

# Construction of Multi Dimensional Performance Measurement Model in Business Organizations: An Empirical Study

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## **ABSTRACT**

*The studies of performance measurement in firms have been conducted for a long period of time. However, the performance models and methods used in previous studies were limited. The purpose of this study is to test a performance based model that uses a modified approach in firms' performance measurement. The new performance model used in this study is based on expectations in terms of performance measurement and evaluation of the firms with multiple dimensions. Different from the conventional gap models, the method used in this study is "Performance Measurement Method Based on Gap Percentages" developed by Eleren (2009). This method allows the researcher to use quantitative and qualitative data together. The model was tested with data collected from 42 firms engaged in business activities in marble industry in the Turkish province of Afyonkarahisar.*

**Keywords:** *Performance Measurement, Multi-Dimensional Performance Evaluation Model, Gap Percentages Analysis, Marble Sector, Afyonkarahisar.*

## **Introduction**

Under the conditions of competitions which changed and became even more difficult with the globalization, the importance of performance management for the firms (enterprises) has become even more important. Performance management is taken into consideration within the management information systems concept-wise and consists of functions such as measurement of performance and development. Following the performance in general from the individuals and units to the general bears importance in terms of power and sustainability under the conditions of competition. Thus, the managers of the enterprises (firms) give a greater importance to performance management systems today. Sometimes the strategy and goals developed by the business organizations in the course of time may be in conformity to all the activities of the organization and obtaining a performance model based on exceeding the goals previously will become an obligation.

Performance measurement and evaluation for firms was executed with simple and limited methods with single measure only until recently and it was based on partial measurements. However today, with the developments in the performance management systems as well as the use of improved statistical and mathematical methods, many models and methods have been developed in measurement and assessment of performance with multiple criteria and multiple dimensions. If the goal in performance measurement and assessment models is the evaluation of the performance of the enterprise in question, the goals to be determined and the criteria of evaluation should have gaps based on the structure of the sector. Thus, the sector based precision must be taken into consideration during the formation of these models.

As the models are being prepared, other than the models prepared in the way to address to all sectors in the way to address them constantly, the importance of designing the models based on the sectors exclusively have gained importance due to reasons such as sector gaps, changes in conditions. Furthermore, changes based on time oblige the models to become more flexible so as to use it in the subsequent time interval. Many methods have been used in performance measurement. One of them is Gap methods which is used for measurement of performance even if not frequently. This method which we meet in performance measurement based on the quality of service (Servqual or Serperf) is based on the principle of comparison of expected (targeted) results and the realized (factual) results.

## **Literature Review**

There are many studies related to performance, performance management and measurement of performance in literature. The concept "Performance management system" was first used by Beer and Ruh (1976). Thereafter, Bell created a foundation for development of the system to a further point with his studies in (1978) and (1987). The studies in this field started to increase in number since 1990s. There are many definitions available in the literature on performance, performance management and performance models. In their study named Auditing Productivity in the firms, Baş and Artar (1991) explained performance as; "the quantitative and qualitative explanation of intended goals that is related with an individual, a group or an enterprise engages and performs, in other

words it is a quantitative and qualitative explanation of what they achieved and performed related with their tasks”. According to Akal (1992), performance is “the concept which determines what was obtained as the result of a purposeful and planned activity in general context.”

According to Macey (2001), performance management is an extensive process to make a firm reach its goals with performance management and functional strategies. Barutçugil (2002) defined performance management as “the management process which undertakes to perform collection of information for the current and future position of the organization, to compare the same and to commence and continue the required and new activities to provide constant development of the performance so as to direct the business organizations to the objectives”. Harrington (1996) defined it as “the series of operations which determine at which rate the organizations can reach to the previously determined objectives”. According to Tekeli (2003) the performance measurement is, “the information obtained by the comparison or association of the factors which affect the success of a firm”. In more technical terms, the performance measurement is “the process of regular and systematic data collection, analysis and reporting to be used by a firm to follow up the resources it uses, the results it obtained with the produced goods and services”.

You may find briefly the primary models in performance literature and the performance dimensions used in these models as listed in the following Table 1.

Table 1. Multi Dimensional Performance Evaluation Models (Ağca, 2009, p.56).

PERFORMANCE DIMENSIONS	MULTI DIMENSIONAL PERFORMANCE EVALUATION MODELS									
	Keegan et al. 1989	Lynch and Cross 1991	Fitzgerald et al. 1991	Kaplan and Norton 1992	Bitici et al. 1997	Atkinson et al. 1997	Chen-nel et al. 2000	Neely et al. 2002	EFQM 1991-1999	Laitinen 2002
	<i>Performance Measurement Matrix</i>	<i>Performance Pyramid</i>	<i>Results Determinants Model</i>	<i>Balanced Scorecard Indicator</i>	<i>Integrated Performance Measurement Model</i>	<i>Responsibility Based Performance Evaluation Model</i>	<i>Organizational Performance Evaluation Model</i>	<i>Performance Prism Model</i>	<i>European Quality Foundation Perfection Model</i>	<i>Integrated performance measurement model for SMEs</i>
Financial	√	√	√	√	√	√	√	√	√	√
Customer	√	√		√	√	√	√	√	√	
Market	√	√			√		√			√
Product/Quality of Processes		√	√	√	√	√	√	√	√	√
Product /Speed of Process	√	√		√	√	√	√	√	√	
Efficiency/ Productivity		√	√	√	√			√	√	√
Flexibility		√	√		√			√		
Innovation	√		√	√				√	√	
Learning and Development	√		√	√				√	√	
Employees				√	√	√	√	√	√	
Vision/ Strategy		√		√	√		√	√	√	

