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The Effect of Competition, Just In Time Production and Total Quality Management on the Use of Multiple Performance Measures: An Empirical Study

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Abstract. This paper is an empirical investigation into the use of multiple performance measures in manufacturing organizations. Specifically, the relationship between multiple performance measurement system and competition factors, JIT practices and TQM practices is examined through the data collected from 122 manufacturing firms from the Turkish top 500 companies in 2005. The results show there is a linear relationship between using multidimensional performance measurement system and the firms that have high market position are those that are using JIT and TQM more than others.

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1. Introduction

Performance measurement is a concept of modern business administration history. The organizations in the market have to identify with concepts such as "dynamism", "scarce resources" and "complexity" and have to show high performance to survive thereby needing to measure and to evaluate their performances accurately. This means for firms that performance measurement is more than a systematic action, but today, performance measurement and evaluation system is the most important managerial tool for organizations.

Nowadays, because of high specialization, division of labour and high competition, it's clear that performance should be thought more

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elaborately as a concept and discussed not in a result-focused but in a process-focused way. (Albright, 2006:157-174; Yasin and et al., 2005: 323). In this context, it will be possible to state two types of criteria concerning the performance measurement in organizations. These are financial and non-financial performance criteria. Financial criteria evaluate the performance in terms of monetary assets gained and therefore attach importance to the result. On the other hand, a non-financial criterion evaluate the performance in terms of units or divisions and work processes in a company and highlights the actions that provide final financial result and enable its sustainability.

It's possible to separate performance criteria theoretically, but both are linked practically. In fact, firms are organizations in business to make a profit, but today it is possible to argue that there are various functions in organizations and therefore financial performance is likely to be affected much more by non-financial processes. Hence, performance measurement has to have a structure containing both financial and non-financial criteria. (Wruck and Jensen, 1998:401–423).

Due to its effect on how successful firms are, performance measurement system has to contain accurate and reliable information, which is so critical to business organizations because of its roles in future planning, evaluation of targets and actual results, and decision-making matters affecting employees are all based on the strength of the information contained in performance measurement evaluative processes.

However, the more important point needing to be noted here is that generally the meaning of performance for organizations has become limited to only profitability or financial incomes. Undoubtedly, firms are profit-based organizations, but more than that, they have to be sustainable. Making profitability sustainable depends on managers' abilities to see all developments in and around firms and evaluate them according to future results. So, this underlines that the concept of performance should not be confined only to financial results, but also should have a wide meaning including the non-financial criteria as well. Balanced Scorecard (BSC) is a performance measurement model, which was proposed as a result of this obligation.

Three reasons for using multiple performance measures are: (1) perceived limitations in traditional accounting-based measures,[1] (2)

[1] Fisher (1995) indicates that many firms believe that financial measures are too historical and "backward-looking", lack predictive ability to explain future

increasing competitive pressure and (3) applying new management techniques like TQM and JIT needed for non-financial measures (Itner and Larcker, 1998: 217-218). Performance should therefore not be interpreted only as profit-focused activities but also as non-financial activities directed toward obtaining or following profit process. This kind of new comprehension on performance measures points to changing perception of firms toward performance. In this context, improvements in information technology make it easy to observe internal and external business processes, consequently making it possible to apply BSC. (Donovan, 1-3).

Hitherto studies have shown that the use of non-financial performance measures by the firms is directly related to such variables as market competition, computer aided production, new production techniques, the structure of firm (size, culture, technological situation and adopted strategy etc.) and sector structure. The aim of this study is to determine whether the multidimensional performance measures are used or not by the manufactures of top 500 firms in Turkey and if they're used, to define the relationship between multidimensional performance measures and firm's market position, market competitive density degree, JIT and TQM practices.

In this context, first the literature and the developed hypotheses on the subject will be reviewed and then the designation of sampling and factor analysis, descriptive statistics, multi-correlation and multinomial logistic regression analysis results will be described together with the results from our empirical study.

2. Literature Review and Hypotheses

2.1. Literature Review

Many factors contribute to why many firms prefer non-financial performance measures. In view of this, 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: 193-223), others suggest that this preference can be related to the JIT, TQM and CAM structure (Hoque, et.al 2001: 23-45). Similarly, while many reported that the use of multiple performance measures is relevant only to the strategic preference of managers (Malina and Selto, 2001:48; Govindarajan and

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performance, reward short-term or incorrect behaviour, provide little information on root causes or solutions to problems, and give inadequate consideration to difficult to quantify "intangible" assets such as intellectual capital**.**

Gupta, 1985: 51-66), 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: 16-35) 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 on production performance are demonstrated in another section of the literature. For example, Banker, Potter and Schroeder (1993: 33-55) 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: 187-206), Callen, et al. (2005: 271-309), Itner and Larcker (1995: 1-34) 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.

Additionally, many studies examine the positive contribution of multiple performance measures on the general enterprise performance from the financial perspective. For example, Davies & Albright (2004: 135-153) and Dilber et al (2005: 220) 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: 1-17) 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: 56-61) 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: 715-741) indicated that the enterprises placing more emphasis on measurement and variety have acquired a much higher stock exchange income. Perera, Harrison and Poole (1997: 557-572) 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: 243-267) 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: 67-80) 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: 239-278) suggested that organizations with higher quality information systems could 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, c) with the JIT practices and d) with the TQM practices.

