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Özet

Rekabet, üretim teknolojileri ve yönetim sistemlerinin gelişimi gibi faktörlerin çoklu performans ölçüm sistemi kullanımına etkileri, pek çok çalışmaya konu olmuştur. Ancak çalışmaların büyük çoğunluğu gelişmiş ülkelerde faaliyet gösteren işletmeler üzerinedir. Bu çalışma özellikle gelişmekte olan ülkeler kategorisine dahil edilebilecek olan Türkiye'deki üretim işletmelerinde çoklu performans ölçümü kullanımına yönelik ampirik bir çalışmadır.

Çalışmada, 2005 yılında Türkiye'de ilk beşyüz büyük işletme içerisinde yer alan 122 imalat işletmesinden toplanan veriler kullanılarak, çoklu performans ölçüm sisteminin pazar rekabet yoğunluğu ve bilgisayar destekli üretim sistemiyle nasıl bir ilişki içerisinde olduğu ampirik olarak incelenmektedir. Sonuçlar, performans değerlendirmeye yönelik çoklu ölçüm sisteminin kullanımı ile yüksek Pazar konumuna sahip ve bilgisayar destekli üretim sisteminin kullanımına önem veren işletmeler arasında doğrusal bir ilişki olduğunu göstermektedir.

Anahtar Kelimeler: *Çoklu Performans Ölçüleri, Bilgisayar Destekli Üretim, Rekabet, Faktör Analizi, Diskriminant Analizi*

Abstract

Many studies have investigated the effects of increasing competition, improving production technologies, and developing management systems on the use of multiple performance measures. However, the majority of these studies examine businesses in developed countries. This paper is an empirical study on the use of multiple performance measures in Turkey, which is classified as a developing country.

With this purpose in mind, data from 122 manufacturing businesses, which were among the top 500 businesses in Turkey according to the 2005 statistics, were gathered, classified, and tested to determine whether there was any significant relationship (and to what degree) between the density of competition in the market, the employment of computer-aided production tools and techniques in production, and the application of performance systems relying on multiple performance criteria.

The results show that there is a linear relationship between the use of a multidimensional performance measurement system directed at performance evaluation and businesses facing high competition and making greater use of a computer aided manufacturing system.

Keywords: *Balanced Scorecard (BSC), Computer Aided Manufacturing (CAM), Competition, Factor Analysis and Discriminative Analysis.*

1. INTRODUCTION

In the new production environment, traditional management accounting and the implementation of performance measurement are subjects of significant discussion (Albright, 2006; Allott, 2000; Fullerton, 2003; Mcılhattan, 1987; Ezzamel, 1992; Sinclair & Zairi, 2000; Yasin et al., 2005). The basis of the argument is that traditional performance measures, which are short-term perspectives and focused on financial results, do not properly and reliably evaluate developments that affect long-term profitability and enterprise positioning in the future. When the competition becomes more intense, the increasing need for alternative management, control, and performance measures become evident.

When the development of performance measurement systems is analyzed from a historical perspective, global competition has played a significant role. This scale of competition urges enterprises to established methods to ensure higher performance. It is possible to see concrete reflections of these methods in the literature. In some respects, the models were developed to address needs required by the new productive and competitive environments, such as computer-aided manufacturing (CAM), flexible manufacturing system (FMS), JIT, and TQM. These models have led to the development of performance measurement systems. These can be evaluated as triggered developments for the gradual gain of much more importance of the non-financial performance measurements. These developments have transitioned from financial focused measurements to non-financial measurement systems. We have observed that recommendations made by the authorities have been directed at relying on non-financial performance measurements, either in the management of the enterprise or the evaluation of their positions in both theory and practice since the 1980s (Johnson & Kaplan, 1987; Kaplan, 1990; Atkinson et.al., 2004; Simons, 2000).

Studies show that the use of non-financial performance measures by enterprises is directly associated with variables like market competition, CAM, new production techniques, firm structure (size, culture, technological situation, and assimilated strategy, etc.) and the included sector. In this study, we sought to determine whether multi-dimensional performance measures were used. Specifically, we examined the manufacturing enterprises to assess the relationship between this (multidimensional performance measures) and market competition density and advanced production techniques. Examination of the literature, the designation of sampling and empirical tests and reliability analysis results will be described together with the results from our empirical study.

2. MULTIPLE PERFORMANCE MEASURES IN THE LITERATURE

Many factors contribute to why many firms prefer non-financial performance measures. According to this, while some researchers suggest that the preference for these measures on a large scale is related to the enterprises operational and competitive structure (Said et al., 2003), others suggest that this preference can be related to the JIT, TQM and CAM structure (Hoque & Mia, 2001). Similarly, while many reported that the use of multiple performance measures is relevant only to the strategic preference of managers' (Malina & Selto, 2001:48; Govindarajan & Gupta, 1985), some reports demonstrate that an enterprise's environmental conditions affect this preference. On this subject, for example, Hoque (2004) found that there was a meaningful relationship between environmental uncertainties and the preference for these measures. Chenhall and Morris (1986) found that organizations prefer non-financial management accounting systems to cope with high environmental uncertainties effectively.

