EFFECT OF MANUFACTURING STRATEGY ON BUSINESS PERFORMANCE

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ABSTRACT

This study which was undertaken to determine the effect of competitive priorities, Advanced Manufacturing Technologies and strategic alignment variables on business performance in small and middle scale enterprises, data from 153 small and middle sized enterprises operating in automotive supply industry was assessed. In the SMEs within the scope of the study, there was a moderate relation between business performance and strategic alignment variables and a weak relation for Advanced Manufacturing Technologies and competitive priorities was determined.

Keywords: Manufacturing Strategy, Business Performance.

JEL Classification: M11, L62

ÜRETİM STRATEJİSİ DEĞİŞKENLERİNİN İŞLETME PERFORMANSI ÜZERİNE ETKİSİ

ÖZ

Küçük ve orta ölçekli işletmelerde rekabet öncelikleri, ileri imalat teknolojileri ve stratejik uyum değişkenlerinin işletme performansına etkilerini belirlemeye dönük gerçekleştirilen bu çalışmada otomotiv yan sanayinde faaliyette bulunan 153 küçük ve orta ölçekli işletme verileri değerlendirilmiştir. Araştırma kapsamındaki KOBİ'lerde işletme performansı ile stratejik uyum kriterleri arasında orta düzeyde, ileri imalat teknolojileri ve rekabet öncelikler için ise zayıf düzeyde ilişkinin olduğu tespit edilmiştir.

Anahtar Kelimeler; Üretim Stratejisi, İşletme Performansı

JEL Sınıflandırması: M11, L62

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Makalenin Geliş Tarihi: 01.09.2014 / Yayına Kabul Tarihi: 02.02.2015

1. Introduction

Considering the tendencies in competitive environment, in order to make enterprises survive and be a success, it has now become inevitable to develop strategic plans. These plans should be developed with an understanding that functional perspectives are to be integrated all the units in an enterprise develop functional strategies for a common aim, that is, enterprise's survival and gaining competitive advantage. Concordantly, production function which is one of the important activities creating value in enterprises is to develop its own strategic approach with the same understanding.

Strategic production depends on the effective use of production powers (competitive priorities and technology) as a means of competition to achieve enterprise objectives (Mills et al., 1995; Ahmed et al., 1996). Competitive priorities make up the potential power of manufacturing strategy, enterprise's competition and performance. Concordantly, when making basic decisions (structural and infrastructural) about production system, manufacturing strategy is to determine competitive priorities. On the other hand, choosing competitive priorities plays determining role in many areas like technology and process choice, capacity, production planning and control (Ward et al, 1998). Advanced Manufacturing Technologies investments that are compatible with and support manufacturing strategy based on competitive priorities is another element that affect production and business performance. In theory, it is thought that manufacturing strategy develops in line with business strategy or manufacturing strategy directs business strategy. One of the most important factors in strategic alignment is the creation of production skills and structure in line with business strategy and directing both business strategy and manufacturing strategy simultaneously to common objectives.

In the framework of all these explanations what was researched in this study was the effects of strategic alignment, competitive priorities (manufacturing powers) and Advanced Manufacturing Technologies on business performance of small and medium sized enterprises (SME) in automotive supply industry in Turkey. In the first part of the study, literature on this subject is summarized; in the second part of the study the methodology and results obtained are presented.

2. Manufacturing Strategy Variables

2.1. Competitive priorities

It is seen that various components are suggested or used by different authors in the literature on competitive priorities. Hayes and Wheelwright (1984) suggested enterprises to follow one or more than one competitive priorities to be able to compete in competitive markets. These are quality, speed, cost and flexibility. Decreasing product life in the face of tough competition in the market required enterprises to add innovation as the fifth factor in gaining competitive advantage. Today costumers have wide range of products to choose from thanks to information technologies and

especially thanks to internet and their bargaining powers have increased. They now expect better customer services besides lower cost, better quality, speed and high flexibility. As a result of these developments, service was added as the sixth factor in competitive priorities (Zhao et al., 2002). Later on, many authors and empirical researchers added new priorities to them. For example, Foo and Friedman (1992) added rapidly reaching to the market and speed to this list under the heading time. It must be stated that competitive priorities other than quality, speed, cost, flexibility and innovation were not accepted generally in the literature (Burgess et al., 1998). In this study, following from studies by Skinner (1969), Hill (1987), Gerwin (1993), De Toni and Toncha (1998) competitive priorities were taken to include five dimensions quality, cost, delivery (speed), flexibility and innovations.