2.2. Variables and Hypotheses

2.2.1. Balanced Scorecard

BSC created firstly by Kaplan and Norton in 1992 at the end of pursuits on alternative planning, control and performance measurement system in

management accounting, is an efficient management tool (Kaplan and Norton: 1992). The target is to enable managers to obtain comprehensive viewpoint about overall business and in this way help them focus more on critical activities that are supposed to improve the organizational strategy of the firm (Wongrassamee, et.al. 2003: 18).

In that way, BSC undertakes two crucial functions. First is being a strategic guide for department managers. Second is being communication and strategic planning tool describing the link between financial and non-financial criteria as a guide for firms (Kaplan and Norton 1996; Kaplan and Atkinson, 1998: 367-375; Atkinson, Kaplan and Young: 2004; Simons: 2000).

Using BSC provides some opportunities to managers on subjects like ability to evaluate changes around a firm, to determine and evaluate the processes of the aims of a firm, to check whether internal performance targets are achieved or not and sustaining the continuation of improvements, in the final analysis. Four dimensions of BSC and derived indicators have created these opportunities. These four dimensions or perspectives will be explained briefly.

Financial performance measures; they are the focal point for the target and measures of other three perspectives in BSC. In this sense, financial performance measures can be considered as the outcome of operational activities (Rao: 2000). Therefore, each selected measure should be a part of the cause-and-effect relationship leading to an improvement in financial performance. These measures are items such as sales amount, market share, new customers, new markets, cash flow, return on capital, etc.(Morrow, 1992: 145).

Customer performance measures; today, being customer-focused is one of important items for firms, so at the same time it's a kind of important expression of vision and mission. In this sense specific measures reflecting critical factors like time, quality, cost should be determined. Customer satisfaction, improving costumer loyalty, gaining new customers, customer profitability, and market and customer shares in targeted scope are basic measures.

Internal operation measures; these are obtained from critical success factors which are effective on providing shareholder and customer satisfaction by focusing on work processes and activities (Keegan, Eiler and

Jones, 1989: 45-49). But, the most important point here is that to create value for both customer and shareholder, it is necessary to define and measure an exact internal operation value chain at the designing and development stage, production and commercializing (Eker, 2004:128). These measures include the duration of presenting new product to the market, number of new products, sales percentage of new products, rate of defect, duration of production, production cost, just-in-time delivery, etc.

Learning and growth measures; making real the ideals related with financial, customer and internal operations highly depend on the learning and growth capacity of an organization. In learning and growth measures especially, it investigates and measures what sort of methods to be followed for increasing the growth of internal operation methods, which measures are employee satisfaction, productivity and sustainability of the employees.

2.2.2. Market Competition

One of the distinguishing factors of the use of multiple performance measures by the firms is the competition environment in the market. As the market competition increases, the firms are likely to need multidimensional performance measurement system more than before in order not to lose their power and market share. Also, the measures included in multidimensional performance measurement system (BSC) are known to increase the level of competitiveness by monitoring the static and dynamic capabilities of the firms (Hoque, Mia and Alam, 2001: 26).

If it's considered that the world has become a single market in global scale, in such a condition, it's necessary for a firm to have the capability of offering speedy customer service (reliability), high quality and low cost, different and new product/service in order to be dominant in its own sector. Furthermore, all these need to be supported by total and coordinated organization efforts and also by performance measurement systems serving the same objectives within the organization. BSC is not only satisfied with following the financial performance of the firm, but it could also be functional by monitoring non-financial performances like customer satisfaction, renewal via quality production, which are essential to sustaining the competitive advantage (Otley, 1999: 363–382; Howell and Soucy, 1987: 27; Trussel and Bitnet, 1998:441).

2.2.3 Just-In-Time Production

It is possible to observe that traditional performance measurement system is inconsistent with JIT system benefiting from technological innovations at a maximum level and also that it prevents or hides broad-based effectiveness of new production methods. In this sense, the restrictions of traditional measurement system in JIT environment might be listed as follows:

- Continuous development in production process is basic element in JIT manufacturing environment. To reach this aim easily, it's intended to make flow of production possible with minimal parties and decreasing stock levels to a minimum. Yet, production and productivity measures of traditional understanding have reported that the productivity is low when small-lot production is made (Drury, 1990: 40-41). For this reason, traditional accounting system suggests increasing batch capacity rather than decreasing lot size, which leads to raising stock levels, long supply process, increasing cost and declining customer satisfaction (Donovan, 2-3; Mcnair, Lynch and Cross, 1990: 29).

- As in standard costing, appropriate operational control of traditional accounting system cannot be carried out in today's production environment (Allott, 2000: 54-56; Cheatham and Cheatham: 1996; Ezzamel, 1992: 117). Besides, due to the reliability and consistency of manufacturing processes in JIT environment, deviations do not exist or exist in quite low level and it also leads to less use of deviation analyses.

