Measuring and Reporting Cost of Quality in a Turkish Manufacturing Company: A Case Study in Electric Industry

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ABSTRACT

Contemporarily, the competition in the markets has thoroughly heated up. Many companies try to decrease their costs in order to survive in this cruel market. In this respects, the quality costs gain importance in all over the world and in Turkey, too. In this study, the implementation of quality costs measuring and reporting system has been performed in a company. Accordingly, the data has been collected from a Turkish manufacturing company. The data gathered from this company's accounting department has been used for studying on quality costs measuring and reporting system. Consequently, it is found out that the company cannot measure its quality costs adequately, for this reason quality reporting system in the company is not efficient. The company needs to give more significance to the quality costs measuring and reporting.

JEL Codes: L15, M41, M49,

Introduction

In recent years, competitive environment of companies has been getting harder and harder. In order to have sustainable competitive advantage, companies should produce their products to entirely supply customers' needs, wants and demands. Subsequently, companies need to have more quality products to remain competitive with other companies.

To gain a competitive advantage over rival companies, a company should produce high quality products. While producing high quality product, the company should also take into account its quality costs. Shortly, companies need to produce high quality products in a low quality costs. As a result, quality and quality costs gain vital importance for a company to survive in a highly competitive market.

The significance of this study is to comprehend the necessity of the quality system for a company which operates in the global and local markets. Another gist of the study is to provide recognition of quality costs system benefit to the profit and brand name. The quality costs system causes decreasing in the production cost and increasing in the brand name which will be perceived as producing qualified products.

The aims of this study are to show the importance of the quality costs for a company which competes in a highly competitive market, and also demonstrate the necessity of quality costs system so as to have high qualified product with a low quality costs. As it is well known, the quality cost is not the responsibility of a department or an individual, on the contrary, every person in an organization should be responsible for quality. Highly qualified products can be reached by the collaboration of all departments in an organization. In this sense, the main aim of this study is to demonstrate the function of accounting department in quality costing activities. Those activities can be summarized as; the measurement of quality costs, the classification of this costs and the reporting techniques of the quality costs. In this respect, the purpose of the current study is to show the importance of quality costs' reporting.

The paper contributes to the literature by documenting the concepts of quality, quality costs, and the classification of quality costs and quality costs measurement. On the basis of literature review, a case study will be handled and lastly, the analysis and results will be given in last section.

Literature review

To be able to analyze the measuring and reporting costs of quality, some concepts should be clear first. The three basic concepts of this paper will be introduced. These concepts are quality and quality costs, classification of quality costs and lastly, quality costs measurement.

The concept of quality has been defined for many quality gurus. So, there are many definitions for quality. Quality is the features of products which meet customer needs and thereby provide customer satisfaction. Quality means freedom from deficiencies (Juran & Godfrey, 1998). According to D. C. Montgomery, Quality means fitness for use, and also he defined quality as inversely proportional to variability (Montgomery, 2005).

In addition to those definitions, some of other quality gurus defined quality as;
- Crosby (1979, p. 7)defines quality as ***"conformance to requirements"***
- Feigenbaum's(1983, p. 7) definition of quality is "***the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectations of the customer."***
- As Ishikawa (1985, p. 45) suggests, quality means ***"quality of work, quality of service, quality of information, quality of process, quality of division, quality of people, including workers, engineers, managers and executives, quality of system, quality of company, quality of objectives, etc."***
- Pirsig's definition (1984,p. 206) of quality is that ***"Quality is a characteristic of thought and statement that is recognized by a nonthinking process. Because definitions are a product of rigid, formal thinking, quality cannot be defined."***

To sum up those definitions, quality is the whole good and service characteristic features of fulfillment power for stated and demanded needs. In other words, many quality gurus defined quality in terms of the degree of the product's conformance to its requirements to maintain customer satisfaction and in terms of a product that contains no defects (Ömürgönülşen, 2009).