2.2. Advanced Manufacturing Technologies

Advanced manufacturing technologies include various technologies directly or indirectly used for realizing, monitoring and controlling production activities. Concordantly, to make them easier to understand and study, researchers classified Advanced Manufacturing Technologies from different points of view in the face of the fact that it has a very wide scope. For example, Boyer et al. (1996) classified AMT as design, production and management technologies. Design and process technologies like computer aided design, computer aided process planning make up design dimension, computer numerical control, flexible manufacturing systems, robotics technologies make up production dimension, technologies like electronic data interchange, decision support systems make up management dimension. In a similar classification, Kotha and Swamidass (2000) classified them as product design technologies (computer aided design and engineering), process technologies (Computer numerical control, computer aided production, flexible manufacturing systems), logistic planning technologies (Material requirement planning) and information exchange technologies (Electronic Data Interchange. Enterprise resource planning).

In their studies, Yousef (1992), Chase and Aquilano (1995), Burgess and Güleş (1998) assessed IIT as engineering (hard) and management (soft) based on machines and equipments and managerial approaches which is closely related with them. Engineering technologies include physical technologies which are used in design, production and management. Management technologies include approaches in the form of software which have an integrative function. Explanations with regard to advanced manufacturing technologies will be made within this scope.

2.3. Strategic Alignment

When the tendencies in competitive environment are considered, it has now become inevitable that enterprises develop strategic plans to survive and to be a success. Enterprises are to use dynamic seeking process and configure their manufacturing processes within this perspective and make their strategic manufacturing decisions in line with these tendencies. For this reason, manufacturing strategies are very important and useful means to direct this decision process. Manufacturing strategy is

a new issue emphasized to solve the problems industry is afflicted with. This issue has gained in importance because of its role in restructuring production processes. Manufacturing strategy aims to determine fundamental decisions about production sources and competitive priorities to make the enterprise to gain skills which will give it competition advantage. Four-stage model developed by Hayes and Wheelwright (1984) evaluates the strategic role of manufacturing function in the relation between manufacturing strategy and business strategy and its contribution to competition strategy in detail. While in stage 1, production units are highly affected by the demands made by superiors and cannot provide any strategic superiority to the enterprise, stage 4 illustrates organizations which have advanced production skills that can give an enterprise competitive advantage (Güleş and Bülbül, 2004). Understood the power of production in the business competitive there is change from reactive production to affective production.

When we consider the relation between business strategy and manufacturing strategy, production function can appear in different forms. In this relation, manufacturing strategy can be the implementer or supporter of business strategy or it can direct business strategy (Slack et al, 2001). When the role of production in business strategy is assessed in Hayes and Wheelwright's four stage model, it is seen that the strategic role of production starts to direct business strategy as the enterprise gets closer to stage 4.

In this study, a scale which includes four factors in Survey on Manufacturing Strategy, (1999) was used to assess the alignment between manufacturing strategy and business strategy.

3.A Study on the Effect of Production Performance on Business Performance

In this part of the study, the results of an empirical study which included enterprises from automotive supply industry to determine the effects of competitive priorities, Advanced Manufacturing Technologies and strategic alignment variables on business performance is presented.

3.1.The Aim of the Study and Hypotheses

The main aim of this study is to determine "the effect of manufacturing strategy variables on business performance in automotive supply ındustry". In line with this main aim, the following hypotheses were developed after literature review:

Following from studies on production skills and business performance by Philips et al. (1983), Cleveland et al. (1989), Vickery et al. (1993), Kim and Arnold (1996), Brown (1998), Milling et al (1999), the hypothesis 1-a was developed.

Hypothesis 1a: There is a positive correlation between competitive priorities and business performance.

