Quality Costs Accounting And A Firm Application

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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.

Companies need to gaining profit for sustainability. And also gaining profit is one and first of companies' two basic goals. In order to achieve this first goal and to gain sustainability, companies have to provide customers' and potential costumers' needs and demand as well as

they do, and also they should gain sustainable competitive advantage by improving its technology, and its product quality.

With the globalization and non-boarding trading, the markets turned into cruel competitive place. In that kind of markets, unfortunately, using low pricing model is not enough for selling goods and services. Companies also need to provide high quality products. In other words, being successful in the global markets, the companies need to have not only low price products, but also high quality products.

As it is stated above, in order to gain sustainable competitive advantages in the market, companies need to act two actions at the same time. Firstly, improving the quality of products and services causes gaining sustainable competitive advantages in the market. Secondly, decreasing production costs by improving efficiency in order to promoting the product, brand or company in the market.In addition, the quality cost system utilizes the production efficiency. Therefore, the quality cost system should be established in every company in which it can be applicable.

***Keywords*:** Total Quality Management, Quality Costs, Managerial Accounting.

1.INTRODUCTION

In recent years, competitive environment of companies are getting 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.

Quality means providing goods and services as suitable for use, and it means fulfilment of clients' demands. Quality product means having conformity with quality standards in the finished goods.

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. Consequently, quality and quality costs gain vital importance for a company to survive in a highly competitive market.

The importance of this study is to comprehend the necessity of the quality system for a company which operates in the global and local markets. Another importance 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 importance of the quality costs for a company which competes in a highly competitive market, and also to demonstrate the necessity of quality costs system in order to have high qualified product with a low quality costs. As it is well known, the quality cost is not a 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 collaboration of all departments in an organization. In this sense, main aim of this study is to demonstrate the function of accounting department in quality costing activities. Those activities can be summarized as, measurement of quality costs, classification of this costs and reporting techniques of the quality costs. In this respect, showing the importance of quality costs' reporting.

2.QUALITY

Many people define quality in many different ways, because quality is a multi-dimensional concept(Karabınar, 1998). Quality is the degree of consumer satisfaction about the goods and services which they consume. In other words, quality is the degree of fulfilment consumers' needs and demands for produced product and served services.

J. M. Juran, who is one of the quality gurus, thought that quality has many meanings, but two of them have critical importance to managing for quality. First one, quality is the features of products which meet customer needs and thereby provide customer satisfaction. Second one, 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).

Quality concept is shaped as a conformance of consumers' needs and use by today's technologic, economic and social conditions(AYDEMİR, 1999).

In addition to those definitions, other quality gurus (Philip B. Crosby, W. Edwards Deming, Armand V. Feigenbaum, Kaoru Ishikawa, Robert M. Pirsig) had been defined quality as(Hoyer & Hoyer, 2001);

- Crosby defines quality as "conformance to requirements"
- Feigenbaum's 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."
- According to Ishikawa, 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 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 summing up those definitions, quality is the whole good and service characteristic features of fulfilment 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).

2.1.Quality Costs

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 making those explanations more specific, Jack Campanella defined cost of quality as(Campanella, 1999);

"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."

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

2.2.Quality Components

2.2.1.The Quality of Design

The quality of design is the measurement of how much intended requirements and expectations reverberate to the finished products by taking into account production factors. Therefore the quality of design is to designate specification and requirements in order to fulfilment of products' expected usage function. The quality of design is to approach/reach the quality level of intended product.

The important issue is whether the final product conforms to the design and performance standards that have been arranged for it, and not the content or validity of those standards(Garvin, 1984).

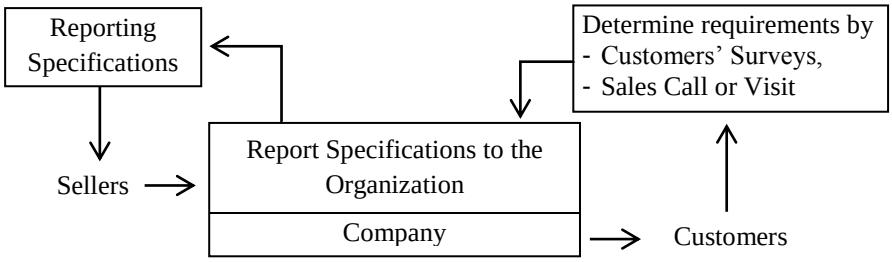


Figure 1: The Process of Design Quality

Source;TÜRKEL Asuman, "İşletme Yöneticileri için Toplam Kalite Yönetimi Ve İnsan Kaynakları", **Türkmen Kitabevi**, İstanbul, 1998, s.36

The figure above represents the process of the design quality. The design quality has started by customers' surveys and sales calls; afterwards, specifications have been determined. This process can continue to reach perfect products or services. It is the fact that consumers have endless needs so this process can continue after having perfect products.