- JIT manufacturing system changes will bring about changes in information requirements (Upton, 1998:110). As it is known, normally traditional performance reporting is prepared monthly or weekly and cannot detect on time real reasons of processes that are not realized as expected. Yet, in JIT production system there is a possibility of short production cycle, so it requires information for the problems coming out in accordance with one-day or "real time" principal.

- In current production environment, direct labor cost is between 5%-15% of total product cost. In this sense, traditional accounting system is likely to exaggerate the importance of labor cost and

ignores the control and measurement methods of increasing general production costs.

- Another limitation of traditional accounting system is its failure in reporting the criteria such as quality, reliability, supply duration, flexibility, and customer satisfaction (Johnson, 1990:63). As a result of this, management and the employees are encouraged to focus only on costs rather than those critical success factors.

Consequently, JIT production system is in need of a performance measurement system that will follow, measure and report critical success factors such as “production and delivery time”, “quality”, “flexibility”, “cost” “efficiency” and “continuous development”(Fullerton, 2003: 40; Mcllhattan, 1987: 25-26). In current environment, which is dominated by a flexible, dynamic, and process-oriented production understanding, JIT production system cannot perform its functions including result-focused traditional performance measurement system, measuring, evaluating and reporting of operational actions in order to be successful. Therefore, performance measurement system of a corporate using Just-in-time production system should support basic variations such as increasing product or service quality, continuous development and reducing the losses (Hendricks, 1994: 27). BSC meets the new management requirements because of its following qualifications: (1) focusing long term perspective instead of short term perspective; (2) performing data both in financial and non-financial/operational dimensions; (3) being timely and ready for usage instead of being prepared for terms; (4) being easy to understand and apply; (5) immediately answering/adapting the changes in the production process, (6) transforming the firm strategy to operational measures (Santari, 1987: 27).

2.2.4 Total Quality Management

TQM does produce value, through a variety of benefits: improved understanding of customers' needs; improved customer satisfaction; improved internal communication; better problem-solving; greater employee commitment and motivation; stronger relationships with suppliers; fewer errors; and reduced waste (Powell, 1995: 15-37). In order to get this value and to ensure the success of the system, the features of the performance measurement system of the businesses applying the system should be: (Kaydos, 1999: 150)

- to focus the attention of managers on the satisfaction of foreign and domestic customers
- to produce assumptions on strategy
- to detect the unforeseen quality and wasting problems
- to provide objective information for priority-setting
- to receive support from managers and employees for further changes when they see concrete improvements in performance
- to increase the loyalty of employees by encouraging managers to delegate their authority

Taking all these features into account, it is seen that BSC is in compliance with what is expected from a performance measurement system in the context of TQM. Because there is a reciprocal relationship between BSC and TQM as the former makes the latter more efficient through its applications. Accordingly, BSC makes TQM more efficient in the following matters: (Kaplan and Norton, 2001:376)

Firstly, it complements the internal processes where the progressive elements with critical importance for the strategic success are found. TQM is implemented in many businesses; however, the effects of its implementation can be determined neither in financial terms nor in terms of the performance with respect to the customer, and the implementation remains limited to the department or unit level. BSC, on the other hand, identifies the processes that are important for the strategy as well as the priorities in these processes. Moreover, it also determines whether the process developments focus on such important issues as cost-cutting, quality improvement and shortening of production cycle, or not.

Secondly, BSC identifies the non-financial quality measures regarding the quality costs and prepares reports on a daily or real-time basis, and it can find out the real causes of the unfulfilled transactions (Sinclair and Zairi, 2000: 156-157). Therefore, BSC proves to be a crucial resource, which provides continuous and accurate feedback to managers and employees, in meeting customer expectations, improvement of processes and reporting of quality performance measures. Thirdly, BSC urges managers to develop business processes in order to achieve successful outputs for customers and shareholders, and to create value. Within this framework, a perpetual relationship between quality and the financial outputs is made possible.

Based on the above studies, we posit that increasing application of JIT and TQM, as well as intense market competition, would prompt greater

multiple performance measures usage. Therefore, the following hypotheses are proposed:

Hypothesis 1: The greater emphasis on the use of multidimensional performance measurements by the management will be associated with a more intensely competitive environment.

Hypothesis 2: The greater emphasis on the use of multidimensional performance measurements by the management will be related to a greater application of JIT.

Hypothesis 3: The greater emphasis on the use of multidimensional performance measurements by the management will be associated with a greater application of TQM.

3. Research Methodology

3.1. The Nature of the Research

This study depends on the data related to 430 manufacture firms 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 manufacture firms 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 products	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.

3.2. Data Collection Tools

The survey form, which was developed to collect the research data, was comprised of three parts. In the first part, it is aimed at defining the usage level of JIT and TQM practices. 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 firm’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 items. The participants were requested to designate whether their firms used the aforementioned measures. 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". 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.

3.3. Data Analysis

In this study, the data was entered into SPSS 13 for data analysis. Factor analysis, descriptive statistics, multi- correlation and multinomial logistic regression analysis were performed.

3.3.1 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.

We use basic components and varimax rotating technique to carry out factor analysis. 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 that 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 2 shows groups of questions.