Quality Cost is a cost for detection and anchoring of low quality about goods and services. Simply, costs of quality are the costs which occur because poor quality may or does exist (Hansen & Mowen, 2006). Quality costs are a measurement of the costs particularly related with the accomplishment or non-accomplishment of
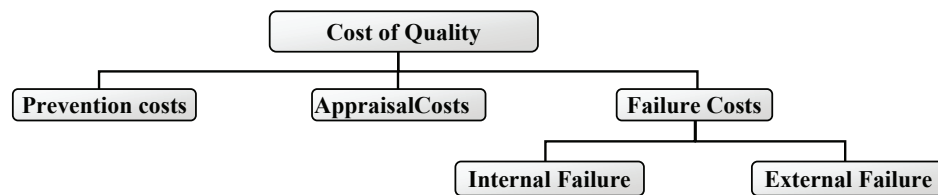
product or service quality. To make those explanations more specific, Jack Campanella(1999, p. 4) defined cost of quality as;

> *"More specifically, quality costs are the sum of the cost incurred by (a) investing in the prevention of non-conformances to requirements, (b) appraising a product or service for conformance to requirements, and (c) failing to meet requirements."*

In the definitions of Campanella, it is understood that the quality costs consist of three main parts; Prevention Costs, Appraisal Costs, Failure Costs.

The required quality activities would incur costs and quality costs arecategorized into three main parts – Prevention, Appraisal and Failure Costs – Those can be also stated as PAF (**P**revention-**A**ppraisal-**F**ailure) model (Jaju & Lakhe, 2009). Failure costs should be taken into consideration as two subtopics which are called internal and external failure costs.

Figure 1. Classification of Quality Costs (Rodchua, 2006)

In Figure 1, three main classifications of quality activities costs have been shown. Those costs do not occur at the same period of the production process. So, it should be also classified as time periods in which they occurred.

Prevention Costs are the preliminary activities' costs to reach quality goals for producing goods and services and avoid deviations of those goals (Kırlıoğlu, 1998). Prevention costs are occurred to prevent low quality in the goods or services being produced (Hansen & Mowen, 2006). Prevention costs are related with quality planning, designing, implementing and managing the quality system, auditing the system, supplier surveys, and process improvements (Rodchua, 2006).

Appraisal Costs are activity costs of measuring the suitability of the product to customers' needs. It is incurred to identify non-conformance to requirements (Oliver & Qu, 1999). Those costs are related with the supplier's and customer's assessment of
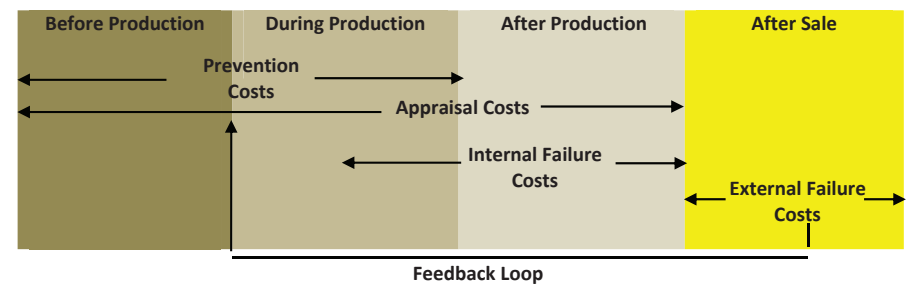
purchased materials, processes, intermediates, products and services to assure conformance with the specified requirements (Tsai, 1998).

Internal Failure Costs are the costs of low quality product which are realized before sales of the product. In other words, these costs arise when the outcomes of production fail to meet stated quality specifications and are noticed before transfer of those low quality products to the customers (Vahevanidis et al., 2009).

External Failure Costs are failure costs which come up after delivering the products to the customers(Kaner, 1996).Those costs take place for the reason that the products and services do not conform to specification or requirements and those products do not satisfy customer needs after being delivered to customers (Hansen & Mowen, 2006). It is also incurred by amending failures after transferring the finished goods and products to the customers (Low & Yeo, 1998).

Additionally, Quality cost classification can be grouped in time periods. For example, prevention costs encompass the stage of both pre-production and during production and appraisal costs cover the three stages of production –preproduction, production and after production stage. Failure costs are divided into two subtopics which internal failure costs and external failure costs. Internal failure costs encompass the period of both production and after production stages. External failure costs just related with the stage of after sale (Barfield et al., 2002).

Figure 2. Time-Phased Model for Quality Costs(Barfield et al., 2002)

The Quality Costs Measuring helps to find out where unnecessary quality costs are occurred, thus management can take actions to eliminate that kind of costs and this

elimination will reduce the occurrence of poor quality costs. In other saying, the quality costs measurement serves management to determine which area of operation requires preventive measures (Low & Yeo, 1998).

To measure quality costs, one should collect related data from quality activities of a company. After the collection of data which are related with quality costs components, they should be analyzed before using in an action. This analysis consists of the relationship between a costs component and other costs components and searches the effect on total costs.