2.2.2.The Quality of Conformance

The quality of conformance is simply expenditures for reaching desired finished products. It is a company's fulfilment ability of conformity to design specifications for satisfying customers' needs, wants and demands. In other words, the quality of conformance shows the conformity degree of a product or a unit to the specifications which had been defined at the stage of quality design in production process. The quality of conformance is conformity between the actual specialty of finished products and the intended speciality which is determined at the stage of product design.

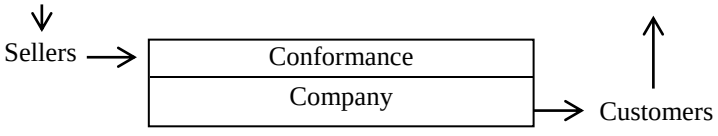


Figure 2: The Process of Quality Conformance

Source;TÜRKEL Asuman, "İşletme Yöneticileri için Toplam Kalite Yönetimi Ve İnsan Kaynakları", **Türkmen Kitabevi**, İstanbul, 1998, s.57

The process of quality conformance is illustrated in the figure above. The aim of this process is to reach conformity with specification which have stated in the stage of product design.

As increasing the development of the process of quality conformance, the customer's complaints and direct material costs, labour costs, maintenance costs would be decreased dramatically, and also the products would be produced in time, in a good quality and in a good price or cost.

2.2.3.The Quality of Usage

The quality of usage can be also called the quality of performance. It demonstrates the level of product performance in the market by performing customers' surveys, sales call and sales analysis. It is an indicator of how well the product working by resulting of marginal consumers usage. Shortly, it is usefulness degree of a product which has been bought by consumers.In this respect the quality of performance is the functional result of design and conformance quality.

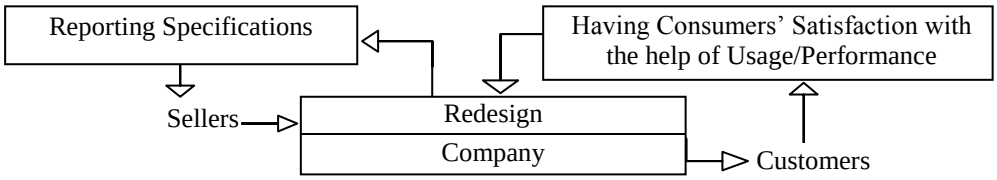


Figure 3: The Process of Usage Quality
Source;TÜRKEL Asuman, "İşletme Yöneticileri için Toplam Kalite Yönetimi Ve İnsan Kaynakları", **Türkmen Kitabevi**, İstanbul, 1998, s.15

Source;TÜRKEL Asuman, "İşletme Yöneticileri için Toplam Kalite Yönetimi Ve İnsan Kaynakları", Türkmen Kitabevi, İstanbul, 1998, s.15

The process, which shown in the figure 3, illustrates usage quality. This process starts with stating the performance levels of the companies' products in the market by making customer's surveys and sales analysis. According to these surveys, company redesigns its product to satisfy consumers' needs, wants and demands.

2.3.Development of Quality Concept

Before 20th century, quality was concerned as detection which means that products had been produced and then checked weather the goods were defective or not. Quality was viewed as a problem and product uniformity had been emphasized and also inspection department was responsible for quality.

By the year of 1920, it was the first time to use control schemas in the processes. By means of those schemas, which were developed by Walter Andrew Shewhart, make the process more intelligible about how quality is the outcome (product), how it is reliable, and whether the process under control or not.

On the other hand, after 1950s, William Edwards Deming, who is the American quality expert, suggested that the important thing is not the outcomes, it is the process itself. It was really important approach for those years.

By the year of 1956, Arnold Feigenbaum put quality concepts one step further and come up with Total Quality concepts. According to Feigenbaum, if production department singly interested in quality, the high quality product production would be just a dream. All parts of an organization - Marketing, engineering, purchasing and production department - should be interested in product quality instead.

By the 1960s, the concept gained a broader meaning. Quality started to be perceived as a thing that included not only the production process, but also the entire organization(Reid & Sanders, 2004).

TIME:	**Early 1900s**	**1940s**	**1960s**	**1980s and Beyond**
FOCUS:	Inspection	Statistical Sampling	Organizational Quality Focus	Customer Driven Quality
	Old Concept of Quality: Inspect for quality after production.			New Concept of Quality: Build quality into the process. Identify and correct causes of quality problems.

Figure 4: Timeline showing the differences between old and new concepts of quality

Source: Reid R. Dan, Sanders Nada R. "Operations Management: an Integrated Approach", **Wiley**, 2nd edition, 2004, p.143.

Until 1970s quality was perceived as something which is just a work consists of inspecting and correcting, even if some quality gurus made good effort for quality approach.

In 1980s and beyond, fortunately, the quality was concerned as a management tools. It was viewed as a competitive opportunity. The market and consumer needs gained importance and this importance pushed the companies to produce high quality product, otherwise they would not compete in the market. The inspection aspect of quality has been changed. Quality has been built into production process. Causes of quality problems began to be identified and corrected before the production process and quality was not viewed as an inspection after production, anymore.