Table 2: Rotated Component Matrix

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 returned Due to poor quality					,774
Number of overdue deliveries					,742

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 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 Eigen value 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.

Table 3: Rotated Component Matrix

	1.Factor	2.Factor
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

3.3.2. Descriptive Statistics related to the Variables and Correlation Analysis

In Table 4, the BSC and sub-dimension averages, minimum, maximum values and standard deviations of the firms are presented. The firm's 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 analysed, 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 process measures usage points varied between 7 and 25 and the average was 18.9174. The learning and growth measures usage points were between 4 and 20 and the average was 12.6148. These average figures show us that the firms 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 4: BSC and Sub Dimensions Averages, Minimum, Maximum Values

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
JIT	117	1	1-5	1	5	3,57	1,191	
TQM	121	1	1-5	1	5	4,08	1,144	
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 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 5 shows a correlation matrix for all variables. As proposed, the overall use of multiple performance measures is positively and significantly correlated with firm's market situation, market competitive density level, JIT and TQM practices and the correlations were 0,425 ($p<0,01$), 0,314 ($p<0,01$), 0.442, ($p<0.01$) 0,537 ($p<0,01$) respectively. Also, Table 6 displays that firm's market situation; market competitive density level, JIT and TQM practices are positively and significantly associated with the four performance dimensions. As a result, it shows that there is a noticeable positive relationship between the usage of multidimensional performance measurement system and the organizations, which prefer the JIT and TQM practices. Also, it shows that there is a noticeable positive relationship between firm's market situation, market competitive density level and the usage of multidimensional performance measurements.

Table 5: Multi Correlation Analysis

Variables	Firm's Market Situation	Market Competitive Density Degree	JIT Practices	TQM Practices	Overall Multi dimensional Performance Measures	Financial Performance Measures	Customer Performance Measures-I	Customer Performance Measures-II	Internal Business Measures	Learning and Growth Measures
Firm's Market Situation	1	,151	,234(*)	,252(**)	,425(**)	,356(**)	,366(**)	,102	,151	,391(**)
Market Competitive Density Degree	,151	1	-,050	,174	,314(**)	,245(**)	,181(*)	,302(**)	,106	,292(**)
JIT Practices	,234(*)	-,050	1	,589(**)	,442(**)	,375(**)	,277(**)	,179	,468(**)	,264(**)
TQM Practices	,252(**)	,174	,589(**)	1	,537(**)	,444(**)	,293(**)	,415(**)	,380(**)	,454(**)
Overall M.P.M.	,425(**)	,314(**)	,442(**)	,537(**)	1	,702(**)	,630(**)	,635(**)	,792(**)	,674(**)
Financial Performance Measures	,356(**)	,245(**)	,375(**)	,444(**)	,702(**)	1	,407(**)	,403(**)	,525(**)	,366(**)
Customer Performance Measures-I	,366(**)	,181(*)	,277(**)	,293(**)	,630(**)	,407(**)	1	,314(**)	,410(**)	,238(**)
Customer Performance Measures-II	,102	,302(**)	,179	,415(**)	,635(**)	,403(**)	,314(**)	1	,534(**)	,321(**)
Internal Business Measures	,151	,106	,468(**)	,380(**)	,792(**)	,525(**)	,410(**)	,534(**)	1	,324(**)
Learning and Growth Measures	,391(**)	,292(**)	,264(**)	,454(**)	,674(**)	,366(**)	,238(**)	,321(**)	,324(**)	1

* Correlation is significant at the 0.05 level (2-tailed).

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

3.3.3 Multi-nominal Logistic Regression Analysis

In this section, we explore whether the use of multiple performance measures varies between (1) low, middle vs. and high competition firms, (2) low, middle and vs. high JIT firms, (3) low, middle and vs. high TQM firms. For this purpose, the logistic regression analysis (a multi-variable statistical technique) was performed to examine the relationships between the dependent and metric independent variables. Logistic regression analysis was preferred instead of other similar methods such as regression analysis and discriminant analysis because of its less stringent assumptions. As it's known, in a logistic regression analysis, double logistic regression and multi-nominal logistic regression methods are used as the two main methods. First one is used when dependent variables have only two categories and the second one is used if dependent variables have more than two categories. In this paper, multi-nominal logistic regression analysis was preferred because of dependent variables having three categories.

In the multi-nominal logistic regression analysis, for determining the impact of independent variables on dependent variables, low market situation, low market competitive density, low-JIT and low-TQM firms were coded with 0; middle market situation, middle market competitive density, middle JIT and middle TQM firms were coded with 1; high market situation, high market competitive density, high JIT and high TQM firms were coded with 2.

A. The effect of firm's market situation;

In the logistic regression analysis which was constituted for determining the effect of firm's market situation predictor variables on the use of multidimensional performance measures, -2 log likelihood statistics (LL) was 142,099 and significant level (p) was 0, 000 (p<, 05) with 10 degrees of freedom. The results of goodness-of-fit test, which are shown in table 6, indicated that the logistic regression model was a good fit. The Cox and Snell R^2 was found to be 33.8% in the first step and this statistics indicated that there was an approximately 33.8% relationship between firm's market situation and BSC's sub-dimensions. Also, Nagelkerke R^2 indicated that there was a 42.5% relationship between the above-mentioned variables.

