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Measurement Frequency of Performance Indicators and Satisfaction on Corporate Performance: A Survey on Manufacturing Companies

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Abstract

Although some surveys done to understand the measurement systems, the importance and usage of the performance indicators, yet there has been no study taking into account the "*measurement frequency*" of performance indicators for the improvement of corporate performance satisfactions. The aim of the study is to determine the effects of the measurement frequency of performance indicators of the balanced scorecard on managers' satisfaction from the corporate performance. We believe that measurement frequency of indicators show their importance for firms more truly rather than asking a manager how they are important for the firm. For this purpose measuring frequencies of performance indicators in manufacturing companies and the corporate performance satisfaction degrees in different aspects are determined and the relationship between them is analysed by multivariate statistical tools. This study includes a survey on performance measurement and management systems in the biggest 500 Turkish manufacturing companies. The indicators used in the survey were classified based on the Balanced Scorecard perspectives.

The results of the study indicate that managers consider the satisfaction from the long-term performance of company as the most important factor among the corporate performance satisfaction factors. Among the performance indicators the measurement frequency of employee capabilities is found as the most important indicator effecting the performance satisfaction.

Keywords: Balanced Scorecard, Canonical Correlation, Performance Indicators, Turkey.
JEL Classification Codes: L25, M41, C44

1. Introduction

Approaches to performance measurement and management have been changing in the last two decades. The importance of non-financial performance measures has been increasing in recent years. There has been a growing criticism of traditional performance measurement systems which tend to focus only on financial results (Johnson and Kaplan 1991; Ittner and Larcker 1998; Fisher 1999;

Vaivio 1999; Parker 2000; Sliwka 2002). The rise of Total Quality Management (TQM) implementations in 1990s increased the adoption of non-financial measures by the companies. This made companies to be more customer focused. Managers realized that they should be aware of the quality of the products and services in order to take competitive advantage (Eccles 1991; Butler, Letza, and Neale 1997). Kaplan and Norton (1992) developed an innovative corporate performance measurement and management system known as the Balanced Scorecard (BSC).

The Balanced Scorecard (Kaplan and Norton 1992; 1993; 1996a; 1996b; 2001a) provides a comprehensive set of financial and nonfinancial performance measures for the organizations. A Classical balanced scorecard has four perspectives: financial, costumer, internal process, and learning and growth. For each perspective of the balanced scorecard, strategic objectives, performance measures relating to these objectives, performance targets for each measure and initiatives are defined. In a BSC performance measures are linked to each other and to the long term vision and strategy, following a cause and effect relationship. The examples of performance measures used in balanced scorecard perspectives are shown in Table 1.

There are many articles published on corporate performance measurement systems, the importance and usage of the performance measures including both financial and non-financial measures. Kald and Nilsson (2000) provided a picture of design and usage of the performance measurement systems of companies in Nordic countries. The measures were categorized and their importance in measuring the performance was evaluated. Blundell, Sayers, and Shanahan (2003), asked about the importance of the twenty-one performance measures in four BSC perspectives and these are compared at organizational and divisional level. Anand, Sahay, and Saha (2005) ranked the different perspectives of the scorecards in terms of importance. For each performance perspective 5-10 key performance indicator were determined and their importance level was measured. Speckbacher, Bischof, and Pfeiffer (2003) resulted that almost all of the companies which are implementing the BSC use financial, customer and process perspectives, but fewer companies use the learning and growth perspective.