3.THE CLASSIFICATION OF QUALITY COSTS

In an organization, in order to produce quality product, companies have to be in an activity which started from purchasing raw materials to taking into place quality products. Those activities charge company some costs which can be classified as two main parts – Activity Costs and Investment Costs.

Cost of Quality

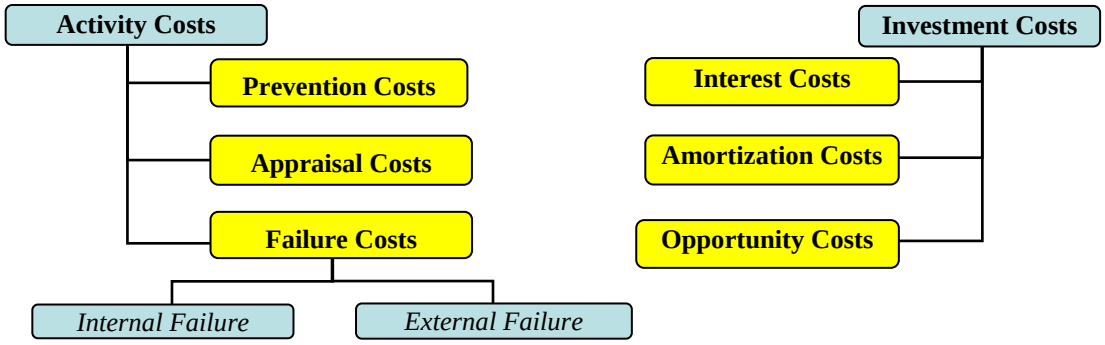


Figure 5: The Classification of Quality Costs

1.1. The Cost of Investments in Quality

Companies have to bear some costs in order to continue their activities, so it is also natural for a company to bear quality costs in order to emerge in the market. Quality investment costs can be defined as the cost to setup research facilities, tests & trials tools and the depreciation of those tools and facilities for taking into place quality goods and services.

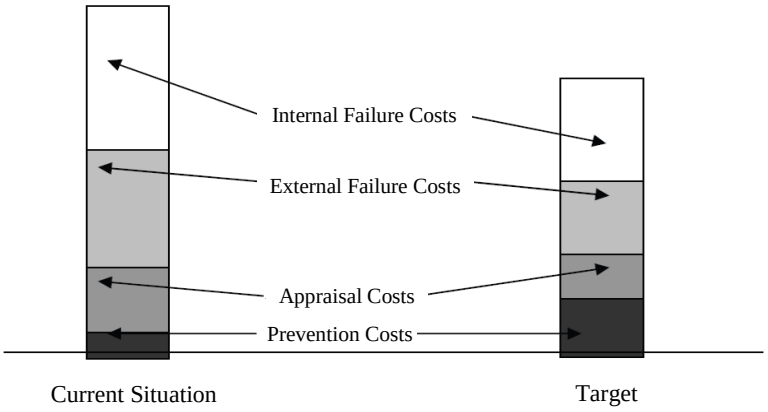


Figure 6: Total quality costs can be reduced by investing in prevention activities.

Source: Sippola, Kari, "Two case studies on real time quality cost measurement in software business", University of Oulu, Finland, p.77

1.2. The Cost of Activity Quality

Having quality product brings some requirements. For example, companies need to bear some costs for quality activities. The most important and well known optimal quality model is TQM. Besides TQM, the prevention-appraisal-failure (PAF) model also known as the optimal quality model (Seokjin & Behnam, 2008).

In 1961, Feigenbaum indicated that the required quality activities will incur costs and he categorised quality costs into three main parts – Prevention, Appraisal and Failure Costs – Those can be also stated as PAF model (Jaju & Lakhe, 2009). Failure costs should be taken into consideration as two subtopics which are called internal and external failure costs.

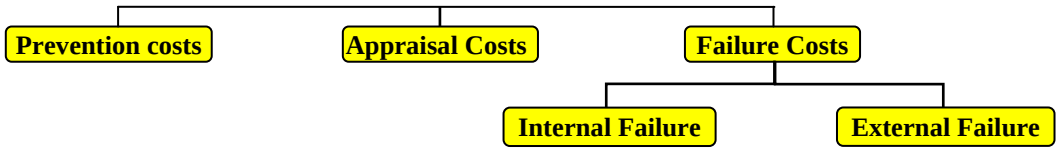


Figure 7: Classification of Quality Activities Costs

Source: SuhansaRodchua, "Factors, Measures, and Problems of Quality Costs Program Implementation in the Manufacturing Environment", **Journal of Industrial Technology**, Vol.22, No.4 (Oct. 2006 through Dec. 2006), p.3.

In the figure 8, 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.

Consequently, quality cost classification can be classified 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 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.