Table 6: Model Fitting Information, Goodness-of-Fit Test of Model and Pseudo R-Square

Model Fitting Information					Goodness- of –Fit				Pseudo R2	
Model	-2 Log Likelihood	Chi-Square	Df	Sig.		Chi-Square	Df	Sig.	Cox and Snell	,338
Intercept Only	191,955				Pearson	175,664	196	,849	Nagelkerke	,425
Final	142,099	49,856	10	,000	Deviance	142,099	196	,999	McFadden	,260

To measure the meaningfulness of independent variable in logistic regression model, likelihood ratio tests were applied. When table 7 is examined, it can be seen that customer-I, customer-II, and learning and growth measures are statistically meaningful.

Table 7: Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	Df	Sig.
Intercept	207,466	65,367	2	,000
Internal business processes P.M.	143,344	1,244	2	,537
Customer P.M.-I	163,685	21,586	2	,000
Learning and growth P.M.	158,274	16,174	2	,000
Customer P.M.-II	152,744	10,645	2	,005
Financial P.M.	142,617	,518	2	,772

After examining the general statistics of model, in table 8, “B” column shows the coefficients (called Beta Coefficients) associated with each predictor, “sig.” column shows the significant levels and “Exp (B)” column shows the odds ratios.

Table 8: Results of logistic regression analysis for business's market situation

M.S. (a)		B	S.E.	Wald	Df	Sig.	Exp(B)	95,0% C.I.for EXP (B)	
								Lower	Upper
,00	Intercept	-4,480	1,243	12,984	1	,000			
	Internal business Processes P.M.	-,548	,590	,864	1	,353	,578	,182	1,836
	Customer P.M.-I	-2,107	,687	9,417	1	,002	,122	,032	,467
	Learning and growth P.M.	-,492	,834	,348	1	,555	,612	,119	3,134
	Customer P.M.-II	-,610	,855	,508	1	,476	,544	,102	2,906
	Financial P.M.	,620	,929	,446	1	,504	1,860	,301	11,490
1,00	Intercept	-,450	,226	3,976	1	,046			
	Internal business Processes P.M.	,099	,227	,190	1	,663	1,104	,707	1,723
	Customer P.M.-I	-,818	,247	10,977	1	,001	,441	,272	,716
	Learning and growth P.M.	-,972	,280	12,086	1	,001	,378	,219	,654
	Customer P.M.-II	-,761	,250	9,255	1	,002	,467	,286	,763
	Financial P.M.	,001	,218	,000	1	,997	1,001	,653	1,534

The reference category is: 2,00.

In table 8, when the Model 1 is examined it can be seen that customer performance measure-I usage level is 8.197 (1 / 0.122) times lower in firms with a low market position than the ones with a higher market position. The Model 2 in which firms with medium market position are compared to the ones with high market position has shown that the usage of customer performance measures-I is 2.268 times, the usage of learning and growth measures is 2.646 times, and the usage of customer performance measures-II is 2.141 times lower.

Table 9: Classification Table

		Predicted			Percentage Correct
		MS			
		0	1	2	
Observed MS	0	1	2	1	25,0%
	1	1	25	20	54,3%
	2	0	9	62	87,3%
Overall Percentage		1,7%	29,8%	68,6%	72,7%

One can assess the success of the logistic regression by looking at the classification table. In the classification which was made according to firm's market situation; the 25% of firms, which have a low market situation, 54,3% of firms, which have a middle market situation and 87,3% of firms, which have a high market situation were appointed correctly. Accurate classification rate of observation results dealt with is 72.7 % as a result of the model established.

B. The effect of market competitive density degree;

In the logistic regression model, which was constituted for determining the effect of firm's market competitive density levels on usage of multidimensional performance measures, -2 log likelihood statistic criteria (LL) were calculated as 131,307. Marginal significant level (p) which is 0, 000 (p<,05) with 10 degrees of freedom, indicate good harmony of likelihood in each other. In table 10, the established model is not meaningful as statistical according to Pearson and deviance values. In addition to this, when the relationship between market competitive density levels and BSC's sub-dimensions are examined, changeable ratios can be observed according to the different statistical model. For instance, according to the Cox and Snell R^2 statistics model this ratio shows 32.3%., in the Nagelkerke R^2 statistics shows 41.8%, and in the McFadden R^2 statistics shows 26.3%.

Table 10: Model Fitting Information, Goodness-of-Fit Test of Model and Pseudo R-Square

Model Fitting Information					Goodness-of-Fit				Pseudo R^2	
Model	-2 Log Likelihood	Chi-Square	Df	Sig.		Chi-Square	Df	Sig.	Cox and Snell	,323
Intercept Only	178,150				Pearson	109,660	194	1,000	Nagelkerke	,418
Final	131,307	46,843	10	,000	Deviance	131,307	194	1,000	McFadden	,263

When likelihood ratio tests are examined in table 11, it can be seen that internal business processes, learning and growth and financial performance measures are statistically meaningful.