Quality costs are analyzed in weekly, monthly, quarterly, yearly, etc. periods. Company structure should be taken into account in determining the period of analysis (Şimşek, 2001). In order to analyze quality costs, companies need to use some techniques. The analysis techniques for quality costs can be listed as;

    I.   Pareto Analysis,
    II.   Ratio Analysis,
    III.   Correlation Analysis,
    IV.   Trend Analysis,
    V.   Regression Analysis.

Pareto Analysis is one of the most used techniques in quality costs analysis. This technique was developed by Wilfredo Pareto who is a nineteenth century Italian social scientist and economist. He gave his surname to the technique. Pareto principle is universally known as the 80/20 rule. Pareto found out this principle by pinning down that 80 percent of Italy's national income is shared by 20 percent of the Italy's populations. With the help of Pareto diagrams, problems can be put in order of importance, problems of costs analysis can be easily performed and relative occurrence numbers could be searched simply (Sarıkaya, 2003). In other words, Pareto analysis can be utilized to recognize cost drivers which are accountable for the most of cost occurred by ranking the cost drivers in order of value (Tsai, 1998).

The Technique of Ratio Analysis is aimed to identify the aspects of the quality costs' performance to aid decision making. Ratio analysis consist of rationing quality costs to revenue, production costs, direct labor costs and rationing total quality costs within themselves (Özcan, 2012).

Correlation analysis represents the direction and the power of the relationship between variables. In correlation analysis, the results do not give cause-effect relation-

ship, because there is no dependent and independent variable in this technique (Altunışık et al., 2005).

Trend Analysis is a useful picture of how the quality improvement program has been doing since its inception. It provides management with information concerning the within-period progress measured relative to specific goals (Hansen & Mowen, 2006).

Regression analysis examines the relationship between one dependent variable and one or more than one independent variables. In other words, this technique tries to explain the changes in dependent variable with the help of independent variables (Altunışık et al., 2005).

Data and Methodology

The data of this study is gathered from X Electric Inc. Company which was founded in 1990 in Adapazarı, Turkey. The company is a Low Voltage Circuit Breaker manufacturer company.

The data has been collected from this company's accounting department. The company's accounting director gave the raw data of the company quality costs. We have analyzed these costs for reporting quality costs.

According to the data, we drew table 1, 2, and 3. With the help of these tables, we made ratio and trend analysis of company's quality costs. The data consists three years which are 2008, 2009, 2010. In the study, trend and ratio analysis have been performed for measuring and reporting the firm quality costs.

Analysis of Quality Costs in the Firm

The table below displays the company's sales and production amount in Turkish Liras (here after TL). The sales and production amount have been given for three years. Additionally, the table contains of total quality costs in the firm for three years.

Table 1. Some Ratios and Ratio Components in the Firm

Data	Years		
	2008	2009	2010
Total Sales (TL)	629.053.415	695.866.750	786.859.486
Total Production Costs (TL)	515.326.274	563.708.245	643.590.468
Total Quality Costs (TL)	10.028.516	11.712.822	12.642.655
The Ratio of Quality Costs to Sales	1,59%	1,68%	1,61%
The Ratio of QC to Production Costs	1,95%	2,08%	1.96%

According to the firm information, the ratios of total quality costs to total sales have been calculated for given three years. And the ratios of total quality costs to total production costs have also been calculated. In the aspect of the information in the previous section, these calculations have been performed as follows.

In 2008, the company's total sales are 629.053.415 TL. In the same year, total quality costs are 10.028.516 TL. So the ratio of total quality costs to sales can be found out as follows;

$$\frac{10.028.516}{629.053.415} = 1,59\%$$

It can be concluded that the amount of total quality costs is only 1.59% of the total sales in 2008.

$$\frac{10.028.516}{515.326.274} = 1,95\%$$

The calculation above demonstrates that the ratio of total quality costs to total production costs is about 1.95%. For the years of 2009 and 2010, total quality costs to sales and total quality costs to total production costs have been calculated by the same way and written down in the figure above.

This ratio is not too much for an early stage of quality costs analysis applier's company. In other words, the firm analyses its quality costs not long ago, so the rates is in the acceptable limits. Besides this ratios can be reduced for more efficient quality costs system.

When analyzing quality costs data for year 2010 as quality costs components, it will be useful for monitoring quality costs. Regarding this classification, quality costs component will be given as costs items. With the help of this costs items, the percentage amount of each costs item will be also calculated and given for the year.