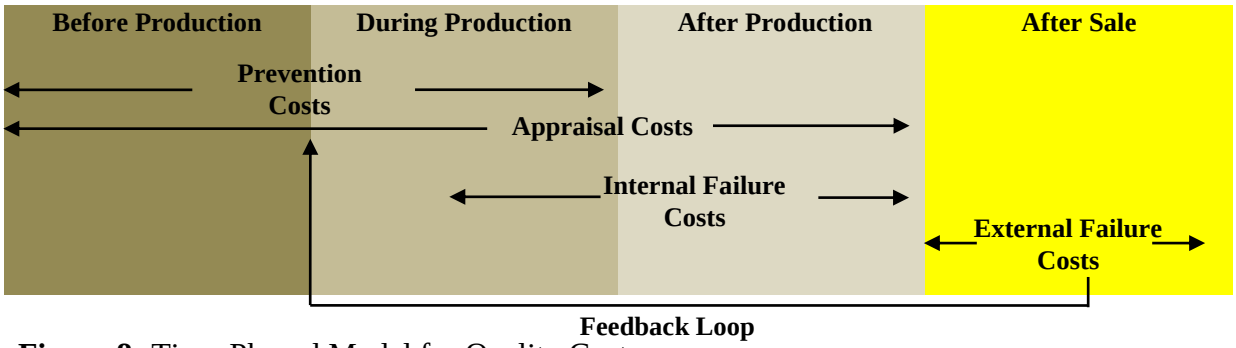


Figure 8: Time-Phased Model for Quality Costs

Source: Barfield, Jesse T., Raiborn, Cecily A., Kinney, Michael R., "**Cost Accounting: Traditions & Innovations**", South-Western College Pub, 5 edition, 2000, p.317

1.2.1. Prevention Costs

Prevention costs are the preliminary activities' costs to reach quality goals for producing goods and services and to avoid deviations of those goals (Kırlıoğlu, 1998). Prevention costs are the activities costs for preventing nonconformity of the goods and services to the costumers' wants, needs and expectations.

Prevention costs are occurred to prevent low quality in the goods or services being produced (Hansen & Mowen, 2006). If prevention activities are adequately performed, these efforts will result in relatively high quality products and low internal and external failure costs. In other word, prevention costs cause to maintain Appraisal and Failure Cost to minimum.

Prevention costs are related with quality planning, designing, implementing and managing the quality system, auditing the system, supplier surveys, and process improvements (Rodchua, 2006).

1.2.2. Appraisal Costs

It is an activity cost 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). These costs can be summarised as Tests and Trials Costs for Incoming Direct Materials, The Costs of Control and Tests for Laboratory Acceptance, Maintenance of Test Device and Equipment, The costs of associated supplies, materials and employee

1.2.3. Failure Costs

Failure costs are the costs of quality deviation to the pre-stated quality specifications and quality target in the any stage of product quality process. As a result of low quality product, companies have to bear additional costs and it indicates the costs of failure. Those costs are not inevitable costs for the companies. It is possible to avoid those costs, so those costs are non-conformity costs in the quality costs (Kırlıoğlu, 1998).

Failure costs contain the activities of reproduction of defective and unsuitable product, repairing and maintenance or sending to scrap. So as to avoid those costs, the compulsory investing activities for quality should be increased (Kırlıoğlu, 1998). Failure costs divided into two subtopics as internal failure costs and external failure costs.

1.2.3.1. Internal Failure Costs

Those costs are the costs of low quality product which is realised 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 those low quality product to the customers (Vahevanidis, et al., 2009). Generally, external failure costs are consisting of Scrap Costs, Reproduction or Repairing Costs, Re-controlling and Retest Costs.

1.2.3.2. External Failure Costs

External failure cost is a component of failure costs. It occurred after selling the poor quality product to the customers. In other words, it is 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 transfer the finished goods and products to the customers (Low & Yeo, 1998).

In general, external failure costs are consisting of Complaints, Warranty, Refunds and Replacement with updated products, Compromise, Recalling.

In the figure 9, it is observable that there is two periods which are initial position of the activity costs of quality and ideal position of it. In the initial position, companies have controllable costs – Prevention and Appraisal –. If a company does not perform prevention and appraisal activities properly, it would cause resultant costs as shown in the figure 9. Those costs consists of five costs components. Improper prevention activities results internal and external failure costs. Inappropriate appraisal costs causes lost reputation, customers' dissatisfaction and customers incurred.

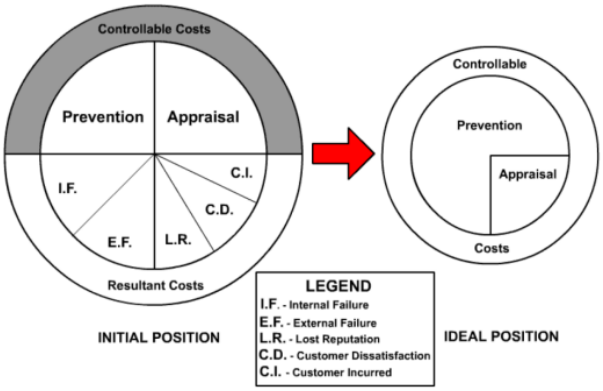


Figure 9: Costs of Quality Model

Source: Beecroft, G.D. (2001), **''Cost of quality and quality planning affect the bottom line''**, The Quality Management Forum, Vol. 27 No. 1, p.6.