Competition	√		√		√		√	√	√	√
Social Responsibility and External Environment	√				√	√	√		√	

Other than the models used for performance measurement, there are also methods of measuring. The information relating to these methods are given in the following Table 2 in brief. As the table is analyzed, it can be seen that the simulation and statistical methods are predominantly preferred. However, it can be observed that there is significant increase in the use of Decision Making Methods with Multiple Criteria. The reason for preferring these methods are other than the fact that they are methods which are easily applicable, it can work with quantitative and qualitative data and it allows a model consisting of different dimensions and variables to be transformed into a single performance variable. The most frequently used method among the Decision Making Methods with Multiple Criteria is the Analytical Hierarchy Process and TOPSIS method. At the same time, the approaches of these methods taken into consideration with fuzzy logic are preferred.

Table 2. Examples from the methods used in the measurement of the performance (Akyüz, 2006, p.26. ; Eleren,,2009, p.1304).

AUTHORS	METHODS USED IN THE MEASUREMENT OF THE PERFORMANCE										
	SPC	PE	FA	MCDM	DEA	SEM	LP	NLP	FUZ	REG	SIM
Jagadees and Babu (1994)	√	√									
Chenhal (1996)			√							√	
Tong and Chen (1998)		√									√
Berry and Cooper (1999)										√	
Caporaletti et al. (1999)					√		√				
Lo and Pushpakumara (1999)				√							
Martin et al. (1999)	√									√	√
Suwignjo et al. (2000)				√							
Bititci et al. (2001)				√							
MacCarthy and Wasuri (2001)	√										√
Selen and Asheyeri (2001)											√
Chan et al. (2002)									√		√
Corbett and Pan (2002)	√	√									
Yurdakul (2002)				√							
Chan et al. (2003)									√		
Sarkis (2003)				√							
Chen and Chen (2004)		√									
Triantis and Otis (2004)					√						
Agus (2005)						√					
Ali and Wadhwa (2005)											√
Meer et al. (2005)										√	
Silandria (2005)										√	
Pearn and Wu (2006)	√	√									
Sandrock et al. (2006)	√							√			√
Eleren and Özgür(2006)				√	√						
Eleren (2007)									√		
Eleren and Soba (2009)				√							

SPC: Statistical Process Control, PE: Process Efficiency, NLP: Non Linear Programming,  
 DEA: Data Enandlope Analysis, SEM: Structural Equation Model, LP: Linear Programming, FA: Factor Analysis,  
 FUZ: Fuzzy Logic, REG: Regression – SIM: Simulation, MCDM: Multi Criteria Decision Making, (egg; AHP, and TOPSIS.Model.)

## **Methodology**

In forming a performance model, determination of performance dimensions and variables, and weighing of variables are required. This research was conducted through a survey among the senior managers of the firms which continue their business activities in the marble industry as registered to the Chamber of Industry and Trade in Province of Afyonkarahisar in Turkey. The purpose of this study is to develop a multidimensional performance measurement model and to determine the dimensions of this model, variables within each dimension and weighing of each variable for a sector.

The sample of the study is composed of the 42 firms engaged in business activities in marble industry in the Province of Afyonkarahisar, registered to the Chamber of Industry and Commerce of Afyonkarahisar and the information relating to these firms for the year 2009. Primary data were used in the study. In order for the researcher to reach its goals, the original data he needs, the data he has collected with the use of relevant devices are named as the primary data (Altunışık et al., 2005). At this point, in order to reach the primary data, face to face interview among conventional survey methods was used. In the selection of the sampling, the method used was sampling method which is not random and based on probability.

In preparing the scale used to obtain the data, the scale used by Eleren and Soba (2009) was considered as the basic scale. However, although it originally consists of six dimensions, the dimensions at this stage were limited to four dimensions as employee satisfaction, finance, production and marketing functions. Two staged scale was used consisting of questions with the purpose of collecting data for each variable the questions relating to weighing the dimensions and the variables relating to such dimensions. In the survey section prepared to collect information, there are questions relating to each dimension. The target relating to the relevant variables in the questions and the results which were realized have been asked to be evaluated. The questions relating to the first of the dimensions were answered by the employees and the others were answered by the senior management.

## **Empirical Results**

Firms participated in this study; 100% of them are classified as SME (according to the criteria of workforce, turnover and capital). 18% of the firms consist of single person enterprises, 68% consist of limited liability companies and others consist of joint stock corporations. 86% of the firms are family businesses and family members are assigned in management positions. 62% of the senior managers of the firms consist of persons with bachelor's degree or higher proves that they attach importance to education although they are SMEs or family businesses. 92% of the workers consist of men and their average age is 29 and this qualifies as young work force. Despite this, their average work experience is 14 years which proves that they started business at a very young age.