Following from the studies on Advanced Manufacturing Technologies and business performance by Roth and Miller (1992), Sweeney and Szwejczewski (1996), Ahmet et al. (1996), Beaumont and Schroeder (1997), Kotha and Swamidass (2000), McKone et al. (2001), Das and Narasimhan (2001) and Bülbül and Güleş (2004), hypothesis 1-b was developed.

Hypothesis 1b: There is a positive correlation between Advanced Manufacturing Technologies and business performance.

Following from the studies by Deane et al (1990), Smith and Reece (1999), Sun and Hong (2002) who studied the effect of alignment between manufacturing strategy and business strategy on business performance hypothesis 1-c was developed.

Hypothesis 1.c.There is a positive correlation between strategic alignment and business performance.

Recently manufacturing strategy is a relatively new field of study, which has recently started attract attention. This study is an attempt to contribute to this new field of study, in particular the literature in our country. Besides, this empirical study seeks to examine the effect of enterprise manufacturing strategy constructions on business performance. Another point that enhances the significance of this study is that the topic is studied in the context of SME which account for the most of the country's economy. It is considered that examination of strategic production studies in automotive supply industry which is one of the most important branches in manufacturing sector in our country will provide an important point of view for enterprises in other areas.

3.2. The Method of the Study

In the study, a questionnaire form which was developed by the researcher based on the literature was used a means of data collection. In the first part of the survey form there are 5-point Likert type items about the production strategies implementations of enterprises, in the second part there are questions to get introductory information about enterprises.

The fact that this study is on SMEs leads to some problems such as the lack of database through which we can access detailed and up-to-date information. As there are different classification criteria to determine the size of SMEs (the number of workers, capital, etc.), different institutions have different number of SMEs. KOBİ-NET Firms Guide 2006 database, which was developed KOSGEB (Small and Medium Industry Development Organization) was used to get detailed and up-to-date information about the structures and characteristics of SMEs. In the database 488 enterprises operating in the automotive supply industry were determined and the study was carried out these 488 enterprises.

Once the questionnaires were administrated, 179 questionnaire forms returned. However, as a result of examinations it was considered that micro (0-9) and small (10-19) sized enterprises could not be effective in using manufacturing strategy and the questionnaire forms from 11 enterprises with less than 20 workers and 9 enterprises based on their responds to the control question (our manufacturing strategy is not clear and well-defined) were excluded from assessment. It was also decided that 6 questionnaire forms be left out of assessment as they did not include utilizable data and the remaining 153 questionnaire forms were assessed. 153 questionnaire forms gathered correspond to a return rate of almost % 31. When the empirical studies on production method and manufacturing strategy are considered, it is seen that return rate ranged between 20% and 50%. For example, the rate of return in a study by Dangayach and Deshmukh (2003) on manufacturing strategy was 29%. In another study by Bülbül (2003) on innovative activities of enterprises, return rate was 25%. Concordantly, the return rate in this study is at acceptable level compared with those of similar studies and when the return rate of questionnaires sent via mail are considered.

Data collected via the questionnaire was analyzed using SPSS (Statistical Package for Social Sciences) Windows 10.0 version. Before analyzing data collected, the reliability of competitive priorities, Advanced Manufacturing Technologies, strategic alignment and business performance scales were tested. To test the reliability of the scales Cronbach Alfa Test which is widely used in the literature was used. The alpha values of the scales were as follow: competitive priorities α= 0.9096; Advanced Manufacturing Technologies α= 0.8628; strategic alignment α= 0.7916; business performance α=0.9021. The reliability coefficients of the scales varied between 0.79 and 0.90 and it was seen that all the scales used in this study have high reliability (inner consistency).

3.3.Results of the Study and Assessment

In this section, introductory data and data about the concordance between competitive priorities, Advanced Manufacturing Technologies and manufacturing strategy and business strategy are presented.

3.3.1.Introductory Information about Enterprises

The study includes 153 enterprises from automotive supply industry. The distribution of the enterprises in terms of the number of workers, the products/services they manufacture, the main customer group and the title of the people who answered the questionnaire of the enterprises is given in Table 1.