Table 1: Examples of Performance Measures Used in Balanced Scorecard Perspectives

Financial Measures	**Customer Measures**	**Process Measures**	**Learning and Growth Measures**
Account receivable turnover	Advertisement costs as a percentage of sales	Average producing time of orders	Average years of service
Average payment period for payables	Brand recognition	Capacity usage rate	Communication among employees and departments
Cost reductions in key areas	Complaints resolved on first contact	Internal rate of return on new projects	
Debt to total assets ratio	Customer complaints	Labor utilization rate	Employee productivity
Economic value added (EVA)	Customer loyalty	Number of new patents	Employee satisfaction
Operating income	Customer satisfaction	Number of new products and services	Employee suggestions accepted and implemented
Percentage change in sales revenue	Market shares of each product/service type	Number of on-time delivery	Ethics violations in the work place
Return on equity	Marketing costs as a percentage of sales	Purchase returns frequency	Information system investments
Return on total assets	Number of customers lost	Quantity of defected units	Leadership development
	Number of new customers	R&D costs as a percentage of sales	Number of cross-trained employees
	Rate of sales returns	Ratio of new products /services to all orders	Number of employee suggestions
	Response time per customer request	Reworked units	Outstanding number of applications for employment
	Sales volume in each sales channel	Set-up times	Quality of work environment
	Total market share of the company	Time to replace or repair the defected products	Time spent to employee training
	Total sales volume in quantities	Warranty claims	

Ho and Chan (2002) studied to understand the type of performance measures used in municipal governments. Sim and Koh (2001) investigated whether there are any linkages between business success and the strategically linked performance measures, which include both financial and non-financial performance measures. They presented the interrelation between the performance measures in four BSC perspectives. Laitinen (2002) presented empirical evidence on the importance of the performance measures in small Finnish technology companies and developed an integrated performance measurement system. He defined the integration of performance measures under two internal and five external factors of performance and showed a causal chain between these measures in seven factors.

In the BSC financial perspective indicates the company's strategy for growth, profitability, and the risk reviewed from the perspective of the shareholders. Customer perspective identifies the strategies for creating value and differentiation from the perspective of the customer. Internal process perspective captures the strategic priorities for various business processes that create customer and shareholders satisfaction. Learning and growth perspective includes the employee capabilities and skills, innovation and technology, and a climate that supports organizational change and growth (Kaplan and Norton 2001b).

In this study, measuring frequency of performance indicators in the manufacturing companies and the satisfaction degree from corporate performance in different aspects are determined. Then the relations between the measurement frequency of performance indicators and the corporate performance satisfaction is analysed by using canonical correlation analysis.

Although some surveys had been done to understand the measurement systems, the importance and usage of the performance measures, yet there has been no study that analyses the relations between the measurement frequency of performance measures and the corporate performance satisfactions. We believe that measurement frequency of indicators show their importance for firms more truly.

When we ask to managers, how much an indicator is important, we usually get answers like highly important or important. But are we sure they are taken into account in the same manner? The analysis based on such questionnaires might not reflect accurate picture of status. Since an indicator which is more or less important for a firm, it is measured more or less frequently; we offer to use measurement frequencies in evaluations. This study uses the measurement frequency of performance indicators based on the classification of BSC and shows which indicators are significant on which performance satisfaction measures. The model applied in our study is given in figure 1.

2. Survey

The biggest 500 manufacturing companies on the Istanbul Chamber of Industry (ICI- 500) listing were chosen as the survey population. We asked the measuring frequency of performance indicators, which were classified on the four balanced scorecard perspectives: financial, costumer, process, and learning and growth. The respondents answered the following question: ‘‘In your company how frequently are you measuring the performance indicators?”. Measurement frequencies of indicators were measured using a five-point scale, with one labeled as “not measured”, two labeled as “once in a year measured”, three labeled “quarterly measured”, four labeled as “every month measured”, and five labeled as “very frequently measured”.

We also asked questions about the satisfaction degree from “overall corporate performance”, “performance compared to competitors”, and corporate performance in the following areas: profitability, borrowing, market value, costumer satisfaction, improvement of employee capabilities, employee satisfaction, social responsibilities, taking the technological innovations and knowledge, cost reduction, market share, capacity usage. The respondents answered the following question: “How do you evaluate your company's previous year's performance in the following areas?”. Satisfaction degree was measured using a five-point scale, from ‘‘not satisfied at all’’ to “extremely satisfied”.