Model is formed in three stages which are listed as follows;

- Determining and weighting dimensions of the model,
- Determining and weighting variables related with the dimensions of the model,

In the first stage, the senior managers were asked to evaluate the dimensions between 1-5 and as the result of these evaluations, the average points were proportioned to the total points based on the significance levels. They are as follows;

- Employee expectations and satisfaction (W=0,189),
- Production Management (W=0,274),
- Marketing Management (W=0,261),
- Financial Management (W=0,276)

In the second stage, the senior managers were asked to evaluate the variables relating to all dimensions between 1-5 and as the result of this evaluation; the significances of the variables within the dimension was calculated.

The results of this evaluation is as follows:

1. In terms of Employee expectations and satisfaction, the purpose was to determine the employees' level of satisfaction from the enterprise and the management. The evaluation questions were asked to only 145 of 489 employees who work in 42 enterprises.

Table 3. Employee expectations and satisfaction factor and its variables

	SIGNIFANCE LEVEL	
	AVERAGE	W/w
<b>1.EMPLOYEE EXPECTATIONS AND SATISFACTION</b>	2.99	0.189
I am satisfied with the salary and wage against what I perform as my job.	4.75	0.118
The working/living quality provided is satisfactory.	4.42	0.110
Peace and safety has priority in terms of work satisfaction.	4.31	0.107
Everyone has fair share of speaking in management.	4.27	0.106
I believe that the distribution of wages and bonuses is fair and just.	4.20	0.104
We believe that the work load is suitable.	4.11	0.102
I believe that we have sufficient work safety	3.93	0.098
We work in team spirit.	3.59	0.089
It is satisfying that the theoretical and applied trainings are provided.	3.49	0.087
All workers have adopted the culture of the enterprise.	3.22	0.080
N : 489 / n: 145		

2. The evaluation of the variables relating to production management function was

conducted by the business owners/senior management. Most of the variables consist of quantitative data.

Table 4. Product Management Factor and its Variables

	SIGNIFANCE LEVEL	
	AVERAGE	W/w
<b>2. PRODUCT MANAGEMENT</b>	4.33	0.274
Diversity of Products (*)	4.54	0.115
Age of production technology (*)	4.48	0.114
Rate of capacity usage (*)	4.31	0.109
Rate of Wastage % (*)(-)	4.22	-0.107
Number of patents developed (*)	4.04	0.102
Number of patents owned (*)	3.93	0.100
Level of professionalism in production (1-5)	3.91	0.099
Vocational training studies ( hour / year) (*)	3.41	0.086
Number of projects performed during last five years (*)	3.36	0.085
Number of work accidents and sicknesses incurred during last five years (*)(-)	3.25	-0.082
N : 124 / n: 42		

Note: [(\*) Quantitative Data ; (-) Negative Directional].

3. The evaluation of the variables relating to marketing management function was conducted by the business owners/senior management. Most of the variables consist of quantitative data.

Table 5. Marketing Management Factor and its variables

	SIGNIFANCE LEVEL	
	AVERAGE	W/w
<b>3. MARKETING MANAGEMENT</b>	4.12	0.261
Rate of increase in annual sales (*)	4.11	0.116
Rate of decrease in customer complaints (1-5)	4.05	0.114
Ratio of exports in all sales (*)	3.92	0.107
Number of trade mark registered products (*)	3.83	0.104
Level of professionalism in marketing management (1-5)	3.79	0.103
Total number of products (*)	3.61	0.101
Number of Web based / e-trade sales % (*)	3.52	0.092
Level of cooperation with Professional logistics companies (1-5)	3.37	0.091
Training of sales personnel (... hour / year)	3.34	0.087
Rate of marketing costs in total costs % (*)(-)	3.28	-0.085
N : 124 / n: 42		

Note: [(\*) Quantitative Data; (-) Negative Dimensional].

4. The evaluation of the variables relating to financial management function was conducted by the business owners/senior management. Most of the variables consist of quantitative data

Table 6. Financial Management Factor and Variables

	SIGNIFANCE LEVEL	
	AVERAGE	W/w
4. FINANCIAL MANAGEMENT	4.36	0.276
Level of professionalism in financial management (1-5)	4.66	0.114
Periodical conduct of Financial planning, analysis and audits (1-5)	4.62	0.112
Management Accounting application (1-5)	4.55	0.109
Equity Capital / Total Assets	4.34	0.100
Turnover Rate of Accounts Receivables	4.15	0.100
Liquidity (Current Ratio)	4.09	0.096
Net Profit / Equity Capital	4.01	0.095
Net Profit / Total Assets	3.93	0.094
Stock Turnover	3.87	0.091
Net Working Capital Rate of turnover	3.71	0.090
N : 124 / n: 42		

Note: [(\*) Quantitative Data].

The factors and variables and their weights to be used in forming the performance model and their weights were determined in the previous section. At this point, the model below was generated with the use of the data mentioned here.