The use of multiple performance measures and its positive effect onproduction performance are demonstrated in another section of the literature. For example, while Banker, Potter and Schroeder (1993) stated that multidimensional performance measurement system reports presented to the personnel in production line was positively associated with the implementation of modern management techniques such as JIT, Team Work and TQM. However, Chenhall (1997), Jeffrey (2005) and Ittner & Larcher(1995) examined the use of BSC together with the aforementioned modern techniques and argued that enterprises using the TQM/JIT and non-financial (production performance) measurements together have reached a higher performance than other firms without these measurements. Similarly, Abernethy & Lillis (1995) and Young & Selto (1991) found that CAM had a positive relationship with measures such as cost, quality, and time.

Additionally, many studies examine the positive contribution of multiple performance measures on the general enterprise performance from the financial perspective. For example, while Davies & Albright (2004) and Dilber et al. (2005) argued that there is a meaningful positive relationship between the use of BSC and high level financial performance. In an empirical study by James, Hoque (2000) demonstrates that the use of BSC increases general enterprise performance, but this increase is not associated with organization size, product life circle, or market position. Lingle and Schiemann (1996) found that enterprises managed by measurements reached a higher financial performance level, a higher industrial position and a higher level in the management process relative to enterprises that are not managed by measurements. Ittnera, Larckera and Randalb (2003) indicated that the enterprises placing more emphasis on measurement and variety have acquired a much higher stock exchange income. Perera, Harrison and Poole (1997) argue that the use of non-financial measures show significant associations with customer focused strategy, but not the link to organizational performance.

Apart from studies examining BSC effects on general enterprise performance, other studies have examined the enterprise's suitable working conditions as an effective performance measurement tool in BSC. For instance, Cavalluzzo and Ittnera (2004) state that organizational factors such as willingness in the top management directed at the use of performance knowledge, decision making and training in the subject of performance measurement techniques have a positive effect on measurement system development and usage. Also, Moers (2005) called significant attention to the positive relationship between the variety of performance measures and the degree of perfection with bias during the performance evaluation. It is clear that the bias mentioned here indicates a pre-cognitive accumulation directed at performance measurement.

On the other hand, Krumwiede (1998) suggested that organizations with higher quality information systems can implement new measurement systems comfortably relative to companies with less sophisticated information systems. Thus, he suggests that this highlights the linear relationship between opportunities for existing information systems and the success of implementation. In addition, he draws attention to managers, who are satisfied with information from the existing system that might not be willing to invest in new systems. This will give way to the development of a negative relationship between the system and its implementation.

Briefly, these studies, within a framework related to literature concerning multidimensional performance measurement system, draw attention to the use of multiple performance measures by enterprises associated with the manager's preference, specifically, the enterprise manager's scientific level, organizational culture, environmental conditions, technological developments, new management techniques, enterprise performance and indirectly, stock exchange incomes. Our study considers the relationship between the four dimensions that occur in BSC (financial, customer, internal business processes, learning and growth), a) with the enterprise's position in the market, b) with the level of competition in the market and c) with the CAM implementation.

3. VARIABLES AND HYPOTHESIS

3.1. Balanced Scorecard (BSC)

BSC can be described as a model or mechanism that transforms an enterprise's organizational strategy into operations (Kaplan & Norton, 2001; Kaplan & Norton, 1992). Naturally, BSC is a result of the conditions in which companies have lost their competitive advantages in America in the 1970's and 1980's. These years represent an economic situation that felt the wave of change created by Japanese companies on a world scale, as these companies became the source of new management techniques and strategies. Within this framework, it is possible to see the BSC as a theoretical form of the quest oriented competitiveness in management accounting.

In particular, the model emphasizes the terms of "balance" and "score". Here, "balance" is explained through four desired factors of the model. Among these, (1) long and short term purposes, (2) financial and non-financial measurements, (3) operation and result indicators, and (4) internal and external perspective of the organization. The term "score" refers to measurement and derives its meaning from the concise expression of Kaplan and Norton (1996: 21), who are the founders of the concept "if you cannot measure, you cannot manage". Briefly, BSC, reminds us of how characteristics of performance measurement systems are important in affecting the attitude and behaviour of the manager and employees.

Measurements, which occur in the BSC, vary between three and eight and these can be classified in four basic headings as financial, customer, internal business processes, learning and growth (Kaplan & Atkinson, 1998).

Financial performance measures' are measures that highlight whether the execution and implementation is oriented towards increasing company profitability. According to this, financial performance measures can be seen as a result of operational activities (Rao, 2000). For this reason, every measure chosen must be a part of the relationship of reason-result which will create development in the financial performance. The measures can be total sales, market share, number of new customers, new markets, net cash flow acquired, and capital income, to name a few (Morrow, 1992).