2.1. Respondents

A questionnaire sent to the chief executive officers of the biggest 500 manufacturing companies on the ICI- 500 listing and it's asked him/her or a person who is responsible from performance management to fill the questionnaire. A 21.36% response rate is achieved. Profiles of the respondents are given in Table 2 and Table 3.

Table 2: Respondents' Position in the Organization

Position	Number of Respondent	Percentage
CEO	21	19,63 %
Vice General Director	11	10,28 %
Vice President of the Board of Directors	4	3,74 %
Member of the Board of Directors	4	3,74 %
Accounting or/and Finance Manager	14	13,08 %
Human Resources Manager	12	11,21 %
Strategic Planning or Research and Planning Manager	8	7,48 %
Quality Manager or Quality Assurance Director	3	2,80 %
Other Managers (Production, Marketing, Productivity Factory, etc.)	8	7,48 %
Other	14	13,08 %
Unknown	8	7,48 %
Total	107	100 %

Table 3: Respondents' Companies Sorted by Industry Type

Industry	Respondents		Survey Population	
	Number	Percentage	Number	Percentage
Textile, clothes, leather and shoes	16	15%	96	19,16 %
Food, beverages and tobacco	15	14%	90	17,96 %
Chemicals, petroleum products, rubber and plastic	13	12%	88	17,56 %
Core metal industry	17	16%	55	10,98 %
Automotive	11	10%	41	8,18 %
Stone and stone based products	11	10%	36	7,19 %
Metal equipment, machine and equipment, and occupational tools	8	7%	41	8,18 %
Paper and paper based products	4	4%	20	3,99 %
Electricity	3	3%	12	2,40 %
Forestry and furniture	2	2%	11	2,20 %
Mining	3	3%	8	1,60 %
Other sectors	1	1%	3	0,60 %
Unknown	3	3%		
Total Respondents	107	100%	501	100 %

2.2. Method

The analysis of the data is conducted at three steps:

- Performing an exploratory factor analysis with varimax rotation to determine the factors of each of the four perspectives of BSC; financial, customer, process, and learning and growth measures in Table 1.
- Performing an exploratory factor analysis with varimax rotation to determine the factors of corporate performance satisfactions.
- After adding two more criteria to the factors of corporate performance satisfactions; named as "overall performance" and "performance compared to competitors", using canonical correlation analysis to determine the effect of measurement frequency of performance measures to corporate performance satisfactions. These steps are discussed in greater detail in the next section.

Step 1:

Factor analysis is a multivariate technique which avoids potential problems of multi-collinearity (Hair et al. 1998). Exploratory factor analysis with varimax rotation was performed on the BSC perspectives in order to extract the dimensions underlying the construct. The factor analysis of the 9 financial variables yielded 2 factors explaining 56,484 % of total variance. The factors were labeled “financial operations” (fin1) and “profitability” (fin2).

- Financial operations (fin1) includes the following measures; account receivable turnover, average payment period for payables, percentage change in sales revenue, debt to total assets ratio and cost reductions in key areas.
- Profitability (fin2) includes return on total assets, return on equity, economic value added (EVA), operating income.

The factor analysis of the 15 customer relations variables yielded 4 factors explaining 72,679 % of total variance. The factors were labeled “customer relations” (cus1), “marketing costs” (cus2), “market share” (cus3) and "sales volume” (cus4). These four factors include the following measures;

- Customer relations (cus1): response time per customer request, number of new customers, number of customers lost, customer loyalty, customer satisfaction, complaints resolved on first contact, customer complaints;
- Marketing costs (cus2): advertisement costs as a percentage of sales, marketing costs as a percentage of sale, rate of sales returns;
- Market share (cus3): total market share of the company, market shares of each product/service type, brand recognition;
- Sales volume (cus4): sales volume in each sales channel, total sales volume in quantities.