Performance Function is denoted by  $f(x)$ , factor (dimension) weights are denoted by  $W_i$ , variables of the gap percentage are denoted by  $x_{ij}$  and the weights of the variables are denoted by  $w_j$ ;

$$f(x) = W_1 * F_1 + W_2 * F_2 + W_3 * F_3 + W_4 * F_4 \tag{1}$$

$$= W_1 * (w_{11} * x_{11} + w_{12} * x_{12} + \dots) + W_2 * (w_{21} * x_{21} + w_{22} * x_{22} + \dots) + \dots \tag{2}$$

### Discussion

The data have been prepared in an M.S. Excel file with all factors and the related variables. As all 42 enterprises which have participated in the research were transferred to the worksheet, since the size of the file increased excessively, 10 enterprises have been selected among the enterprises to define the small and mid-scaled enterprises so as to represent them and performance model was applied on these enterprises.

**Calculation of Gaps and Gap Percentages:** The data relating to all dimensions and variables for each enterprise were entered in M.S. Excel worksheet. The data entered consist of binary data system. These are the realized and expected performance values. These values are classified into four groups being quantitative and qualitative and positive and negative dimensional. Likert questions consist of qualitative values between 1 and 5. Moreover, quantitative data such as rate of capacity usage or liquidity consist of rations or numbers which express these variables. Furthermore, the variables such as rate of wastage which is



not desired to be increased are defined as negative directional and the weight coefficients have the sign (-).

As the differences are calculated, the formulations mentioned below will be used:

$$\text{gap} = (\text{Performance Value Realized}) - (\text{Performance Value Expected}) \quad (3)$$

The result being zero means that the expected prediction was not provided hence low performance. If the result is zero, it means that full performance was maintained and if it is over zero, it means that it was exceeded. Performance gap percentages are other indications of the gap and since the rate defined for performance calculation is between -1/+1, it allows that the data will be standardized before they were used in performance model.

$$\text{gap percentage} = (\text{Performance Value Realized} - \text{Performance Value Expected}) / (\text{Performance Value Expected}) \quad (4)$$

After formation of the performance function  $f(x_i)$ , by using all ratios, groups and weights, performance points can be determined. The points are calculated as the result of the operations below respectively.

For each enterprise involved in performance evaluation individually;

- The gaps and the gap percentages between the performance values expected and realized for each observation will be calculated for all performance dimensions and variables.
- The weighted gap percentages will be calculated by multiplying the gap percentages with the weights of the variables.
- The weighted gap percentages of the variables at all dimensions will be calculated and the dimension scores will be found.
- The weighted dimension scores will be calculated by multiplying the score dimensions with their own dimensional weights.
- At the last stage, the weighted score for each dimension will be summed and the total scores of the enterprises will have been obtained. As the scores were ranked in order of amplitude, the performance order of the enterprises will have been formed. If the score is negative, it is interpreted that the enterprise failed to reach its goals in terms of all dimensions. If it is zero, it means that it fully reached its target and if it is a positive number than it will be interpreted that it has exceeded its targets and became more successful.
- Theoretically, it is assumed that total points vary between -1,00 and +1,00. Moreover, since the performance scores based on dimensions were found by summing them, it should be taken into consideration that the numbers of variables should be different in all dimensions. For instance, in this study, each dimension was defined with 10 variables (questions). If different number of variables were present in dimensions, it needs to be balanced after summing the dimension scores taking the

number of the variables in consideration comparatively.

Table 7. The Dimensions of the Enterprises and the Performance Points and Ranking in Total

<b>PERFORMANCE DIMENSIONS</b>
<b>1. EMPLOYEE EXPECTATIONS AND SATISFACTION</b>
<p>I am satisfied with the salary and wage against what I perform as my job.</p> <p>The working/living quality provided is satisfactory.</p> <p>Peace and safety has priority in terms of work satisfaction.</p> <p>Everyone has fair share of speaking in management.</p> <p>I believe that the distribution of wages and bonuses is fair and just.</p> <p>We believe that the work load is suitable.</p> <p>I believe that we have sufficient work safety</p> <p>We work in team spirit.</p> <p>It is satisfying that the theoretical and applied trainings are provided.</p> <p>All workers have adopted the culture of the enterprise.</p>
<b>2. PRODUCT MANAGEMENT</b>
<p>Diversity of Products (*)</p> <p>Age of production technology (*)</p> <p>Rate of capacity usage (*)</p> <p>Rate of Wastage % (*)()</p> <p>Number of patents developed (*)</p> <p>Number of patents owned (*)</p> <p>Level of professionalism in production (1-5)</p> <p>Vocational training studies ( hour / year) (*)</p> <p>Number of projects performed during last five years (*)</p> <p>Number of work accidents and sicknesses incurred during last five years (*)()</p>