Customer performance measures: Customer orientation is an important expression of vision and mission for today's enterprises. For the implementation of a company's mission, important critical factors (time, quality, cost) directed towards the customer must be defined. In this context, basic measures can be ranked as customer satisfaction level, customer loyalty, number of new customers, customer profitability and market and customer shares in the targeted section.

Internal business process measures: After the definition of financial and customer measures, the measures related to the internal operation methods can be developed. Internal business process measures can be obtained by focusing on work processes and activities that offer critical success factors to provide customer satisfaction (Keegan et al., 1989). Here, the most important point that should not neglected, is the necessity of definition and measurement of a complete internal operation value chain at the stage of design and development, production and commercialization, to create value either for the customer or the shareholder (Eker, 2004).

In particular, design and development operations have had great importance to the company's internal operations such as defining market characteristics, which are thought to offer services in the future, designing and producing goods and services that satisfy targeted sections will give the company a distinct competitive advantage over competitors. The aforementioned internal business processes measures can express the time for launching new products on the market, the number of new products, sales percentage of the new products, rate of production defects, production time, production cost, delivery on time, etc.

Learning and growth measures: It is necessary to be in the process of continual development directed towards the new and existing product and processes in the intensive global competitive environment. For learning and growth measures, methods of developing internal operation methods are being questioned and measured. These measurements are related to employee satisfaction, productivity and continuity.

The measurements, which are chosen for every section in the company, will likely be different from those that are defined for other sections, because these measurements are in harmony with original targets and strategies of every section (Lipe & Salterio, 2000). Generally, the significance carried by BSC for the company can be summarized with its function. According to this, BSC does not function solely as a performance measurement system to examine specific operations and summarize the reason-result relationship between these operations and basic financial targets, but it also functions as a means of conveying long-term strategic initiative related to the sections and obtaining long-term financial success.

3.2 Market Competition

For the use of multiple performance measures by the enterprise, one of the determining factors is the competitive environment of the market. When the competition density is increased in the market, it is possible that the enterprises will feel a greater need for multiple performance measures use, since the measurements included in BSC are known to increase the level of competitiveness by clearly following the static and dynamic attributes of the organization (Hoque et al., 2001).

From the enterprise's perspective, companies had to receive some benefit from measurement and opportunity economies to compete in the first quarter of the 20th century. For this reason, performance measurements were developed to distribute both financial and physical capital effectively, and provide control. The developed measurements were provided in the best possible manner, as expected during that period. These performance measurements that we describe as traditional were inadequate to evaluate and define the road to compete in the new production environments (Bukh et.al., www.bettermanagement.com).

It is known that reports, which are prepared periodically within the framework of traditional criterion and are based on repeating and consequently including information that does not meet decision making requirements, could not adequately address the results of the activities in processes of related periods and changes that occurred in operational subjects, such as production and product quality. However, because the enterprise defines production performance by non-financial indicators, more importance should be given to these types of indicators (Howell & Soucy, 1987). The basic purpose of the aforementioned measurements is to maximize the investment benefit, satisfy the customer, focus on the processes of the profitable product or services and eliminate unnecessary activities to obtain competitive advantage (Trussel & Bitnet, 1998; Wongrassamee et al., 2003; Hendrikcs, 1994; Cheatham & Cheatham, 1996; Wruck & Jensen, 1998; Upton, 1998).

Since the world has become one market on a global scale, an enterprise must have the ability to present fast customer service (trustworthiness) and produce high quality, low cost, different and new product/services to be a leader in its sector. In addition, all these must be supported by an integrated and coordinated organizational effort and with the performance measurement systems within the scope of the enterprise that work towards a similar aim. BSC, which does not only confine itself to following the financial performance of the company, can be functional in this subject by following the performance of non-financial areas, such as customer satisfaction, regeneration and production quality, which is necessary for a competitive advantage (Otley, 1999).

Briefly, a company's strategy and competitive structure will be affected by the connection among the aforementioned four basic performance dimensions. If one of the connections cannot fulfil the function properly, this will negatively affect the performance of other dimensions. For this reason, companies should establish a structure that incorporates performance measurements of activities related to the customer, internal business processes, innovation, development and performance measurement systems with financial measures. As Hoque stated, the extra effort demonstrated in the incorporation and coordination needs a sophisticated control tool that mirrors a universal and serious performance model like the BSC system (Hoque et al., 2001).

3.3 Computer Aided Manufacturing (CAM)

When the literature related to the performance measurement systems is reviewed, it is seen that according to different enterprises, the need for performance measurement systems is recommended. It cannot be said that one recommendation is superior to the other because a difference in activity can only be mentioned rather than superiority among the different company structures and the measurements systems necessary for different company environments. In brief, different manufacturing environments require different measurements to evaluate organizational productivity (Bruggeman & Slagmulder, 1995; Duncan, 1972; Khandwalla, 1972; Mia & Chenhall, 1994). Today, the use of information technologies has become heavily concentrated. Consequently, manufacturing activities should not be considered independent from information technology and the understanding of computer aided manufacturing.