As shown in figure 9, companies should get rid of the failure costs by adequately performing prevention and appraisal activities. As a result, company should take ideal position in the quality system in order to not to bear failure costs.

1.3. The Quality Costs Measurements

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

1.4. The Necessity of Measuring Quality Costs

Measuring quality costs would show the importance of quality costs and with the help of quality management, it has a positive effect on the workers' behaviour and attitude for quality improvements.

Measurement of quality costs exposes nonconformity which may not be identified by the traditional accounting procedures. Thus, it helps the find out inexactness actions which is ignored or overlooked by traditional implementations. Also measuring quality costs reduce after sale costs in the quality costs category (Kırlıoğlu, 1998). The quality costs information can be used as to monitor financial value of the quality improving programme (Sarıkaya, 2003).

1.5. The Quality Costs Analysis

After the collection of data, related with quality costs components, 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 analyse 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 analyse 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.

Let's explain them.

1.5.1. Pareto Analysis

It is one of the most used techniques in quality costs analysis. This technique 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 find out that principle by pin downing that 80 percent of Italy's national income is sharing 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 components of the Pareto analysis are arranged in descending order, starting from the left to right, beginning with the biggest elements to lowest one. The technique contains the list of factors which contribute to the problem and sort them in proportion to the size of the contributions (Campanella, 1999).

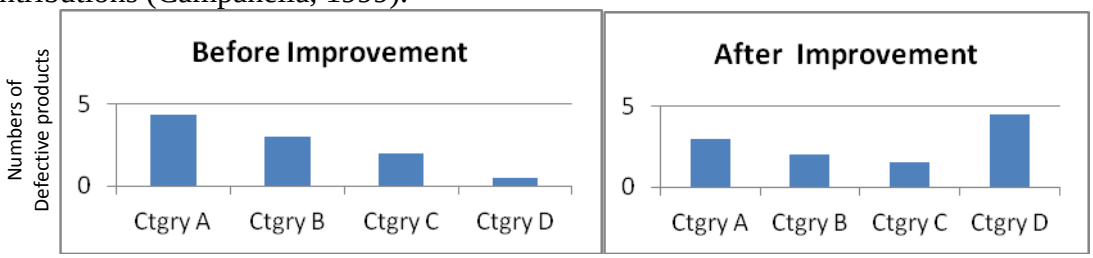


Figure 10: An Example of Pareto Diagram

Source: Nilgün Sarıkaya, **Toplam Kalite Yönetimi**, 1. Baskı, Sakarya: Sakarya Kitabevi, 2003, s.32

In the diagram above, errors in categories are shown in before production decrease after improvements.

1.5.2. Ratio Analysis

The Ratio Analysis technique is a comparison of costs information which has significant relationship. In order to make ratio analysis for quality costs performance departmentally, the first step should be gathering the quality costs information and to make a comparison, a convenient common ground should be stated.

First one is according to direct labour costs; various quality costs can be analysed by total labour costs or direct labour costs.

$$\frac{\text{Internal Failure Costs}}{\text{Direct Labour Costs}} \quad \text{or} \quad \frac{\text{Prevention Costs}}{\text{Total Labour Costs}}$$

Second one is according to production costs; the production costs can also be used in calculating quality costs.

$$\frac{\text{Total Quality Costs}}{\text{Total Production Costs}} \quad \text{or} \quad \frac{\text{External Failure Costs}}{\text{Total Production Costs}}$$

Third one is according to unit basis; various quality costs can be analysed by comparison with number of produced products.

$$\frac{\text{Appraisal Costs}}{\text{The Amount of Production}} \quad \text{or} \quad \frac{\text{Total Quality Costs}}{\text{The Amount of Production}}$$

Another one is according to Sales basis; various quality costs can be analysed by comparison with the amount of sales.
Last one is according to the costs of goods sold basis; various quality costs can be analysed by the costs of goods sold.

$$\frac{\text{Total Quality Costs}}{\text{Sales}} \quad \text{or} \quad \frac{\text{Internal Failure Costs}}{\text{Sales}}$$

$$\frac{\text{Total Quality Costs}}{\text{Costs of Goods Sold}} \quad \text{or} \quad \frac{\text{Internal Failure Costs}}{\text{Costs of Goods Sold}}$$

After the calculation of the ratio above for current period, the results can enable to conduct an analysis by compared with previous period ratios. Consequently, those ratios provide managers to see the trend of the quality costs ratio among the years.

1.5.3. Correlation Analysis

Correlation analysis represents the direction and the power of the relationship between variables. In correlation analysis, the results do not give cause-effect relationship, because there is no dependent and independent variable in this technique (Altunışık, et al., 2005).

Correlation coefficient (r) has a value between -1 and +1. If the coefficient value is near to +1, it means that there is a strong positive relationship between two variables. If it is close to -1, it can be said that there is a strong negative relationship. If the correlation coefficient value is nearby zero (0), it indicates that there is no significant relationship between these two variables.