ENTERPRICES										
A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	AVR
<b>- 0,004</b>	<b>- 0,010</b>	<b>- 0,023</b>	<b>- 0,021</b>	<b>- 0,015</b>	<b>- 0,010</b>	<b>- 0,015</b>	<b>0,002</b>	<b>- 0,013</b>	<b>0,004</b>	<b>- 0,011</b>
0,004	- 0,003	- 0,003	- 0,003	- 0,001	- 0,002	- 0,004	- 0,002	- 0,003	- 0,002	- 0,002
- 0,002	- 0,001	- 0,003	- 0,002	0,004	- 0,003	0,004	0,002	- 0,001	0,003	0,000
- 0,002	- 0,003	- 0,001	- 0,002	- 0,003	0,003	- 0,001	0,002	0,001	- 0,001	- 0,001
- 0,001	- 0,003	- 0,003	- 0,003	- 0,003	- 0,002	- 0,003	- 0,000	- 0,003	0,002	- 0,002
0,001	0,003	- 0,003	- 0,002	- 0,003	- 0,003	- 0,002	0,003	- 0,002	- 0,001	- 0,001
- 0,002	- 0,002	- 0,003	- 0,001	- 0,003	- 0,001	- 0,002	- 0,002	- 0,001	0,004	- 0,001
- 0,002	- 0,001	- 0,002	- 0,002	- 0,001	0,003	- 0,002	- 0,001	- 0,002	- 0,000	- 0,001
- 0,001	- 0,001	- 0,001	- 0,001	- 0,002	- 0,001	- 0,002	- 0,001	0,002	- 0,001	- 0,001
0,003	0,003	- 0,002	- 0,003	- 0,001	- 0,002	- 0,002	0,002	- 0,003	- 0,002	- 0,001
- 0,001	- 0,002	- 0,001	- 0,002	- 0,003	- 0,001	- 0,002	- 0,001	- 0,002	0,002	- 0,001
<b>0,002</b>	<b>- 0,006</b>	<b>- 0,011</b>	<b>- 0,012</b>	<b>- 0,001</b>	<b>0,001</b>	<b>- 0,005</b>	<b>- 0,009</b>	<b>0,002</b>	<b>- 0,001</b>	<b>- 0,004</b>
- 0,000	- 0,003	- 0,000	- 0,001	0,001	- 0,000	0,002	0,002	0,004	- 0,003	0,000
0,002	- 0,001	- 0,001	- 0,002	- 0,002	0,001	0,003	- 0,001	- 0,003	- 0,001	- 0,001
0,001	- 0,001	- 0,001	0,003	0,002	0,001	0,001	0,001	0,000	0,002	0,001
0,019	0,018	0,018	0,019	0,017	0,016	0,019	0,017	0,019	0,016	0,018
0,000	0,000	- 0,006	- 0,005	0,000	- 0,006	- 0,006	- 0,004	0,000	0,000	- 0,003
0,000	0,000	0,000	- 0,006	0,000	- 0,004	- 0,005	0,000	0,000	0,000	- 0,002
- 0,004	- 0,003	- 0,002	- 0,002	- 0,003	- 0,002	- 0,003	- 0,004	- 0,003	0,003	- 0,002
- 0,002	- 0,002	- 0,003	- 0,003	- 0,002	- 0,003	- 0,002	- 0,002	- 0,002	- 0,003	- 0,002
- 0,005	- 0,005	- 0,006	- 0,007	- 0,006	- 0,006	- 0,006	- 0,006	- 0,005	- 0,006	- 0,006
0,003	- 0,008	- 0,008	- 0,007	0,002	0,004	- 0,007	- 0,008	0,002	- 0,007	- 0,003

<b>3. MARKETING MANAGEMENT</b>
Rate of increase in annual sales (*)
Rate of decrease in customer complaints (1-5)
Ratio of exports in all sales (*)
Number of trade mark registered products (*)
Level of professionalism in marketing management (1-5)
Total number of products (*)
Number of Web based / e-trade sales % (*)
Level of cooperation with Professional logistics companies (1-5)
Training of sales personnel ( ... hour / year)
Rate of marketing costs in total costs % (*) ( )
<b>4. FINANCIAL MANAGEMENT</b>
Level of professionalism in financial management (1-5)
Periodical conduct of Financial planning, analysis and audits (1-5)
Management Accounting application (1-5)
Equity Capital / Total Assets
Turnover Rate of Accounts Receivables
Liquidity (Current Ratio)
Net Profit / Equity Capital
Net Profit / Total Assets
Stock Turnover
Net Working Capital Rate of turnover
<b>PERFORMANCE SCORE</b>
<b>RAN. NUM.</b>