This fact, which is conceptualized as computer aided manufacturing (CAM), provides data necessary to rehash the relationship of the above mentioned performance measurement and manufacturing environment. Computer aided manufacturing directly affects the performance measurement system in the enterprise. Because enterprises are dependent on value creations for investments made to the computer aided manufacturing, they followed work processes much more rationally and the financial measurements that were directed towards the performance evaluation have become controversial for their ability to show competence in following the organizational structure alone. The increasing tendency towards computer aided manufacturing must incorporate performance in a multi dimensional way.

It can be shown that the main basic contribution of computer aided manufacturing processes to BSC is to provide enterprises with the opportunity to see activities that have critical value for their development, in the setting of immediate data provided by BSC. With this system, this current is analyzed continuously For example, in this context, it has been put forth empirically that CAM systems can support strategies in which priority targets for enterprise are established (see Abernethy & Lillis, 1995; Young & Selto, 1991).

In addition to increasing market competition, the implementations of increasing computer aided manufacturing encourage the use of a multidimensional performance measurement system over financial performance.

The increased emphasis on the use of multidimensional performance measurements by the management will be related to a) the greater density competitive environments and b) the implementations of much wider computer aided manufacturing processes.

4. METHODOLOGY

4.1. The Nature of the Research and Sampling

This study depends on data related to 430 manufacturing enterprises of the top 500 in Turkey. The data forms were delivered between the dates of 01 January- 30 June by post and mailed to the top managers (general manager or vice general managers) of manufacturing enterprises that participated in this study. The survey forms return rate was 28.3% (122). The manufacturing activity of the firms is depicted in Table 1.

Table 1

Profile of Respondents by Manufacturing Activity

Manufacturing Activity	Frequency	Percent	Valid Percent	Cumulative Percent
1 Textile, clothing and footwear	25	20,5	20,7	20,7
2 Food and allied products	15	12,3	12,4	33,1
3 Drink and tobacco	1	,8	,8	33,9
4 Construction	10	8,2	8,3	42,1
5 Petroleum and chemicals	12	9,8	9,1	51,2
6 Plastic products	6	4,9	5,0	56,2
7 Metal Wares	6	4,9	5,0	61,2
8 Machinery	13	10,7	10,7	71,9
9 Wood and paper products	7	5,7	5,8	77,7
10 Automotive and spare part	20	16,4	16,5	94,2
11 Glass prodcts	1	,8	,8	95,0
12 Electronic products	6	4,9	5,0	100,0
TOTAL	**121**	**99,2**	**100,0**	

As can be seen from the table, manufacturing activity distribution was realised in the following order, 20.7% Textile, clothing and footwear, 16.5% Automotive and Spare Parts, 12.4% Food and allied products and 10.7% Machinery Sector.

4.2. Data Collection Tools

The survey form, which was developed to collect research data, was comprised of three parts. In the first part, it is aimed at defining the usage level of CAM implementations. Within this framework, participants were requested to designate their choose "not used", "partly used", "used", "rather used" and "used at high level". The second part consisted of 5 questions, which were directed at defining the enterprise's market situation and the competition level in the market. Within this framework, participants were requested to mark each term "very bad", "bad", "average", "good" and "very good" for each denotation which occurred between 1 and 5. In the last section, the diversity of measurement is measured with an adapted version of the instrument used by Hoque and James (2000) and Hoque et al. (2001). The aforementioned BSC approach was comprised of four sub-dimensions, such as "financial", "customer", "internal business processes" and "learning and growth" and a total of 20 factors. The participants were requested to designate whether their enterprises used the aforementioned measurements. For this, the likert scale, in which the choices between 1 and 5 were "not used at all", "partly used", "used", "used rather a lot", and "used very much".

4.3. Data Analysis

In this study, the data was entered into SPSS 13 for data analysis. The reliability test, factor analysis, multi- correlation, and discriminate analysis were performed.

4.3.1. Reliability Analysis and Descriptive Statistics for The Performance Measurement Items

The reliability analysis was performed to test the consistency of BSC's survey results. The alpha coefficient was found to be 90%. No variable was negatively associated with the total correlation. The data showed strong internal consistency.

In Table 2, the descriptive statistical data related to performance measures usage are illustrated. According to this data, the enterprises' usage level of financial performance measures changed between 2 and 5 and the average was 4.283. The usage level of customer measures ranged between 1 and 5 and the mean was 3.86. The usage level of internal business processes measures ranged between 1 and 5 and the average was 3.796. Lastly, the usage level of learning and growth measures ranged between 1 and 5 and the average was 3.195. The data obtained show us that the enterprises' financial performance measures were used at a very high level. The customer and internal business processes measures were above average and the learning and growth measures were below average.