Table 11: Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	Df	Sig.
Intercept	226,995	95,688	2	,000
Internal business processes P.M.	150,228	18,921	2	,000
Customer P.M.-I	134,744	3,437	2	,179
Learning and growth P.M.	154,410	23,103	2	,000
Customer P.M.-II	135,681	4,374	2	,112
Financial P.M.	152,141	20,834	2	,000

After examining the general statistics of model, table 12 consisted of parameter predictions (B), Wald statistics, significant levels and odd ratios were prepared.

Table 12: Results of logistic regression analysis for market competitive density degree

M.C.D.D(a)		B	S.E.	Wald	Df	Sig.	Exp(B)	95,0% C.I.for EXP(B)	
								Lower	Upper
,00	Intercept	-161,158	46930,616	,000	1	,997			
	Internal business processes P.M.	61,797	26987,042	,000	1	,998		,000	.(b)
	Customer P.M.-I	-5,869	,000	.	1	.	,003	,003	,003
	Learning and growth P.M.	47,927	16474,780	,000	1	,998		,000	.(b)
	Customer P.M.-II	-12,842	11683,651	,000	1	,999	2,65E-006	,000	.(b)
	Financial P.M.	79,605	27671,890	,000	1	,998		,000	.(b)
1,00	Intercept	,593	,222	7,136	1	,008			
	Internal business processes P.M.	-,361	,217	2,772	1	,096	,697	,456	1,066
	Customer P.M.-I	-,423	,233	3,284	1	,070	,655	,415	1,035
	Learning and growth P.M.	-,736	,237	9,632	1	,002	,479	,301	,763
	Customer P.M.-II	-,461	,230	4,016	1	,045	,631	,402	,990
	Financial P.M.	-,725	,275	6,944	1	,008	,484	,282	,830

a The reference category is: 2,00.

In the table 12, when Model 1 is examined, it can be seen that there is no meaningful difference statistically in usage of multidimensional performance measures between firms subjected to low and high market competitive density. ($p<0,05$). Model 2 is taken up in which firms with medium market competitive density are compared to the ones with high market competitive density has shown that usage of learning and growth measures is 2.088 times, usage of customer performance measures-II is 1.585 times and usage of financial performance measures is 2.066 times lower.

Table 13: Classification Table

		Predicted			Percentage Correct
		MCDD			
		0	1	2	
Observed MCDD	0	2	0	0	100,0%
	1	0	59	13	81,9%
	2	0	21	25	54,3%
Overall Percentage		1,7%	66,7%	31,7%	71,7%

In the classification which was made according to market competitive density degrees; the 100% of firms which have a low market competitive density degree, 81.9% of firms which have a middle market competitive density degree and 54.3% of firms which have a high market competitive density degree were appointed correctly. Accurate classification rate of observation results dealt with is 71.7 % as a result of the model established.

C. The effect of JIT practices;

Table 14 shows the model fitting information test of the logistic regression model, which was constituted for determining the effect of JIT practices on the use of BSC sub-dimensions. As seen in Table 14, -2 log likelihood statistics was 189,328 and marginal significant level (p) which was 0, 001 ($p<,05$) with 10 degrees of freedom. These results indicated good harmony of likelihood in each other. In the table 14, the established model was meaningful as statistical according to Pearson and deviance values. In addition to this, when the Pseudo R-Square values were examined, the Cox and Snell R^2 statistics indicated 21.9% relationship between JIT practice levels and usage of BSC's sub dimensions. Also, while Nagelkerke R^2 statistics indicated 25..9% relationship, McFadden R^2 showed 13.3% relationship between the above-mentioned variables.

Table 14: Model Fitting Information, Goodness-of-Fit Test of Model and Pseudo R-Square

Model Fitting Information					Goodness-of-Fit				Pseudo R^2	
Model	-2 Log Likelihood	Chi-Square	Df	Sig.		Chi-Square	Df	Sig.	Cox and Snell	,219
Intercept Only	218,270				Pearson	227,983	190	,031	Nagelkerke	,259
Final	189,328	28,942	10	,001	Deviance	189,328	190	,500	McFadden	,133

In table 15, when likelihood ratio tests are examined, it can be seen that internal business processes measures and customer performance measures-I are statistically meaningful.

Table 15: Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	Df	Sig.
Intercept	225,079	35,751	2	,000
Internal business processes P.M.	202,304	12,976	2	,002
Customer P.M.-I	195,595	6,266	2	,044
Learning and growth P.M.	194,822	5,493	2	,064
Customer P.M.-II	189,375	,047	2	,977
Financial P.M.	194,235	4,906	2	,086

After examining the general statistics of model, table 16 consisted of parameter predictions (B) Wald statistics significant levels and odd ratios were prepared.