<b>- 0,015</b>	<b>0,012</b>	<b>- 0,017</b>	<b>- 0,018</b>	<b>0,003</b>	<b>- 0,011</b>	<b>- 0,019</b>	<b>- 0,013</b>	<b>- 0,018</b>	<b>- 0,003</b>	<b>-0,010</b>
- 0,004	0,003	- 0,004	- 0,005	- 0,004	- 0,001	- 0,002	- 0,005	- 0,005	- 0,004	-0,003
- 0,003	- 0,001	0,001	- 0,002	- 0,000	- 0,002	- 0,002	0,003	- 0,002	0,000	-0,001
- 0,005	- 0,004	- 0,003	- 0,005	0,006	- 0,006	- 0,005	- 0,006	- 0,005	- 0,005	-0,004
- 0,006	0,006	- 0,005	- 0,006	- 0,004	- 0,005	- 0,006	0,004	- 0,003	- 0,004	-0,003
- 0,003	- 0,002	- 0,004	- 0,003	- 0,002	- 0,002	- 0,003	- 0,003	- 0,002	- 0,004	-0,003
- 0,003	- 0,002	- 0,002	- 0,003	- 0,002	- 0,002	- 0,003	- 0,003	- 0,002	- 0,003	-0,003
- 0,006	- 0,008	- 0,007	- 0,006	- 0,005	- 0,004	- 0,004	- 0,007	- 0,006	0,007	-0,005
- 0,002	- 0,003	- 0,002	- 0,002	- 0,003	- 0,004	- 0,003	- 0,002	- 0,002	- 0,003	-0,002
0,002	0,000	0,002	- 0,000	0,000	- 0,002	- 0,003	0,000	- 0,000	- 0,005	-0,001
0,015	0,022	0,007	0,015	0,017	0,017	0,011	0,005	0,009	0,018	0,014
<b>- 0,009</b>	<b>0,010</b>	<b>- 0,019</b>	<b>- 0,010</b>	<b>- 0,009</b>	<b>0,003</b>	<b>- 0,004</b>	<b>- 0,009</b>	<b>- 0,010</b>	<b>0,000</b>	<b>-0,006</b>
- 0,003	0,003	- 0,003	- 0,003	0,004	- 0,002	- 0,004	- 0,003	- 0,003	- 0,003	-0,002
- 0,003	- 0,002	- 0,002	- 0,003	- 0,003	- 0,002	- 0,003	- 0,002	- 0,003	0,003	-0,002
- 0,004	- 0,003	- 0,003	- 0,003	- 0,004	0,002	- 0,003	0,004	- 0,003	- 0,003	-0,002
- 0,003	- 0,002	- 0,003	- 0,002	- 0,003	0,002	0,002	- 0,003	- 0,002	- 0,002	-0,002
0,004	0,001	0,002	0,003	0,004	0,000	0,002	0,001	0,002	0,002	0,002
- 0,000	0,001	- 0,003	- 0,001	0,000	- 0,001	- 0,001	- 0,000	- 0,002	0,001	-0,001
- 0,002	0,004	- 0,002	- 0,000	- 0,002	- 0,004	- 0,001	- 0,004	- 0,002	0,003	-0,001
0,001	0,005	- 0,002	0,001	- 0,006	0,002	0,001	0,000	- 0,000	0,001	0,000
0,004	0,003	0,000	0,002	0,002	0,004	0,003	- 0,002	0,003	0,002	0,002
- 0,002	0,002	- 0,003	- 0,004	- 0,001	0,000	- 0,001	- 0,000	0,000	- 0,001	-0,001
<b>- 0,015</b>	<b>0,008</b>	<b>- 0,068</b>	<b>- 0,061</b>	<b>- 0,012</b>	<b>- 0,017</b>	<b>- 0,043</b>	<b>- 0,024</b>	<b>- 0,030</b>	<b>0,000</b>	<b>- 0,026</b>
<b>4</b>	<b>1</b>	<b>10</b>	<b>9</b>	<b>3</b>	<b>5</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>2</b>	

**Total Performance Points and Ranking of The Firms:** As the transactions mentioned in the previous section were followed up, the performance scores of the firms were calculated based on all dimensions and variables and it was shown above. Based on this;

- All the firms at the model stage were not included in the sample application. Taking the matrix dimensions of the work sheet it was limited to 10 enterprises. The names of the enterprises were not mentioned since permission hasn't been obtained. However they were denominated by numbers from 1 to 10.
- The study is directly applicable to quantitative and qualitative data.
- The Model is designed on an exclusive basis to the sectors taking the characteristics and the priorities of the sector in consideration. It also has the nature to be redesigned for each sector. Once, the model has been designed, the data based on each year can be used and be evaluated in comparative evaluations.
- As the results were analyzed, it can be seen that the enterprise no. A02 takes the lead. It can be seen that especially the points which were obtained from finance and marketing dimensions were effective.

## Conclusion

Many studies have been done on performance measurement and evaluation in the literature so far. Many models have been developed during these studies and different methods have been tried. It is of essential importance for the business organizations to determine their positions and their future goals precisely under the conditions of competition which became harder as well as following it up constantly. Due to this reason, it is inevitable that similar studies will continue on performance.

The difference of the study in terms of the model and the method is based on re-evaluation of the differences based on gaps formed according to the differences between the previously used gap model and the results performed. The method applied allows separate scoring for all dimensions and by monitoring the scores, it is allowed to interpret how the scores have been formed and to analyze the quantitative - qualitative data together. The precision of the model varies based on the accurateness of data, participation of the significant rate of firms or enterprises in the sector, and the level of awareness of the participants as to the necessity of such a study. The Model is applicable in terms of individual evaluation of the enterprises (within its own course) and collective performance evaluations following its design for the sectors with dimensions, variables and weights.

A02, A10 and A05 firms take the first three of ten enterprises denominated at the application stage of the study in code numbers. A02 firm which takes the first place has gained an advantage in terms of marketing and finance as it was evaluated in terms of dimensions. In terms of dimensions, A10 and A08 firms take the lead based on the in employee satisfaction,; A01 and A09 firms take the lead based on production, A02 and A05 firms take the lead based on marketing management and A02 and A06 firms take the lead based on financial management.