Table 2

Descriptive Statistics for The Performance Measurement Items

Performance Measurement Items	N	Minimum	Maximum	Mean	SD
Financial Performance Measures					
Operating income	122	2	5	4,54	,729
Sales growth	122	2	5	4,42	,801
Return-on-investment	122	2	5	3,89	,977
Internal Business Process Measures					
Rate of material scrap loss	120	1	5	3,58	1,120
Ratio of good output to total output at each production process	121	1	5	3,88	1,119
Manufacturing lead time	120	1	5	4,14	,910
Materials efficiency variance	121	1	5	3,69	1,133
Labour efficiency variance	121	1	5	3,69	1,033
Learning and Growth Measures					
Number of new patents	118	1	5	2,57	1,349
Number of new product launches	121	1	5	3,26	1,209
Time-to-market new products	120	1	5	3,29	1,111
Employee satisfaction	122	1	5	3,66	1,134
Customer Performance Measures					
Market share	122	1	5	4,10	,948
Customer response time	120	1	5	4,20	,866
On-time delivery	122	1	5	4,02	,931
Number of customer complains	122	1	5	4,19	,982
Number of warranty claims	118	1	5	3,34	1,428
Survey of customer satisfaction	122	1	5	4,11	,911
Percentage of shipments returned due to poor quality	119	1	5	3,63	1,255
Number of overdue deliveries	120	1	5	3,29	1,219
Valid N	**107**				

4.3.2 Factor Analysis

Exploratory factor analysis was used to designate the factors which form the sub dimensions of BSC. Firstly, KMO (Kaiser-Meyer-Olkin) sampling adequacy measure was calculated for determining the convenience of data for factor analysis. KMO varies from 0 to 1. This measure shows that sampling is convenient for factor analysis when it is close to 1 and it shows that sampling is not convenient for factor analysis when it is under 0.50. In the analysis the KMO sampling sufficiency has been calculated as 0.803, this shows that this sampling has sufficient size.

Factor analysis has been

carried out by using basic components and varimax rotating technique. The obtained factor analysis results were examined, because the factor burden related to the market share measure in the second and third factors and the factor burden related to the employees satisfaction measure in the second and fourth factors have almost the same burdens, analysis has been done again excluding these two variables.

At the end of the analysis 5 factors have been determined whose Eigen value is above 1. Five factors explained 69.857 % of the total variance. Factor 1 explained most proportion of the total variance (17.098 %) and consisted of variables which contained "internal business processes measures". Factor 2 explained 14.381% of the total variance and consisted of variables which were related to "customer performance measures-I". Factor 3 explained 13.582% of the total variance and consisted of variables which were related to "financial performance measures". Factor 4 explained 13.495% of the total variance and factor 5 explained 11.301% of the total variance and they consisted of variables which were related to "learning and growth measures" and "customer performance measures-II", respectively. Table 3 shows groups of questions.

The analysis carried out on performance measures was also performed respectively on competitive factors. According to this, alpha coefficient was calculated as 58% for competitive factors. KMO sampling adequacy measure was 0,561 therefore sampling was convenient for factor analysis. Also, significant level of Bartlett test was calculated as 0,00. Consequently, both

Table 3

Results of Factor Analysis for Performance Measurement Dimensions

Performance Measurement Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Internal Business Measures					
Rate of material scrap loss	,839				
Ratio of good output to total output at each production process	,748				
Manufacturing lead time	,667				
Materials efficiency variance	,613				
Labour efficiency variance	,546				
Customer Performance Measures-I					
Customer response time		,745			
Number of warranty claims		,694			
On-time delivery		,662			
Survey of customer satisfaction		,609			
Number of customer complains		,562			
Financial Performance Measures					
Sales growth			,873		
Operating income			,827		
Return-on-investment			,576		
Learning and Growth Measures					
Number of new product launches				,831	
Time-to-market new products				,824	
Number of new patents				,736	
Customer Performance Measures –II					
Percentage of shipments returneddue to poor quality					,774
Number of overdue deliveries					,742

Table 4

Results of Factor Analysis For The Competition Factors

Items	Factor 1	Factor 2
Competition for Marketing	,867	
Competition for Market Share	,824	
Competition for New Product Development	,683	
Competitors' Power		,820
Number of Competitors in the Industry		,810

of the tests showed that factor analysis could be applied to data.

In the factor analysis, principal component analysis and none rotation technique were used. At the end of the analysis 2 factors have been determined which have eigenvalue above 1. Two factors explained 65.972% of the total variance. Factor 1 explained most proportion of the total variance 38.186% and Factor 2 explained 27.786% of the total variance. In the results of factor analysis the first factor is named firm's market situation and the second factor as market competitive density level.