The factor analysis of the 15 process variables yielded 3 factors explaining 63,759 % of total variance. The factors were labeled “operational activities” (pro1), “innovation” (pro2) and “resource utilization” (pro3). These three factors include the following measures;

- Operational activities (pro1) : time to replace or repair the defected products, reworked units, quantity of defected units, number of on-time delivery, set-up times, purchase returns frequency, average producing time of orders;
- Innovation (pro2) : internal rate of return on new projects, ratio of new products /services to all orders, number of new patents, warranty claims, number of new products and services, R&D costs as a percentage of sales;
- Resource utilization (pro3) capacity usage rate, labor utilization rate
- The factor analysis of the 13 learning and growth variables yielded 3 factors explaining 61,296 % of total variance. The factors were labeled “work environment” (gro1), “employee relations” (gro2), and "employee capabilities” (gro3). These three factors include the following measures;
- Work environment (gro1): information system investments, communication among employees and departments, ethics violations in the work place, outstanding number of applications for employment, quality of work environment;
- Employee relations (gro2): employee suggestions accepted and implemented, number of employee suggestion, employee productivity, leadership development, employee satisfaction ;
- Employee capabilities (gro3): average years of service, time spent to employee training, number of cross-trained employees.

Step 2:

Exploratory factor analysis with varimax rotation was performed on the corporate performance satisfaction in order to extract the dimensions underlying the construct. The factor analysis of the 11 performance satisfaction variables yielded 2 factors explaining 57,422 % of total variance. The factors

were labeled “long-term performance” and “short-term performance” These two factors include the following measures;

- Long-term performance: improvement of employee capabilities, employee satisfaction, social responsibilities, taking the technological innovations and knowledge, cost reduction;
- Short-term performance: market share, capacity usage, profitability, borrowing, costumer satisfaction, market value.

Step 3:

In this study we used Canonical Correlation Analysis (CCA) to analyze the relationship between corporate performance satisfaction and the measurement frequency of performance indicators. CCA is an extension of multiple regression to the case of a multidimensional response measure. It is currently being used to analyze multidimensional relations between multiple independent and multiple dependent variables. In multiple regression analysis, the aim is to find a linear combination of the independent (or predictor) variables such that the composite has the maximum correlation with the dependent (or criterion) variable. Multiple regression allows multiple independent variables but only a single dependent variable. CCA focuses on the correlation between a linear combination of the variables in one set and a linear combination of the variables in another set (Johnson and Wichern, 2002).

Simply the formulation is as follows

$v = \gamma' y$ and $u = \alpha' x$, where v is a linear combination of corporate performance satisfactions and u is a linear combination of measurement frequencies of indicators. The correlation between u and v is,

$$Kor(u,v) = \frac{Kov(u,v)}{\left[\text{var}(u)\,\text{var}(v)\right]^{1/2}} = \frac{\alpha' \Sigma_{12} \gamma}{\sqrt{\alpha' \Sigma_{11} \alpha}\sqrt{\gamma' \Sigma_{22} \gamma}} = \frac{Kov(u,v)}{(1 \quad 1)^{1/2}} = Kov(u,v) = \rho$$

The aim is to maximize $Kor(u,v)$

$$Max\ Kor(u,v) = Max\ \alpha' \Sigma_{12} \gamma = \rho$$

Subject to

$$Var(u) = E\left[u - E(u)\right]\left[u - E(u)\right]' = \alpha' Kov(x) \alpha = \alpha' \Sigma_{11} \alpha = 1$$

$$Var(v) = E\left[v - E(v)\right]\left[v - E(v)\right]' = \gamma' Kov(y) \gamma = \gamma' \Sigma_{22} \gamma = 1$$

The correlation between the two sets of variables is called canonical correlation and the coefficients α *and* γ are known as canonical coefficients. A variable which has a high-standardized coefficient is significant. If a variable is highly correlated with its canonical variable, its movement will be closely related to that canonical variable. Therefore, either a high-standardized canonical coefficient or a high correlation with its canonical variable signifies the importance of that variable. In general, it is suggested that correlations are superior to canonical coefficients (Hair et al. 1998, Levine 1977).