1.5.4. Trend Analysis

In the long time period, in order to analyze companies' situation or tenor, managers need to examine and compare previous years to current year. Therefore, trend analysis is most suitable analysis technique to monitor companies' trend. In a narrow sense, trend analysis is a kind of analysis which is based on comparing the current period costs to previous period costs.

By using basic trend analysis technique, the results above can be indicated about the quality costs (Sipahi & Yıldırım, 2004);

- By monitoring the quality costs tenor year by year, the trend can be stated that it tends to increase or decrease,
- By stated the investment amount in quality, the effect of quality costs on sales can measured,
- By the help of the results above, the decision about investment in quality can be also analysed.

A trend analysis graph can be drawn as follows;

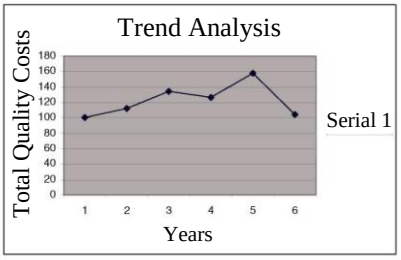


Figure 11: An Example of Trend Analysis Graph

1.5.5. Regression Analysis

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

The regression analysis is crucial technique for analyzing quality costs. It points out the all factors which has an effect on the quality costs.

The regression analysis can be used for answering the questions below (Altunışık, et al., 2005);

- Can the changes in dependent variable be explained by independent variables?
- How much of the changes in dependent variable can be explained by independent variables? (severity of relationship),
- If there is a relationship between dependent and independent variables, what is the direction of the relationship?
- When the certain conditions controlled, what is the effect of a specific variable or variable group on other variables?

Consequently, quality costs have a vital importance for a company and a well-managed quality costs system helps the companies to reach huge amount of profit.

2. AN APPLICATION ABOUT QUALITY COSTS ACCOUNTING ON THE X ELECTRIC INCORPORATED COMPANY

In this part of the study, an application will be handled. Until this part, the literature review about quality costs has been given. The concept mentioned in this study will be applied to a firm's activities.

X Electric Inc. Company was founded in 1990 in Adapazarı, Turkey. The company is a Low Voltage Circuit Breaker manufacturer company. The company was founded with hundred percent national capital. It is settled down in a total area of 40.000 square meters, out of which 25.000 square meters is covered area. The company's product range includes 3250 different types of products.

2.1. The Quality Costs Activities in X Electric Inc. Co.

In the firm, the quality costs are analysed, measured and reported in order to decrease some avoidable costs in the firm. The company's failure costs have a big portion among the all quality costs' components. In order to measure failure costs, the needed chart and report has been prepared monthly and reported to the related departments.

4.1.1. The Prevention Costs

Prevention costs are occurred before the production stage of products. The firm takes precaution in order not to produce poor quality product and increase defective product costs. These precaution activities can be stated as; Quality Planning, Quality Circle, The Training of Quality, Inspection and Tests Instructions, Supplier Quality Planning, Preventive Maintenances, Other Prevention Costs.

4.1.1.1. The Quality Planning

The quality planning consists of some activities, in order to reach targeted quality level in products. Those activities can be summarized as preparing quality plans, planning all tests

equipment, preparing yearly quality plan, preparing quality handbook, quality costs reports, personnel planning and other planning activities for quality. Those all activities prepared by quality control supervisor and quality assurance department manager revise this framework and then if it is adequate, the manager approves it.

*4.1.1.2.*The Quality Circle

The quality circle cost consists of the expenditure for the quality circle groups. In the firm, there are two quality circle groups, each group has four members. These members try to find out inaccuracies in the firm and report these inaccuracies to the quality assurance manager. The quality circle cost contains the members' wages for spending time on the quality circle activities and other costs which occurred by the activities of these circle groups.

4.1.1.3. The Training of Quality

The firm gives their personnel periodically training programme for improving their various skills. These training programmes have a context of improving product quality, so these training costs sending to prevention costs as the training costs of quality.

4.1.1.4. The Inspection and Tests Instructions

The firm has instructions to make inspection and test for quality. These instructions started from purchasing row materials to reaching final products. The instructions have been prepared by quality control personnel and quality assurance department. These quality costs occurred from the personnel costs and quality assurance department costs for preparing instruction, and it is transferred to the prevention costs as the inspection and tests instructions costs.

4.1.1.5. Supplier Quality Planning

The firm provide its row materials from various suppliers. In addition, the firm purchases some products and semi-finished goods by the way of outsourcing. So, the company has some agreements about the outsourcing activities. In these agreements, company states its condition for products quality. By determination of these conditions, some costs are occurred. These costs should be transferred to prevention costs.

4.1.1.6. Preventive Maintenance

Machine and equipment has been maintained periodically, in order not to breakdown and produce poor quality products. This maintenance costs transferred to preventive costs. These costs are determined by related department maintenance employee.