4.3.3. Average Values Related to the Variables and The Correlation Matrix

In Table 5, the BSC and sub dimensions averages, minimum, maximum values and standard deviations of the enterprises are presented. The enterprises usage points of overall multidimensional performance measures are between 38 and 100; the average usage point was 74.751. When the BSC sub dimensions were analyzed, the financial measures were between 6 and 15 and the average was 12.8525. The customer measures usage points were between 17 and 40 and the average was 30.5656. The internal business processes measures usage points varied between 7 and 25 and the average was 18.9174. The learning and growth measure usage points were between 4 and 20 and the average was 12.6148. These average figures show us that the enterprises use the financial performance measures (86%), customer performance measures (76%), and internal business processes measures (75%) at a rather high level and learning and growth measures at a medium level.

Table 5

Descriptive Statistics for All Variables

Variable	N	No of items	Theoretical range	Minimum	Maximum	Mean	Standard deviation	Cronbach alpha
Competition Factors	122	5	5-25	2,2	21,2	18,3639	2,40303	,572
CAM	118	1	1-5	1	5	4,14	,951	
Overall Multidimensional Performance Measures	122	20	20-100	38	100	74,7951	12,64842	,905
Financial Performance Measures	122	3	3-15	6	15	12,8525	2,07970	,762
Customer Performance Measures	122	8	8-40	17	40	30,5656	5,46361	,787
Internal Business Processes Measures	121	5	5-25	7	25	18,9174	4,23396	,849
Learning and Growth Measures	122	4	4-20	4	20	12,6148	3,88352	,813

Table 6 shows a correlation matrix for all variables. As proposed, the overall use of multiple performance measures is positively and significantly correlated with CAM, the firm's market situation and market competitive density level and the correlations were 0.479 ($p<0.01$), 0.443 ($p<0.01$), and 0.286 ($p<0.01$), respectively. Also, Table 6 displays that the CAM, firm's market situation and market competitive density level are positively and significantly associated with the four performance dimensions.

analysis. For this reason, a correlation matrix of independent variables was calculated and the correlation coefficients were under 0.70. This showed that there were no multiple linear linkages between independent variables. The group covariances were calculated. In the situation where group covariances were equal, we used the linear discriminate and in situations where the group covariances were not equal, we used the squared discriminate to establish equality.

Table 6

Correlation Matrix for All Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) CAM	1								
(2) Firm's market situation	,337(**)	1							
(3) Market competitive density degree	,260(**)	,146	1						
(4) Overall Performance Measures Usage	,498(**)	,443(**)	,286(**)	1					
(5)Financial Performance Measures	,479(**)	,358(**)	,271(**)	,724(**)	1				
(6) Customer Performance Measures-I	,277(**)	,470(**)	,254(**)	,751(**)	,429(**)	1			
(7) Internal Business Processes Measures	,385(**)	,186(*)	,128	,781(**)	,512(**)	,411(**)	1		
(8)Learning and Growth Measures	,418(**)	,405(**)	,243(**)	,693(**)	,400(**)	,453(**)	,326(**)	1	
(9)Customer Performance Measures-II	,260(**)	,119	,257(**)	,674(**)	,420(**)	,340(**)	,564(**)	,349(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

5. Discrimination analysis

In this section, we explore whether the use of multiple performance measures vary between (1) low vs. high market situations, (2) low vs. high market competitive densities and (3) low vs. high CAM firms. For this purpose, discriminate analysis (a multi-variable statistical technique) was performed to examine the relationships between the dependent and metric independent variables. Some assumptions must be made prior to

A. Discrimination for firm's market situation

To determine the effect of market situation on the use of multiple performance measures, the market situation was grouped into two levels, low (G1) and high (G2) level firms. Since the covariance group matrix was not equal (Box's M=29,323 F=2,637 p=0,03), we applied the squared discriminate to establish equality (Box's M=2,120 F=2,073 p=0,15). Table 7 shows the structure matrix, standardized canonical discriminant function coefficients and fisher's linear discriminant functions (classification function coefficients), which were constituted according to the firm's market situation. In table 7, the structure matrix shows the correlations of each variable with each discriminant function. While structure matrix coefficients are whole (not partial) coefficients, the standardized canonical discriminant function coefficients indicate the partial contribution of each variable to the discriminant functions and are used to compare the relative importance of these independent variables.

mer performance measures (r=0.529), learning and growth measures (r=0.469), financial performance measures (r=0.456) and internal business processes measures (r=0.322). According to the standardized canonical discriminant function coefficients, financial, customer, internal business processes and learning and growth dimensions were found to significantly influence group separation.