3. Results of Analysis

We used canonical correlation analysis to investigate the interrelationships between two sets of variables: the criterion set includes corporate performance satisfaction factors (overall performance, performance compared to competitors, short-term performance and long-term performance) while the predictor set consists of variables reflecting measurement frequency of performance measures classified based on the BSC approach (financial; financial operations and profitability. Process; operational activities, innovation and resource utilization. Customer; customer relations, marketing costs, market share and sales volume. Learning and growth; work environment, employee relations and employee capabilities)

Table 4 shows the Pearson Correlation Coefficients between the corporate performance satisfaction and the measurement frequencies of performance indicators. It measures the strength of the linear relationship between two variables. According to the table all the significant correlations are positive. Long-term performance has correlations with pro1 (R=0,316), cus1 (R=0,311), fin2 (R=0,305), (R=0,316), gro3 (R=0,294) and gro1 (R=0,259). Past performance has correlations with gro3 (R=0,340), cus4 (R=0,296), fin2 (R=0,213), and pro1 (R=0,203). Overall performance has correlations with pro1 (R=0,342), fin2 (R=0,264), gro3 (R=0,254), gro2 (R=0,225), and cus4 (R=0,200). Performance according to competitors has correlations with gro3 (R=0,314), gro2 (R=0,289), fin2 (R=0,274), cus4 (R=0,254), pro3 (R=0,216), and pro1 (R=0,203).

Table 4: Pearson correlation coefficients between corporate performance and predictors

	fin1	**fin2**	**cus1**	**cus2**	**cus3**	**cus4**
Long-term	0,172	0,305*	0,311*	0,118	-0,098	0,092
Short-term	0,196**	0,213**	0,023	0,187	0,128	0,296*
Overall	0,117	0,264*	0,116	0,105	0,106	0,200**
Competitors	0,151	0,274*	0,116	0,082	0,138	0,254**
	pro1	**pro2**	**pro3**	**gro1**	**gro2**	**gro3**
Long-term	0,316*	0,154	0,149	0,259*	0,161	0,294*
Short-term	0,203**	0,174	0,083	0,046	0,161	0,340*
Overall	0,342*	0,136	0,001	0,061	0,225**	0,254**
Competitors	0,203**	0,151	0,216**	0,056	0,289*	0,314*

*Correlation is significant at the 0.01 level (2-tailed).
**Correlation is significant at the 0.05 level (2-tailed).

Table 5 displays the test statistics of canonical correlation. The first canonical correlation (R=0,66, P=0,000093) indicates a strong relationship between corporate performance satisfactions and the measurement frequency of performance indicators. The last three canonical functions were not found to be significant at an alpha level of 0,05 using Bartlett's chi-square test.

Table 5: Canonical Correlations Between Corporate Performance Satisfactions and Measurement Frequencies of Performance Indicators