Table 1: General Information about the Enterprises Participating the Study

		Number	Percentage
Number of Workers	20–49 (small)	46	30.0
	50–99 (medium)	51	33.3
	100–249 (medium)	43	28.1
	250 – 499 (medium)	13	8.4
Type of Product/Service	Finished product	73	47.7
	Consumer goods	41	26.8
	Raw material	29	18.9
	Other	10	6.5
Main customer group	Consumer	50	32.7
	Manufacturing industry	83	54.2
	Service industry	16	10.5
	State – public	3	1,9
	Other	1	0,6
The titles of the respondents	General director	25	16,3
	Enterprise director	38	24,8
	Manufacturing planning director	40	26.1
	Enterprise owner	42	27.4
	Other	8	5.2

Notes: (i) n=153

The most common basic criteria in the definitions of SME is the number of the people employed in an enterprise. While according to some institutions, the number of the workers is to be less than 250, some of them regard this number as 99. In this study, the criteria used by EUROSTAT* were considered. When the number of the workers in the enterprises in this study is considered, 30% of the enterprises in the study are small (20–49 workers) and 70% (50–499 workers) are medium enterprises.

47% of the enterprises in the study manufacture end product, 26.8% manufacture consumer's goods and 18.9% produce raw material. The 54.2% of their main customer group of the enterprises are in manufacturing industry, 32.7% are end users, 10.5% are in services industry and 1.9% of them are public institutions.

The questionnaire forms were generally responded by top executives in the enterprises. Concordantly, it can be said that the questionnaire forms were responded by people who know and implement the manufacturing strategy of the enterprises they work for. 27.4% of the respondents are the enterprise owners, 26.1% are production planning director, 24.8% are enterprise directors, 16.3% are general directors.

* *Small and Medium Industry Development Organization*
* *Statistical Office of the Europen Commission*

3.3.2. Competitive Priorities

Besides fundamental making decisions about production system, enterprises are to determine competitive priorities to gain competitive advantage based on manufacturing strategy (Hayes and Wheelwright, 1985). In this study, quality, cost, delivery (speed), flexibility and innovation which are widely used in the literature are used as competitive priorities. Information about the level of importance enterprises in this study attach to competitive priorities is given in Table 2.

Table 2: Competitive Priorities

		Mean		S.D.
Cost	Competitive Price	4.06	*(8)*	1.22
	Low- cost production	4.09	*(7)*	1.18
Quality	Conformance quality	4.21	*(4)*	1.14
	Product durability	4.25	*(3)*	1.04
	Product reliability	4.56	*(1)*	0.89
	Product performance	4.18	*(5)*	1.17
Delivery	Delivery speed	4.26	*(2)*	1.01
	Dependable Delivery	4.14	*(6)*	1.10
Flexibility	Product customization	3.84	*(11)*	1.18
	Product- mix changes	3.78	*(13)*	1.20
	Design Changes	3.96	*(10)*	1.15
	Volume Changes	3.84	*(12)*	1.18
Innovation	New product	3.98	*(9)*	1.14

Notes: (i) n=153, (ii) In the scale 1 means certainly unimportant and 5 means very important. (iii) According to Friedman two-way Anova test (χ^2=802.712; p<0.001), the results are statistically significant. (iv) Cronbach Alpha of scale was 0.9096, which indicates that total scores of scale can be added and total scores can be found.(v)The numbers in the parentheses indicate significance order.

It is seen that the enterprises in this study attach the greatest importance to quality compare to other dimensions of competitive priorities. Quality is followed by delivery (speed). According to data in Table 2, the competition priority to which enterprises attach the least importance is flexibility. When data about competitive priorities are generally considered, it is seen that SMEs in the scope of this study attach more importance to quality, cost and delivery.

3.3.3.Advanced Manufacturing Technologies

One important variable in passing from production method to strategic production is Advanced Manufacturing Technologies. Priorities which were taught to contradict with each other now support each other thanks to technologic advancements and today it has become mandatory that they are realized simultaneously. Enterprises can now realize competitive priorities simultaneously thanks to Advanced Manufacturing Technologies and can boost their competitive powers. The enterprises in this study were asked questions about their investments on Advanced Manufacturing Technologies and the results are given in Table 3.