Table 2. Total Quality Costs as Each Cost Items for the Components in the year of 2010

Components of Quality Costs	Costs (TL)	Ratio (%)
Prevention Costs	1.782.614,36	14,1
Quality Planning	518.348,86	4,1
Quality Circle	75.855,93	0,6
The Training of Quality	202.282,48	1,6
Inspection and Tests Instructions	113.783,90	0,9
Supplier Quality Planning	214.925,14	1,7
Preventive Maintenances	480.420,89	3,8
Other Prevention Costs	176.997,17	1,4
Appraisal Costs	5.031.776,69	39,8
Inspection and tests of purchased materials	1.036.697,71	8.2
Control, maintenance and calibration of measurement instruments	101.141,24	0,8
Process inspection and tests	1.150.481,61	9,1
Consumable materials for laboratory and tests	581.562,13	4,6
Products inspection and tests	1.984.896,84	15,7
Other appraisal costs	176.997,17	1,4
Internal Failure Costs	4.450.214,56	35,2
Salvage	2.225.107,28	17,6
Reproduction and Repairs	1.656.187,81	13,1
Re-inspection	480.420,89	3,8
Corrective actions	88.498,59	0,7
External Failure Costs	1.378.049,40	10,9
Products Returns	998.769,75	7,9
Transportation Damage	50.570,62	0,4
Warranty Costs	328.709,03	2,6
Total Quality Costs	12.642.655	100,0

In the figure 2010, the non-conformance costs are under the half of the total quality costs. This demonstrates that the firm is going in the right way. The company gives more importance for conformance costs day by day, so the non-conformance costs decreases naturally. These changes will benefit the company in more ways than one. The figures below should be reported to the managers for monitoring quality costs activates by management. The importance of quality costs increases day by day.

The next table shows the total quality costs as categorization groups. As it is mentioned before, the quality costs have two components which are conformance and non-conformance costs. And these components costs are given in the chart. Moreover, conformance costs are divided into two cost elements that are prevention costs and appraisal costs. The amounts of these costs are also given yearly in the table. The

conformance costs are increasing for the given years. It rose up two times from the amount of 2008 to 2010 amount. It is good for a company to increase its prevention activities in order not to confront defects after selling the products out. Besides, the amount of prevention costs in conformance costs is too small. The firm should concentrate more on prevention costs.
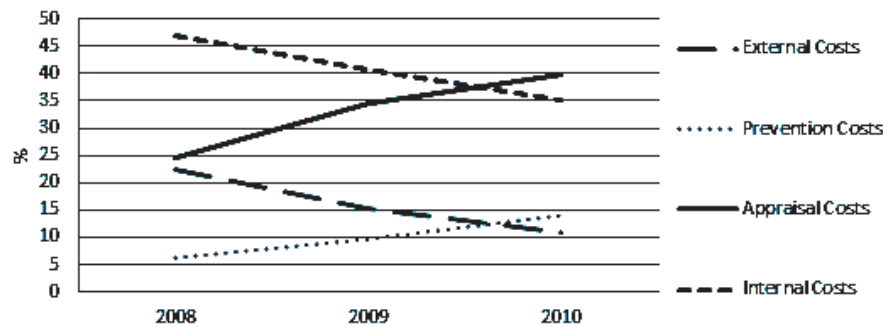
Table 3. The Amount of Quality Costs in Classification through the Years

Quality Costs	2008	2009	2010
Conformance Costs	3.098.811,45	5.177.067,33	6.814.391,05
Prevention Costs	631.796,51	1.147.856,56	1.782.614,36
Appraisal Costs	2.467.014,94	4.029.210,77	5.031.776,69
Non-Conformance Costs	6.929.704,56	6.535.754,67	5.828.263,96
Internal Failure Costs	4.693.345,49	4.767.118,55	4.450.214,56
External Failure Costs	2.236.359,07	1.768.636,12	1.378.049,40
Total Quality Costs	10.028.516	11.712.822	12.642.655