## References

- Agus, A. (2005). The Structural Linkages between TQM, Product Quality Performance, and Business Performance: Preliminary Empirical Study in Electronics Companies. *Singapore Management Review*, 27 (1), 87-105.
- Ağca, V. (2009). Türk İmalat İşletmelerinde Çok Boyutlu Performans Değerleme (PD) Modellerine Dayalı Performans Göstergelerinin Kullanılabilirliği, (The Usefulness of Performance Measures Based On Multi-Dimensional Performance Measurements Models in Turkish Manufacturing Firms), *Dumlupınar University, Social Science Institute Journal*, 23, 51-66.
- Altunışık, R., Coşkun, R., Bayraktaroğlu, S. & Yıldırım, E., (2005) *Sosyal Bilimlerde Araştırma Yöntemleri: SPSS Uygulamalı* (4th Ed.). Sakarya.
- Akal, Z. (1992). *İşletmelerde Performans Ölçüm ve Denetimi*. Ankara: MPM Yayınları.
- Akyüz, Gökhan (2006). Proses İmalatında Performans Ölçme Ve İyileştirmeye Yönelik Bir Modelleme Yaklaşımı: Bir Uygulama. (Basılmamış Doktora Tezi).Akdeniz Üniversitesi Sosyal Bilimler Enstitüsü, Antalya.
- Ali, M. & Wadhwa, S. (2005). Performance Analysis of Partial Flexible Manufacturing Systems. *Global Journal of Flexible Systems Management*, 6 (1),9-19.
- Andersen, B. (1999). *Business Process Improvement*. American Society for Quality: USA.
- Andersen, B. & Fagerhaug, T. (2001). *Performance Measurement Explained, Designing and Implementing Your State-of-the-Art System*, American Society for Quality: USA.
- Atkinson, A.A., Waterhouse, J.H. & Wells, R.B. (1997). A Stakeholder Approach to Strategic Performance Measurement. *Sloan Management Review*, 38 (3), 25-38.
- Atkinson, A. A. (1997). New Direction in Management Accounting Research. *Journal of Management Accounting Research*, 9, 285-311.
- Barutçugil, İ.(2002). *Performans Yönetimi*, Kariyer Yayınları: İstanbul.
- Baş, M. & Artar, A. (1991). *İşletmelerde Verimlilik Denetimi*. Ankara: MPM Yayınları No: 434.
- Beer, M. & Ruh, R. A. (1957). Employee Growth Through Performance Management. *Harvard Business Review*, July-August, 59-66.
- Beer, M., Ruh, R., Dawson, J. A., McCaa, B. B. & Kavanagh, M. J. (1978). A Performance

Management System: Research, Design, Introduction and Evaluation. *Personel Psychology*, 31, 505-535.

Berry, W. L. & Cooper, M. C. (1999). Manufacturing Flexibility: Methods for Measuring the Impact of Product Variety on Performance in Process Industries. *Journal of Operations Management*, 17, 63-178.

Bititci, U. S., Suwignjo, P. & Carrie, A. S. (2001). Strategy Management Through Quantitative Modelling of Performance Measurement Systems. *International Journal of Production Economics*, 69, 15-22.

Chan, D. C. K., Yung, K. L., Ip, A. W. H. (2002). An Application of Fuzzy Sets to Process Performance Evaluation. *Integrated Manufacturing Systems*, 13 (4), 237-246.

Chenhall, R. H. (1996). Strategies of Manufacturing Flexibility, Manufacturing Performance Measures and Organizational Performance: An Empirical Investigation. *Integrated Manufacturing Systems*, 7 (5), 25-32.

Caporaletti, L. E., Dula, J. H. & Womer, N. K. (1999). Performance Evaluation Based on Multiple Attributes with Nonparametric Frontiers. *Omega*, 27, 637-645.

Chen, J. P. & Chen, K. S. (2004). Quality And Reliability Corner Comparison of Two Process Capabilities by Using Indices Cpm: An Application to a Color STN Display. *International Journal of Quality & Reliability Management*, 21(1), 90-101.

Chennell, A., Dransfield, S., Field, J., Fisher, N., Saunders, I. & Shaw, D. (2000). *In Proceedings of the Performance Measurement –Past, Present and Future Conference 2000: OPM: A System for Organisational Performance Measurement. Cambridge.*

Corbett, C.J. & Pan, J. N., (2002). Evaluating Environmental Performance Using Statistical Process Control Techniques. *European Journal of Operational Research*, 139, 68-83.

European Foundation For Quality Management (1998). EFQM Mükemmellik Modeli 2000 (EFQM ve KalDer Yayınları). İstanbul: Author. <http://www.efqm.org>

Eleren, Ali. (2007). İMKB'ye Kayıtlı Çimento İşletmelerinin Finansal Tablolarının Bulanık Mantık Yaklaşımı İle Değerlendirilmesi. *AKÜ İİBF Dergisi*, 9 (1), 141-154.

Eleren, A. & Özgür, E. (2006). Proceedins from 4. Ulusal Araştırmalar Sempozyumu'06: *Gıda Sektöründe Faaliyet Gösteren İMKB'ye Kayıtlı İşletmelerde Analitik Hiyerarşi Süreci Yöntemi İle Performans Ölçümü.* İstanbul: Turkey.