In Table 7, columns of Group 1 and Group 2 show the Fisher discriminate function co efficiencies. Group 1 shows the coefficients of

Table 7

Structure Matrix, Standardized Canonical Discriminant Function Coefficients and Fisher's Linear Discriminant Functions for Firm's Market Situation

Variables	Structure Matrix	Variables	1 Function	1.Group	2 Group
Customer P.M. (Factor 2)	,529	Financial P.M.(Factor 3)	,566	-,822	,117
Learning and growth P.M. (Factor 4)	,469	Customer P.M (Factor 2)	,641	-,939	,135
(Factor 2)	,641	-,939	,135		
Financial P.M. (Factor 3)(a)	,456	Internal business Processes M. (Factor 1)	,408	-,579	,086
Internal business processes M. (Factor 1) (a)	,322	Learning and growth M. (Factor 4)	,579	-,842	,120
(Constant)		(Constant)		-3,025	-,162

In the structure matrix, there was one discriminat function because the dependent had two groups (low and high). The discriminat function in the structure matrix had a positive and significiant correlation with custo-

low level market firms and Group 2 shows the coefficients of high level market firms. These coefficients show the contribution of factors to group discrimination. While the high coefficient shows the high contribution,

Table 8

Eigenvalues and Wilks' Lambda for Firm's Market Situation

Function	Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi-square	Df	Sig.
1	,306(a)	,484	,766	31,199	4	,000

a First 1 canonical discriminant functions were used in the analysis.

Table 9

Classification Results for Firm's Market Situation (a)

Predicted Group Membership					
Original	Count	Grup	1	2	Total
		1	6	10	16
		2	4	101	105
		Ungrouped cases	0	1	1
	%	1	37,5	62,5	100,0
		2	3,8	96,2	100,0
		Ungrouped cases	,0	100,0	100,0

a 88,4% of original grouped cases correctly classified.

the low coefficient shows the low contribution. As a result, the factors 4,1,2 and 3 is a better predictor for high/important market firms. No predictive factor for low market situation firms could be determined.

Table 8 shows the eigenvalue of discriminant functions and the significance level of the eigenvalue for each discriminant function. The larger the eigenvalue, the greater the variance in the dependent variable is explained by that function. Wilks's lambda tests the significance of each discriminant function. As seen in Table 8, the discriminant function was found to be statistically significant (Wilks' Lambda=0.766; 2=31,199; df=4 and p<0.01). The eigenvalue value indicated that the discriminant function explained 30.6% of the total variance and the square of canonical correlation indicated that the discriminant function explained 23.43% of the variance in the dependent variable. The classification results, which were made according to the importance degree of the enterprise's market situation, are presented in table 9.

Table 9 indicates the classification results of discriminant function, which was constituted for market situation. As seen in Table 14, 37.5% of the 16 low level market firms were correctly classified, 96.2% of the 105 high level market firms were correctly classified. The correct classification ratio was 88.4% [(6+101)/121] in this analysis. This result indicated that the discrimination characteristic of the discriminant function was high level.

B. Discrimination for market competitive density level

As covariance matrixs of groups were equal (Box's M=0,520; F=0,391; p=0,537), linear dicriminant analysis was used. Table 10 shows structure matrix, standardized canonical discriminant function coefficients and classification function coefficients for variables as predictors of competitive market density levels.

As seen in Table 10, the discriminant analysis of the five variables yielded one function and this function indicated that factor 1 was the only discriminating variable for market competitive density levels. In other words, only internal business processes measures were identified by firms as being associated with their level of market competitive density. According to the classification function coefficients, internal business processes measures were significant predictors of low level market firms. No factors were found to be significant predictors for firmswith high level market competitive density.

Table 11 shows the eigenvalue value and the significance levels for the discriminant function of market competitive density levels. The discriminant function was found to be statistically significant (Wilks' Lambda=0,966; 2=4,123; df=1 and p<0,05). The eigenvalue value indicated that the discriminant function explained 3.6% of the total variance and the square of canonical correlation indicated that the discriminant function explained 3.5% of the variance in the dependent variable.

Table 10

Structure Matrix, Standardized Canonical Discriminant Function Coefficients and Fisher's Linear Discriminant Functions for Market Competitive Density

Variables	Structure Matrix	Standardized Canonical Discriminant Function Coefficients	Classification Function Coefficients	
	Function 1	Function 1	Group 1	Group 2
Internal business processes P.M. (Factor 1)	1,000	1,000	1,446	-,037
Financial P.M. (Factor 3) (a)	-,029			
Learning and growth P.M (a)	-,005			
Customer P.M. (a)	,000			
Constant			-5,113	-,017

a 88,4% of original grouped cases correctly classified.

Table 11

Eigenvalues and Wilks' Lambda of Discriminant Function For Market Competitive Density

Function	Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi-square	Df	Sig.
1	,036(a)	,186	,966	4,123	1	,042

a First 1 canonical discriminant functions were used in the analysis.

Table 12

Classification Results For Market Competitive Density

Predicted Group Membership					
Original	**Count**	**Gurup**	**1**	**2**	**Total**
		1	0	2	2
		2	0	118	118
		Ungrouped cases	0	2	2
	%	1	0	100,0	100,0
		2	0	100,0	100,0
		Ungrouped cases	0	100,0	100,0

a 98,3% of original grouped cases correctly classified

Table 12 shows the classification results of discriminant function for market competitive density levels. As seen Table 17, 100% of 118 firms with low market competitive density scores were correctly classified. The function correctly classified 98.3% of firms. This result indicated that the discrimination characteristics of the discriminant function were high level.