Table 16: Results of logistic regression analysis for JIT practices

JIT (a)		B	S.E.	Wald	Df	Sig.	Exp(B)	95,0% C.I.for EXP(B)	
								Lower	Upper
,00	Intercept	-1,421	,310	21,024	1	,000			
	Internal business Processes P.M.	-1,023	,312	10,773	1	,001	,359	,195	,662
	Customer P.M.-I	-,625	,264	5,595	1	,018	,535	,319	,898
	Learning and growth P.M.	-,499	,277	3,238	1	,072	,607	,353	1,045
	Customer P.M.-II	,058	,270	,046	1	,830	1,060	,624	1,799
	Financial P.M.	-,549	,260	4,445	1	,035	,577	,347	,962
1,00	Intercept	-1,129	,256	19,442	1	,000			
	Internal business Processes P.M.	-,455	,280	2,653	1	,103	,634	,367	1,097
	Customer P.M.-I	-,138	,252	,300	1	,584	,871	,531	1,428
	learning and growth P.M.	-,483	,254	3,602	1	,058	,617	,375	1,016
	Customer P.M.-II	,022	,248	,008	1	,929	1,022	,629	1,662
	Financial P.M.	-,325	,269	1,466	1	,226	,722	,427	1,223

The reference category is: 2,00.

In the table 16, when the Model 1 is examined, low JIT firms compared to high JIT firms has indicated that the usage of internal business processes measures is 2.786 times, the usage of customer performance measures-I is 1.869 times, the usage of financial performance measures is 1.733 times lower. Model 2 indicates that there is no meaningful difference statistically in usage of multi-dimensional performance measures between middle JIT firms and high JIT firms. ($p<0,05$).

Table 17: Classification Table

		Predicted			Percentage Correct
		JIT			
		0	1	2	
Observed JIT	0	6	0	17	26,1%
	1	5	0	17	,0%
	2	7	0	65	90,3%
Overall Percentage		15,4%	,0%	84,6%	60,7%

In the classification which was made according to degree of JIT practices; the 26.1% of low JIT firms, 0% of middle JIT firms and 90,3% of high JIT firms were assigned correctly. Accurate classification rate of observation results dealt with is 60.7 % as a result of the model established.

D. The effect of TQM practices;

In the logistic regression model which was constituted for determining the effect of predictor variables on use of BSC sub-dimensions, -2 log likelihood statistics (LL) was 142,520 and marginal significant level (p) is 0, 000 (p<,05) with 10 degrees of freedom. The results indicate good harmony of likelihood in each other. In the table 18, the established model is not meaningful as statistical according to Pearson and deviance values. In addition to this, when the relationship between TQM practice degrees and usage of BSC's sub-dimensions are examined, changeable ratios can be observed according to the different statistical model. For instance, according to the Cox and Snell R^2 statistics model this ratio shows 29%., in the Nagelkerke R^2 statistics shows 37.2%, and in the McFadden R^2 statistics shows 22.6%.

Table 18: Model Fitting Information, Goodness-of-Fit Test of Model and Pseudo R-Square

Model Fitting Information					Goodness-of-Fit				Pseudo R^2	
Model	-2 Log Likelihood	Chi-Square	Df	Sig.		Chi-Square	Df	Sig.	Cox and Snell	,290
Intercept Only	184,033				Pearson	225,428	196	,073	Nagelkerke	,372
Final	142,520	41,513	10	,000	Deviance	142,520	196	,998	McFadden	,226

In the table 19, likelihood ratio tests indicate that learning and growth measures, customer performance measures-II and financial performance measures are statistically meaningful.

Table 19: Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	Df	Sig.
Intercept	227,873	85,353	2	,000
Internal business processes P.M.	145,984	3,463	2	,177
Customer P.M.-I	147,689	5,169	2	,075
Learning and growth P.M.	163,361	20,840	2	,000
Customer P.M.-II	150,342	7,822	2	,020
Financial P.M.	152,038	9,518	2	,009

Table 20 indicates parameter predictions (B), Wald statistics significant levels and odd ratios

Table 20: Results of logistic regression analysis for TQM practices

TQM (a)		B	S.E.	Wald	Df	Sig.	Exp(B)	95,0% C.I.for EXP(B)	
								Lower	Upper
,00	Intercept	-2,451	,444	30,438	1	,000			
	Internal business Processes P.M.	-,477	,333	2,058	1	,151	,621	,323	1,191
	Customer P.M.-I	-,671	,308	4,750	1	,029	,511	,279	,935
	Learning and growth P.M.	-1,193	,367	10,545	1	,001	,303	,148	,623
	Customer P.M.-II	-,831	,320	6,759	1	,009	,435	,233	,815
	Financial P.M.	-,870	,319	7,462	1	,006	,419	,224	,782
1,00	Intercept	-1,904	,333	32,676	1	,000			

	Internal business Processes P.M.	-,436	,290	2,263	1	,133	,646	,366	1,141
	Customer P.M.-I	-,129	,276	,219	1	,639	,879	,512	1,509
	Learning and growth P.M.	-1,051	,317	10,992	1	,001	,350	,188	,651
	Customer P.M.-II	-,462	,287	2,588	1	,108	,630	,359	1,106
	Financial P.M.	-,626	,299	4,370	1	,037	,535	,297	,962

The reference category is: 2,00.

The Model 1 in which firms with low TQM practices are compared to the ones with high TQM practices has shown that the usage of customer performance measures-I is 1.975 times, the usage of learning and growth measures is 3.300 times, the usage of customer performance measures-II is 2.299 times and usage of financial performance measures is 2.387 times lower.