- Eleren, A. & Özgür, E. (2006). Türkiye'de Yabancı Sermayeli Mevduat Bankalarının Veri Zarflama Yöntemi İle Etkinlik Analizlerinin Yapılması. *AKÜ İİBF Dergisi*, 8 (2), 53-76.
- Eleren, A. & Soba, M. (2009). Proceedins from International Davraz Conress'09: *The First International Davraz Congress on Social and Economic Issues Shaping the World's Future: New Global Dialogue*. Isparta: Turkey.
- Eleren, A. (2009). Proceeding from 6. KOBİ'ler ve Verimlilik Kongresi'09: *The Sixth KOBİ'ler ve Verimlilik Kongresi*. İstanbul: Turkey.
- Fitzgerald, L., Johnson, R., Brignall, S., Silvestro, R. & Voss, C. (1991). *Performance Measurement in Service Businesses*. London: CIMA.
- Frolick, M. N. & Ariyachandra, T. R. (2006). Business Performance Management: One Truth. *Information Systems Management*, 23(1), 41-48.
- Grady, M. W. (1991). Performance Measurement: Implementing Strategy. *Management Accounting*, 72 (June), 137-148.
- Heide, D. P. (1993). A Comprehensive Performance Management Model. (A Dissertation of Presented to the Graduate Faculty of the School of Human Behavior). United States International University Press. San Diego.
- Johnson, P. & Bell, C. (1987). Focused Vision for Focused Performance. *Training and Development Journal*, 41 (12), 56-59. Retrived from <http://ehis.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=4&hid=5&sid=fe3ddb0e-8ce1-4f9f-914a-d9ec39bab838%40sessionmgr11>
- Kaplan, R. ve Norton, D. (1992). The Balanced Scorecard: The Measures That Drive Performance. *Harvard Business Review*, Jan-Feb, 71-79. Retrived from <http://hbr.org/2005/07/the-balanced-scorecard/ar/1>
- Laitinen, E. K. (2002). A Dynamic Performance Measurement System: Evidence from Small Finnish Technology Companies. *Scandinavian Journal of Management*, 18, 65-99.
- Lo, E. K. & Pushpakumara, C. (1999). Performance and Partnership in Global Manufacturing Modelling Frameworks and Techniques. *International Journal of Production Economics*, 60 (1), 261-269.
- Lynch, R. & Cross, K. (1991). *Measure UP! Yardsticks for Continuous Improvement* Oxford: Blackwell Publishing.
- Macey, S. (2001) *An Integrated Model for Performance Management Based on ISO9000 and Business*

*Excellence Models, Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Applied Science.* Industrial Engineering at Dalhous University, Canada.

MacCarthy, B. L. & Wasusri, T. (2001). Statistical Process Control for Monitoring Scheduling Performance-Addressing the Problem of Correlated Data. *Journal of the Operational Research Society*, 52 (7), 810-820.

Martin, E. B., Morris, A. J., Kiparissides, C. (1999). Manufacturing Performance Enhancement Through Multivariate Statistical Process Control. *Annual Reviews in Control*, 23, 35-44. doi:10.1016/S1367-5788(99)90055

Medori, D. & Steple, D. (2000). A Framework for Auditing and Enhancing Performance Measurement Systems. *International Journal of Operations & Production Management*, 20(5), 520-533. Retrieved from <http://www.emeraldinsight.com/journals.htm?issn=0144-3577&volume=20&issue=5>

McGregor, D. (1957). An Uneasy Look at Performance Appraisal. *Harvard Business Review*, 35 (3), 89-94.

Meyer, H. H., Kay, E. & French, J. R. P. (1965). Split Roles in Performance Appraisal. *Harvard Business Review*, 43(1), 123-129.

Pearn, W. L. & Wu, C. W. (2006). Production Quality and Yield Assurance for Processes with Multiple Independent Characteristics. *European Journal of Operational Research*, 173, 637-647.

Sandrock, C., Vaal, P. & Weightman, D. (2006). Performance Comparison of Controllers Acting on A Batch Pulp Digester Using Monte Carlo Modelling. *Control Engineering Practice*, 14, 949-958.

Sarkis, J. (2003). Quantitative Models for Performance Measurement Systems-Alternate Considerations. *International Journal of Production Economics*, 86, 81-90.

Selen, W. J. & Ashayeri, J. (2001). Manufacturing Cell Performance Improvement: A Simulation Study. *Robotics and Computer Integrated Manufacturing*, 17, 169-176.

Silveria, G. J. C. (2005). Market Priorities, Manufacturing Configuration and Business Performance: An Empirical Analysis of the Order-Winners Framework. *Journal Of Operations Management*, 23, 662-675.

Smith, PC. & Goddard, M. (2002). Performance Management and Operational Research: A Marriage Made in Heaven?. *Journal of the Operational Research Society*, 53, 247-255.

Suwignjo, P., Bititci, U. S. & Carrie, A. S. (2000). Quantitative Models for Performance Measurement Systems. *International Journal of Production Economics*, 64, 231-241.

Tong, L. I. & Chen, J. P. (1998). Lower Confidence Limits of Process Capability Indices For Non-Normal Process Distributions. *International Journal of Quality & Reliability Management*, 15(8/9), 907-919.

Triantis, K. & Otis, P. (2004). Dominance-Based Measurement of Productive and Environmental Performance for Manufacturing. *European Journal of Operational Research*, 154, 447-464.

Yurdakul, M. (2002). Measuring A Manufacturing System's Performance Using Saaty's System with Feedback Approach. *Integrated Manufacturing Systems*, 13(1), 25-34.