and Frohlich and Dixon (2001). The results regarding performance indicate that competitive capabilities are related to the overall performance, even if this relationship arises from mainly growth rather than profitability. Particularly, when combining the results and those of Sum et al. (2004), it can also be concluded that manufacturing strategies have more impact on growth performance than profitability. Like any other study, this study also has some limitations that will suggest directions for future research. The use of a cross-sectional research metho-dology in the study provides limited longitudinal evidence, and does not show precisely how the development of different types of manufacturing strategies and strategic types affect firm performance. Thus, with a longitudinal research, the subject of how firms make progress between strategic types and how these types affect the firm performance variables might be investigated in future studies. Another limitation is that the samples selected in this research, in order to obtain accurate and rich data, are members of ISIC 384 in Turkey's leading 1000 industrial firms. Therefore, the sample size, comparable to those of operations management studies, is relatively small and consists of mid-sized and large firms. These limitations might limit the generalization of the results of the study. However, including a significant amount of foreign owned and joint venture firms in the sample increased the generalizability of the findings. In order to overcome the mentioned limitation and obtain comparative insights, future research might use samples from multiple countries, including firms of different sizes.

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