Table 3: Advanced Manufacturing Technologies

		Mean		S.D.
Engineering Technologies	Flexible manufacturing systems	3.47	*(3)*	1.33
	Automated material handling systems	2.53	*(12)*	1.39
	Bar coding/Automatic identification	2.76	*(10)*	1.13
	Computer numerical control (CNC)	3.35	*(5)*	1.31
	Robotics	2.95	*(9)*	1.38
	Group technology	2.22	*(13*	0.99
	Computer aided design	3.05	*(8)*	1.31
	Computer aided manufacturing	3.29	*(7)*	1.20
Management Technologies	Computer aided process planning	2.73	*(11)*	1.25
	Manufacturing resources planning	3.55	*(2)*	1.32
	Just-in-time manufacturing (JIT)	3.42	*(4)*	1.29
	Total Quality Management	3.58	*(1)*	1.25
	Benchmarking	3.35	(6)	1.34

Notes: (i) n=153, (ii) In the scale 1 means no invention and 5 means a lot of investment made. (iii) According to Friedman two way Anova test (χ^2=879.856; p<0.001), results are statistically significant. (iv) Cronbach Alpha value of the scale is 0.8628 , which indicates that the scale can be added and total scores can be obtained. (v) The numbers in the parentheses indicate significance order.

In Advanced Manufacturing Technologies scale, it was asked to the participant enterprises about their level of investments in Advanced Manufacturing Technologies. When Table 3, which information about the enterprises investment levels in sub-dimensions of this scale is examined, it was seen that enterprises make more investment in management technologies compared to engineering technologies. Especially, the fact that high amount of investment in Total Quality Management, one of the management technologies is compatible with data that the enterprises attach more importance to quality as one of the competitive priorities . As a matter of fact, technological infrastructure that will support targeted competition priority is to be concordance between flexibility competition priority to which the least importance is attached and flexible manufacturing systems investments, which is in the third position in terms of importance.

3.3.4. Strategic Alignment

For enterprises to survive and reach their objectives, functional units are to be compatible with each other and carry out their activities by supporting each other. To achieve such an alignment, enterprises are to determine functional strategies that will support their competitive advantage strategies and functional requirements are to be reflected in business strategy by making feedback process active. All these require strategic alignment in the enterprise. Concordantly, the enterprises in this study were asked to assess the statements regarding alignment between business strategy and manufacturing strategy (Table 4).

Table 4: Strategic Alignment

	Mean	S.D.
We follow our manufacturing strategy actively.	3,95	1,14
We turned our business strategy into production terms.	3,30	1,09
Our production investments are compatible with business strategy.	3,77	1,18
Production activities are a part of business strategy.	3.98	1,10

Notes: (i) n=153, (ii) In the scale, 1 means I totally disagree and 5 means I totally agree. (iii) According to Friedman two way Anova test (χ^2=528.854; p<0.001), the results are statistically significant. (iv) the Cronbach alpha value of the scale is 0.7916, which means that total scores can be obtained by adding the scores in the scale.

When Table 4 in which the responds enterprises participating this study gave as to whether they agree or do not agree with the statements in strategic alignment scale, it is seen that production activities are mostly a part of business strategy in enterprises (3.98). It was determined that in most of the enterprises manufacturing strategy was actively followed (3.95). Another important point for strategic alignment is the alignment with business strategy and production investments. It was seen that enterprises in the scope of this study mostly accept the existence of this alignment (3.77). It is important that each function of business strategy is to be a part of functional strategy considering its own processes, work models and priorities, a requirement which can be achieved by expressing business strategy in manufacturing strategy terms. It is seen that enterprise participating the study mostly converted their business strategies into production terms (3.30).

3.3.5. Manufacturing Strategy Variables and Business Performance

In this study the effects of competitive priorities (cost, quality, delivery, flexibility and innovation), advanced manufacturing technologies (management and engineering technologies) and strategic alignment (the interaction between manufacturing strategy and business strategy) on business performance were investigated. In this study, market share, export and profit information which can explain the growth of the enterprises in the study were used as business performance variable based on enterprise's market and financial data (Dangayach and Deshmuch, 2006; Kim and Arnold, 1993). The respondents were asked to assess market share, export and profit information based on the last three years. First of all, the relation between competitive priorities, Advanced Manufacturing Technologies, strategic alignment and business performance was calculated using Pearson correlation coefficient (Table 5).