According to model 2, firms with medium TQM practices than the ones with high TQM practices has put forth that usage of learning and growth measures is 2.857 times and usage of financial performance measures is 1.869 times lower. The classification results, which were made according to the degrees of the firm TQM practices are presented in table 21.

Table 21: Classification Table

		Predicted			Percentage Correct
		TQM			
		0	1	2	
Observed TQM	0	5	0	10	33,3%
	1	1	5	11	29,4%
	2	2	3	84	94,4%
Overall Percentage		6,6%	6,6%	86,8%	77,7%

In the classification which was made according to degree of firms' TQM practices; the 33,3% of low TQM firms, 29.4% of middle TQM firms and 94.4% of high TQM firms were made correctly. Accurate classification rate of observation results dealt with is 77.7 % as a result of the model established.

4. Results, Analysis and Discussions

This study intends to reveal the contingent relationship between the usage of multidimensional performance measures and variables such as a firm's market position, market competitive density degree, JIT and TQM practices. In this context, the study surveyed the data related to 122 manufacturing firms from the top 500 companies in Turkey. Factor analysis, descriptive statistics (mean and standard deviation), correlation analysis and multi-nominal logistic regression analysis were used in the data analysis.

The results of factor analysis reveal five factors, which form the sub-dimensions of BSC. These are "internal business processes measures", "customer performance measures-I", "financial performance measures", "learning and growth measures" and "customer performance measures-II", respectively. According to the mean of BSC sub-dimensions, the firms use the financial performance measures (12.8525), customer performance measures (30.5656), and internal business processes measures (18.9174) at a rather high level and learning and growth (12.6148) measures at a medium level. Also, there is a noticeable positive relationship between the firms' use of multiple performance measures and market situation, market competitive density degree, JIT and TQM practices. The multi-nominal logistic regression analysis show that use of multiple performance measures can appear in both the firms which have low market situation/market competitive density/JIT/TQM practices and also the firms which have high market situation/ market competitive density/ JIT/TQM practices, but this can be in different degrees from the point of view of preponderance and mixture. The obtained-results of the analyses are summarized below.

In the outcome of the first analysis, it is seen that market position of the firm has effects on usage of financial performance measures, customer performance measures and learning and growth measures. Accordingly, when Model 1 is examined in our application it can be seen that customer performance measure usage level is 8.197 times lower in firms with a low

market position than the ones with a high market position. Model 2 in which firms with medium market position are compared to the ones with high market position has shown that use of customer performance measures is 2.268 times, financial performance measures is 2.646 times, learning and growth measures is 2.141 times lower. Accurate classification rate of observation results dealt with is 72.7 % as a result of the model established.

As a result of the second analysis, it is seen that the use of internal business processes, learning and growth and financial performance measures are affected by market competitive density factor. In this context, in the aforementioned analysis, when the Model 1 is examined, it can be seen that there is no meaningful difference statistically in usage of multidimensional performance measures between the firms subjected to low and high market competitive density. ($p<0,05$). Model 2 in which firms with medium market competitive density are compared to the ones with high market competitive density has shown that usage of learning and growth measures is 2.088 times, usage of customer performance measures-II is 1.585 times and usage of financial performance measures is 2.066 times lower. Accurate classification rate of observation results dealt with is 71.7 % as a result of the model established.

As a result of the third analysis, it is seen that JIT practice levels of the firm has effects on use of internal business processes and customer performance measures. Accordingly, in the third analysis, when the Model 1 is examined, low JIT firms according to the high JIT firms has indicated that the usage of internal business processes measures is 2.786 times, the usage of customer performance measures-I is 1.869 times, the usage of financial performance measures is 1.733 times lower. Model 2 has indicated that there is no meaningful difference statistically in usage of multidimensional performance measures between middle JIT firms and high JIT firms. Accurate classification rate of observation results dealt with is 60.7 % as a result of the model established.

As an outcome of the last analysis, it is seen that TQM practice levels of the firm has effects on usage of learning and growth measures, customer performance measures-II and financial performance measures. Accordingly, in application, when the Model 1 is examined, firms with low TQM practices are compared to the ones with high TQM practices has shown that the usage of customer performance measures-I is 1.975 times, the usage of learning and growth measures is 3.300 times, the usage of customer performance measures-II is 2.299 times and usage of financial performance

measures is 2.387 times lower. According to model 2, firms with medium TQM practices than the ones with high TQM practices has put forth that usage of learning and growth measures is 2.857 times and usage of financial performance measures is 1.869 times lower. Accurate classification rate of observation results dealt with is 77.7 % as a result of the model established. These results show that the discriminating characteristic of aforementioned functions is in a high level.

Overall results confirmed that the four elements, which define the new manufacturing and competition environment, are the contingent characteristic variables directed towards the performance measurement and determined forms of performance measurement system. On the other hand, when our study is considered only in view of competitive factors and new management techniques (such as JIT and TQM) it comes out clearly that it is necessary to examine the subject from the point of view of the variables such as CAM, business structure, business size and culture.

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