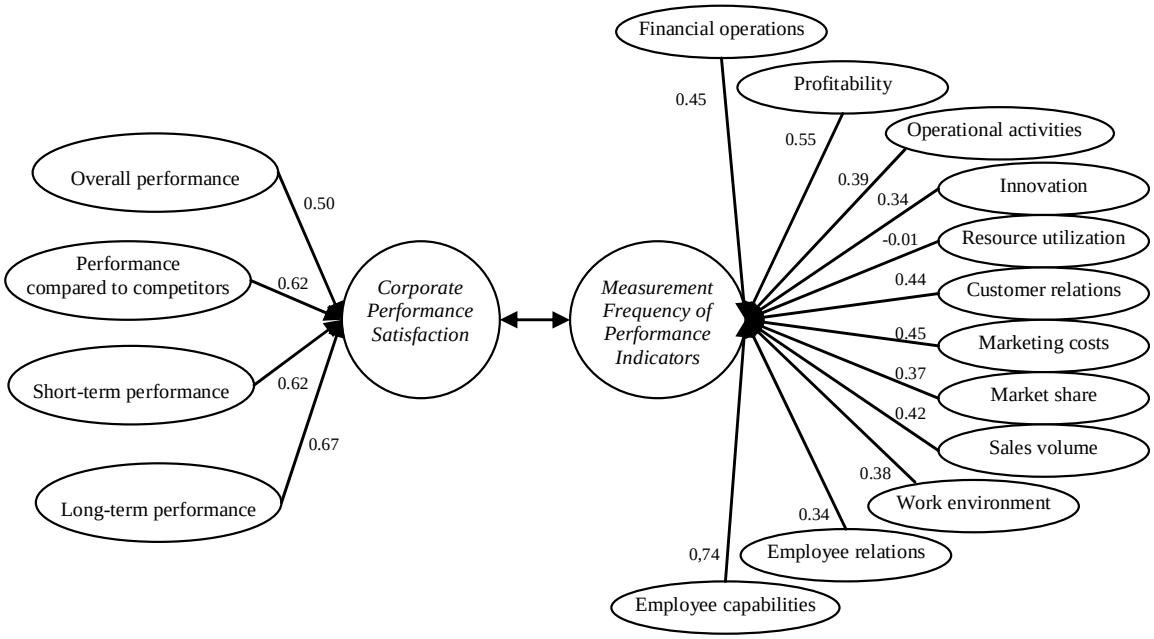
Variate Number	**Can. Cor.**	**R-Squared**	**F-Value**	**Num DF**	**Den DF**	**Prob Level**	**Wilks' Lambda**
1	0,66	0,44	2,08	48	353	0,000093	0,3826
2	0,41	0,17	1,16	33	272	0,257226	0,6779
3	0,37	0,14	1,00	20	186	0,465762	0,8154
4	0,24	0,06	0,63	9	94	0,765189	0,9427

F-value tests whether this canonical correlation and those following are zero.

Table 6: Canonical Loadings

	fin1	**fin2**	**cus1**	**cus2**	**cus3**	**cus4**	**pro1**	**pro2**	**pro3**	**gro1**	**gro2**	**gro3**
U1	0,45	0,55	0,39	0,34	-0,01	0,44	0,45	0,37	0,42	0,38	0,34	0,74
	long-term	short-term	overall	competitors								
V1	0,67	0,62	0,5	0,62								

Figure 1: Model Applied in the Study



The canonical loadings are shown in Table 6. Canonical variable for the criterion set is a linear combination of four performance satisfaction variables (long-term, short-term, overall, and competitors). According to the table; all of the performance satisfaction variables have significant loadings (we assume significant if R>0,40), therefore they are important. Long-term performance has the highest correlation (0,67) with its variable and thus, is the most important variable. Competitors (R=0,62), short-term (R=0,62) and overall performance (R=0,50) variables are also important and load onto the canonical variable significantly. In the predictor set among the measurement frequency of performance indicators the most important variable is the most heavily loaded variable, which is gro 3; loading of 0,74 to its canonical variate indicates its importance. Fin 2, pro 1, fin 1, cus 4, and pro 3 are also highly correlated with their canonical variate. The loadings of other variables are not so significant, the only unimportant variable in this set is cus 3.

4. Conclusion

Because of the strong relationship between corporate performance satisfactions and measurement frequency of performance indicators, performance satisfactions can be explained by the measurement frequency of performance indicators in Turkish manufacturing companies.

All of the performance satisfaction factors which were defined as long-term performance, short-term performance, performance compared to competitors and company's overall performance are considered as important factors by the managers in the self evaluations of the companies. Among these factors, long-term performance is the most important factor. *Long-term performance of the company* includes the factors such as improvement of employee capabilities, employee satisfaction, and social responsibilities, taking the technological innovations and knowledge, and cost reduction.

Among the measuring frequency of performance factors employee capabilities which consist of the average years of service, time spent to employee training, number of cross-trained employees, is the most effecting factor on the corporate performance satisfaction. Profitability, financial operations, operational activities, sales volume and resource utilization follows the employee capabilities in effecting the corporate performance satisfaction. Market share is evaluated to be ineffective factor on the corporate performance satisfaction.

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