C. Discrimination for CAM implementation levels;

As covariance matrixs of groups were equal (Box's M=5,244; F=1,675 and p=0,170),linear dicriminant analysis was used. Table 13 shows the results of this linear discrimiant analysis, which was constituted according to CAM implementation levels.

As indicated in Table 13, there was one function because there were two groups. The discriminat function for CAM implementation levels were positively and significiantly correlated with financial performance measures (r=0,701) and learning and growth measures (r=0,607). According to the standardized canonical discriminant function coefficients, financial performance measures and learning and growth measures were significant discriminating variables for CAM implementation levels. According to the classification function coefficients, financial performance measures and learning and growth measures were significant predictors of firms with a high level of CAM implementation. No factors were found to be significant predictors for firms with low level CAM implementation.

Table 14 shows the eigenvalue value and the significance level of the discriminant function for firms's CAM implementation levels. As seen in Table 14, the discriminant function was found to be statistically significant (Wilks' Lambda=0,766; 2=14,907; df=2 and p<0,01). The eigenvalue value indicated that

Table 13

Structure Matrix, Standardized Canonical Discriminant Function Coefficients, Fisher's Linear Discriminant Functions For The Firm's CAM Implementation Levels

Variables	Structure Matrix	Functions	1.Group	2. Group
Financial P.M.	,701	,803	-,709	,245
Learning and growth P.M.	,607	,721	-,518	,254
Internal business processes M.(a)	-,094			
Customer P.M. (a)	-,079			
Constant			-2,017	-,233

Table 14

Eigenvalues and Wilks' Lambda For the Firm's CAM Implementation Levels

Function	Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi-square	Df	Sig.
1	,149(a)	,361	,870	14,907	2	,001

a First 1 canonical discriminant functions were used in the analysis.

Table 15

Classification Results For The Firm's CAM Implementation Levels (a)

Predicted Group Membership					
Original	**Count**	**Gurup**	**1**	**2**	**Total**
		1	3	16	19
		2	3	88	91
		Ungrouped cases	3	9	12
	%	1	15,80	84,2	100,0
		2	3,3	96,7	100,0
		Ungrouped cases	25,0	75,0	100,0

a 82,7% of original grouped cases correctly classified.

the discriminant function explained 14.9% of the total variance and the square of the canonical correlation indicated that the discriminant function explained 13% of the variance in the dependent variable.

Table 15 indicates the classification result of discriminant function, which was constituted for the firm's CAM implementation levels. 15.8% of 3 firms with low CAM implementation scores were correctly classified and 96.7% of 88 firms with high CAM implementation scores were correctly classified. 82.7% of the original grouped cases were correctly classified in this analysis. This result indicated that the discrimination characteristics of the discriminant function was high level.

6. DISCUSSION AND RESULT

Today, market position, market competitive density and CAM implementations are the elements that define the enterprise environment. As a result, these concepts are often emphasized in the literature. These concepts, which define the manufacturing variety, and changes in its dimension paved the way for changes in the perception of performance. Performance was evaluated in a multi-dimensional manner. The multiple performance measurement system is the result of conceptual changes directed towards performance.

The results confirm the aforementioned hypothetic relationship, which was aimed at examining the theoretical relationship between multiple performance measurement system and new manufacturing environments. Also, the study confirmed that the three elements that define the new manufacturing environment are characteristic variables that are contingent upon performance measurement, and as a result, their degree of effectiveness differs. These results support the contingency approach because the effects of the variables on performance measurement show a difference.

The results show that there is a noticeable positive relationship between the enterprise's use of multiple performance measurement systems and organizations that prefer a CAM model. Also, these results support the idea that an organizational strategy, which takes into consideration the use of multiple performance measurement system is necessary to follow changes in a manufacturing environment directed by computer aided manufacturing.

Also, the study demonstrates that there is a noticeable positive relationship between the enterprise's market situation and the use of multiple performance measurements. It can be said that the enterprises with good market situations emphasize the use of multiple performance measurements.

Extensive analysis has examined the probability of relationship between the changing market situations, market competitive density level, computerized manufacturing implementations and use of multiple performance measures. Results of discriminate analysis support the study's proposition that high market situation firms with CAM implementation tend to rely more upon multi-dimensional measures for performance evaluation than the firms with low market situations and CAM implementation. However, except in the case of internal business performance measures, variations in the use of multidimensional performance measures between firms with low and high market competitive density were not observed. The obtained results show that all firms might not use multiple performance measurements in the market.

Since Turkey is a developing country that simultaneously experiences the global technological and competitive effects with developed countries, the practical importance and necessity of the studies related to performance evaluation can be seen more clearly. This study contributes to the local academic accumulation of knowledge related to this subject. On the other hand, when the aforementioned study accounts for computer aided manufacturing and competitive factors, it is clear that it is necessary to examine the subject using variables such as JIT, TQM, and culture.

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