4.1.1.7. Other Prevention Costs

These costs are occurred from other prevention activities which are not listed above. For instance, try to find out potential causes of non-conformance, and problem solving activities and so on. Because of these activities, the firm bear labour costs, reporting costs and measurement costs. Those all costs are elements of other prevention costs.

4.1.2. The Appraisal Costs

The appraisal costs are occurred from the activities of conforming to quality standards and specifications. It consists of calibration, audit, tests and inspection of products, semi-finished products. In the firm, the appraisal costs occur by the activities which are (1) Inspection and tests of purchased materials, (2) Control, maintenance and calibration of Measurement instruments, (3) Process inspection and tests, (4) Consumable materials for laboratory and tests, (5) Products inspection and tests, (6) Other appraisal costs.

4.1.2.1. Inspection and Tests of Purchased Materials

In the firm, first of all, the purchased materials have been checked for quantity control by warehouseman. And then, package, appearance, and conformity inspections are performed by quality control department. Those all activities have been made properly. The results of these inspections are reported and products are stigmatized as approval or rejection. According to this label the approval ones send to warehouse, rejection products returned to the suppliers.

4.1.2.2. Control, Maintenance and Calibration of Measurement Instruments

All measurement instruments should be adjusted according to national and international standards in order to check, whether or not, the products produce in conformity with pre-stated standards and specifications. The costs occurred by making these activities, are transferred to appraisal costs.

4.1.2.3. Process Inspection and Tests

The each phase of semi-finished products is checked for conformity with predetermined specifications. These activities performed by doing process inspection and tests. According to the result of inspection and tests, semi-finished products are determined whether they continue the production process or not.

4.1.2.4. Consumable Materials for Laboratory and Tests

By performing appraisal activities in the laboratory, some consumable materials are consumed or damaged. Besides, the tests are performed by laboratory assistant. The costs, which are occurred form the activities above and laboratory assistant salary, are added to appraisal costs as consumable materials for laboratory and test costs.

4.1.2.5. Products Inspection and Tests

As it is mentioned before the firm is a circuit breaker manufacturing company. The circuit breaker is very risky and essential device in every home, office, and factory and so on. It is most important safety device in wherever electricity has been used. So, in order to prevent adverse effect on people's safety of life and property, all products of the firm are tested. In other words, one hundred percent of the products are controlled one by one.

4.1.2.6. Other Appraisal Costs

These costs consist of all the activities which are not mentioned above. For example, in order to check quality system conformity with quality planning an audit job has been performed. So, the firm endures some costs which should be transferred to appraisal costs as other appraisal costs.

4.1.3. The Internal Failure Costs

These costs are occurred from the poor quality products which are detected before delivering the products to the consumers. These costs can be summarised as (1) Salvage, (2) Reproduction and Repairs, (3) Re-inspection, (4) Corrective actions.

4.1.3.1. Salvage Costs

These costs are occurred by Salvage and waste product costs. Salvage and waste product means the defective product cannot be repaired or reproduced, it should definitely be scrapped. These costs are calculated by the labour costs and loss of row materials. This calculation is made by quality assurance department with the help of accounting department.

4.1.3.2. Reproduction and Repairs Costs

It consists of row materials, labour and other production costs which the firm have to endure reproduction and repairs of the defective products in order to make the defective products convenient to deliver the consumers.

4.1.3.3. Re-inspection Costs

The reproduced and repaired products are inspected again. The goal of this inspection is to check whether these products conform to the specifications or not. Those re-inspection activities cause some costs. These costs are transferred to the internal failure costs as re-inspection costs.

4.1.3.4. Corrective Actions

According to the customers' compliant, the firm make some corrective activities for non-conformities before selling the products out. The customers' complaints are collected and reported. According to this report the firm makes corrective activities in order not to receive same complaints about the products. So these activities cause some costs and these costs are added to internal failure costs as corrective actions costs.

4.1.4. The External Failure Costs

These costs are raised after selling the product to the customers. These costs are endured after delivering the products to the consumers by failures, defects, and incompleteness of the sold products. The external failure costs arise from the actions that are (1) Products Returns (Returned Products), (2) Transportation Damage, (3) Warranty Costs

4.1.4.1. Products Returns

The products returns consist of the defects of the products which cannot repair in the related warranty period or displayed goods and tester products. In addition, the products which are call backed because of manufacturing defects are also added to this cost. All returned products costs have been calculated by marketing department and reported to quality assurance department. These all costs are sum up and transferred to the external failure costs.

4.1.4.2. Transportation Damage

The damage of products which takes place during the transportation of the customers is element of activities for this cost. The damaged products in transportation are transferred to reproduction or repair department, and repost these products to the customers. Those all reproduction, repair and repost or re-transportation costs are added to external failure costs as transportation damage costs.

4.1.4.3. Warranty Costs

Every cost made in guaranty period and under warranty activities are added to this cost. The company gives a 2 year warranty. After warranty period, the firm also gives repair services to its customers.

4.1. Reporting Quality Costs in the Firm

The firm concentrates on reporting activities for internal and external failure costs. In the firm, production assembly and circuit breaker tests department reports salvages and reproductions to the quality assurance department monthly. External failure costs are pursued by the quality assurance department.