On the other hand, in the table above, the non-conformance costs have been shown in two parts which are internal and external failure costs. The company has endured too much internal failure costs. And, the company should increase its preventive activities and decrease the internal failure costs. When it comes to external failure costs, the firm is going in a right way, because the amounts of external failure costs are going down for each given year.
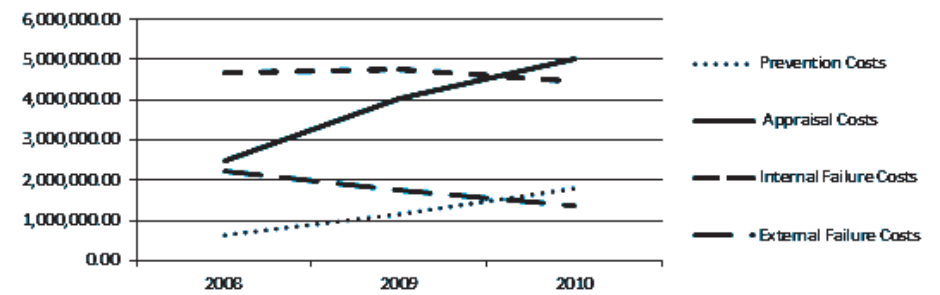
With the help of Table 3, it can be seen that conformance costs – prevention and appraisal costs – are increasing for each year. Additionally, non-conformance costs – internal and external failure costs – are decreasing for each year. It also shows that the huge amounts of total quality costs are occurred after production stage. The internal failure costs are the biggest costs in the total quality costs for every year. This situation represents that the defects are realized after the stage of production.

Figure 3. The Trends of Quality Costs' Categorization in percentage

In general, the movements of quality costs components are in a right way, even though the non-conformance costs are more than conformance costs. In the chart, it can also be seen that the amount of prevention costs is under the 15% of the total quality costs which means the firm do not pay enough importance for the prevention activities. Although the trend of external failure costs is declining, the external failure costs have too much portion of total quality costs. Having too much external failure costs brings more costs than the firm can measure.

Figure 4. The Trends of Quality Costs' Categorization in TL

In Chart 2, it is again shown the trend of quality costs components. Chart 1 shows the trends as percentage value; Chart 2 shows these trends as Turkish Liras amounts. The inferences of the Chart 2 are similar to Chart 1.

The Application Results

The quality costs activities in X Electric Inc. are concentrated in non-conformance activities. In other words, the firm is highly interested in internal and external costs. So, non-conformance costs are monthly reported to management. Besides, the firm does not give required importance for prevention and appraisal costs' measurement. Therefore, conformance costs are just reported yearly period, even though the firm is giving more importance to conformance costs than before.

On the other hand, while paying the non-conformance costs more importance than the conformance costs in the firm, the company endures more costs than it can measure. That is to say, the firm can bear the quality costs more than in numbers; there may be a non-visual negative effect on the firm. For instance, the firm may confront the loss of customers, bad brand recognition and poor employee motivation and so

on. Furthermore, the efficient quality system causes to benefit the company in more ways than one. It decreases the non-conformance costs and increases profitability of the firm. The firm would have sustainable competitive advantage in the market.

It is found out that the company cannot measure its quality costs adequately, for this reason quality reporting system in the company is not efficient. The company needs to give more importance to the quality costs measuring and reporting activities.

Conclusion

Previously, the company thought that quality control was just a waste of time. But this thought changed in course of time. With the help of effective quality control system, company can reduce the salvage, loss of labor hours and so on, which increase the productivity level.

Yearly reporting of total quality costs is not efficient for making decisions on these costs. The measurement of prevention and appraisal costs is not made appropriately. The allocation key is generally labor costs which are not suitable for measurement of every costs item in the quality costs.

The firm should establish an efficient quality costs system and determine this system specification for effective measurement and reporting of quality costs. By having reliable and sufficient data in quality costing, company can reduce its non-conformance costs. And it causes to reduce total quality costs and increase profitability of the firm. The firm should prepare instructions and procedures for making measurement more efficient especially in prevention and appraisal costs. Every person in the firm should be informed about these instructions and procedures.

On the other hand, only the quality assurance department is responsible for quality costing in the firm. As it is mentioned in the previous parts, quality is not a person or a department job; it should be responsibility of every person and every department in the firm. The quality costs reports should be prepared and reported monthly. The accounting department should determine more suitable allocation keys for the measurement of quality costs and according to this measurement, the accountants in the firm should make the necessary journal entries for these costs.

By measuring and reporting quality costs, the managers can recognize that there is a huge amount of costs which they do not take into consideration while making managerial decisions. They can realize that the non-quality issues increase the evitable costs by too much.

In the short run, investing in preventing activities can increase total quality costs in the firm, but in the long run, these investments will cause decreasing in failure costs. So, the firm will reduce its evitable costs in the long run.

In the globalizing world, the firm should take the products quality into account. Also, it needs to be noted here that a company cannot survive in a highly competitive market with its low quality products. Last, but not the least, it must be kept in mind that the amounts of quality costs never excess the amount of poor quality costs.

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