Table 5: Matrix of Business Performance and Its Dimension

	Enterprise Performance	AMT	Competitive priorities	Strategic Alignment
Enterprise Performance	1			
AMT	,430 <.001	1		
Competition Priorities	,251 <.001	,273 <.001	1	
Strategic Alignment	,544 <.001	,406 <.001	,172 <.05	1

As it can be understood from the correlation matrix in the Table 5, there is a mild statistically significant relation between business performance and strategic alignment criteria and a weak statistically significant relation between Advanced Manufacturing Technologies and competitive priorities (p<.001). Concordantly, *hypotheses 1a, 1b and 1c* which argue that there is a positive relation between business performance and competitive priorities, Advanced Manufacturing Technologies and strategic alignment were accepted. The strongest relation is between business performance and strategic alignment with a correlation coefficient of .544.

After the correlation between business performance and the dimension which can be influential in accounting for this performance, multiple regression analysis was employed to determine the relation between the dimensions explaining the business performance. Multiple regression analysis is a powerful technique used for predicting the unknown value of a variable from the known value of two or more variables. The total score of each scale using a variable was included in the regression analysis. The regression model tested and the results of regression are given below (Table 6).

Business performance = $b_0 + b_1$ *AMT* + b_2 *Competitive priorities* + b_3 *Strategic Alignment*

Table 6: Multiple Regression Analysis

Dependent variable	R^2	ΔR^2	Independent variables	B	Standard Error	*T*	F
Business performance	.361	.350	İİT	.051	.016	3.270*	33.099[a]
			Competitive priorities	.030	.016	1.837**	
			Strategic alignment	.329	.050	6.573*	

Note: *[a]p<.001; *p<.001; **p<.10;*

According to regression analysis results in Table 6, R^2 (explained variance percentage) and F (the significance level of regression model) indicate that business performance can be accounted for with competitive priorities, AMT and strategic alignment and the results are statistically significant. Therefore, competitive priorities, AMT and strategic alignment account for statistically significant percentage (35%) of change in business performance. This finding supports *hypotheses 1a, 1b and 1c*. According to regression analysis results, strategic alignment affect business performance more strongly compared to the other two factors.

4. Conclusion

When competitive priorities scale is considered, it was found out that enterprises attach greater importance to quality, cost and delivery. Concordantly, it can be said that the SMEs in this study adopt a more traditional manufacturing strategy development. Considering that 2008 Global Financial Crisis was happening and its effect was still going on in the period when the study was carried out, it seems quite meaningful that enterprises follow a traditional approach. The crisis which changed the operational styles in the world and the flow global economy increased the competition pressure and affected enterprises seriously. This effect was especially exerted with enterprises'- suffering from great financial problems- attachment of less importance to high cost and risky innovation and flexibility activities. On the other hand, in addition to some limitations due to their scales, the saving-the-day understanding in the crisis made traditional competitive priorities more applicable for SMEs.

In the SMEs within the scope of this study, based on the data about competitive priorities scale and AMT investment levels it is seen that there is an alignment between competitive priorities and technology infrastructure, partially tough. Considering that higher alignment will make it easier for enterprise to reach its objectives and thus affect business performance, it can be said that the enterprises in our study are to act more strategically in this respect. This finding can be argued to be another reason why the effects of competitive priorities and AMT on business performance are weak (Table 5 and 6).

It was found that the SMEs in the scope of the study agree with the statements about the alignment between manufacturing strategy and business strategy with a high mean. Therefore, it is seen that in enterprises in this study the strategic alignment between business strategy and manufacturing strategy is high, which is positively reflected in business performance.

The results obtained pointed out that in the SMEs in the scope of this study there is a mild statistically significant relation between business performance and strategic alignment criteria and a weak statistically significant relation between Advanced Manufacturing Technologies and competitive priorities ($p<.001$). Besides, according to the results of the regression analysis, competitive priorities, AMT and

strategic alignment variables account for statistically significant percentage (%35) of change in business performance of the enterprises within the scope of this study.

In this study, only the performances of the enterprises in automotive supply industry were examined. Therefore, it is recommended that further studies examine other sectors separately and/or comparatively if sufficient amount of fund can be allocated.

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