4.2. Analysis of Quality Costs in the Firm

Under this topic, it will be tried to demonstrate the firm data about quality costs. According to this data some ratio analysis will be done. This analysis will be shown with the help of tables and some charts.

The figure below shows the company's sales and production amount in Turkish Liras (here after TL). The sales and production amount have been given for three years. In addition, the figure contents of total quality costs in the firm for three years.

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%

Table 12: Some Ratios and Ratio Components in the Firm

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 been also calculated. In the aspect of the information in the section two, 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 conclude 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 sales is about 1.95%. For the years of 2009 and 2010 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 word, the firm analyses it is quality costs not long ago, so the rates is in the acceptable amount. Besides this ratios can be reduced for more efficient quality costs system.

4.3. The Analysis of Quality Costs as Its Components

According to the data which gathering from the firm authorised persons, the quality costs will be given as the classification of quality costs components for 2010. According to this classification, quality costs component will be given as costs items for each one. With the

help of this costs items, the percentage amount of each costs item will be also calculated and given for the year.

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

Table 4: Total Quality Costs as Each Cost Items for the Components in the year of 2010

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 pays 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.

In the firm, the figures below are reported to the managers in order to monitoring quality costs activates by management. The importance of quality costs increases day by day.

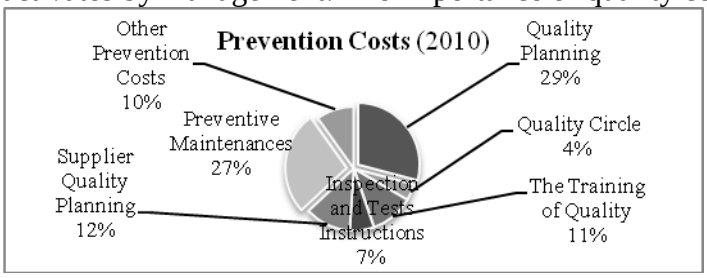


Chart 1: the pie chart of Prevention Costs items

The chart shows the percentage amount of costs items in prevention costs. The quality planning costs and preventive maintenance costs are about 56% of prevention costs. Quality circle in the firm has too small amount of prevention costs, because this group is voluntary group and the group is not working actively.

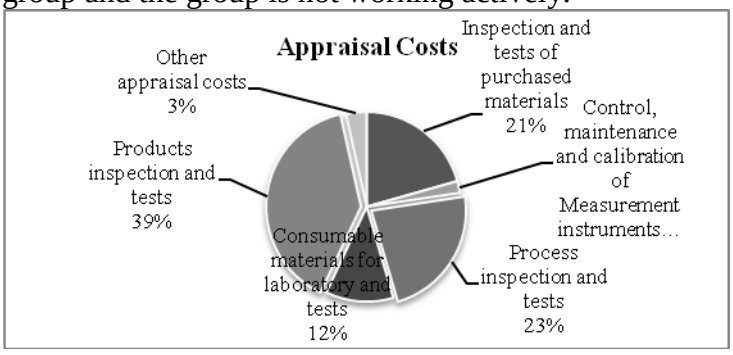


Chart 2: the pie chart of Appraisal Costs items

The chart 2 represents appraisal costs components' percentage. The production inspection and test has huge amount among these costs. In production inspection and test activities, the company performed control in it is finished products, because of the type of produced products. The finished products have been checked due to prevent consumers' safety of life and wealth.

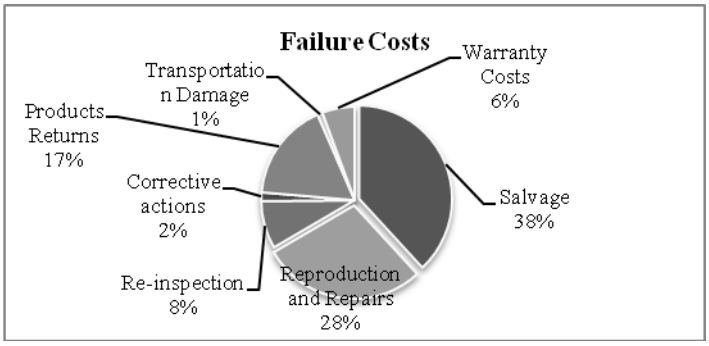


Chart 3: The pie chart of failure costs items

In the chart 3, the failure costs – internal and external failure costs – are drawn as percentage of all costs items in the failure costs. Salvage and reproduction costs have a portion of approximately 66% in the failure costs.

The next table is shown 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. In addition, 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 amount 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 confront defects after selling the products out. Besides, the amount of prevention costs in conformance costs is too small. The firm should be concentrate more on prevention costs.

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**

Table 5: the amount of quality costs in classification through the years

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. It should be 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 for each given years the amount of external failure costs going down.

The chart below monitors the percentage amount of the quality costs' categories for the years. The numbers are percentage of the each category for the year. Each colour in the chart represents the years of 2008, 2009, and 2010.

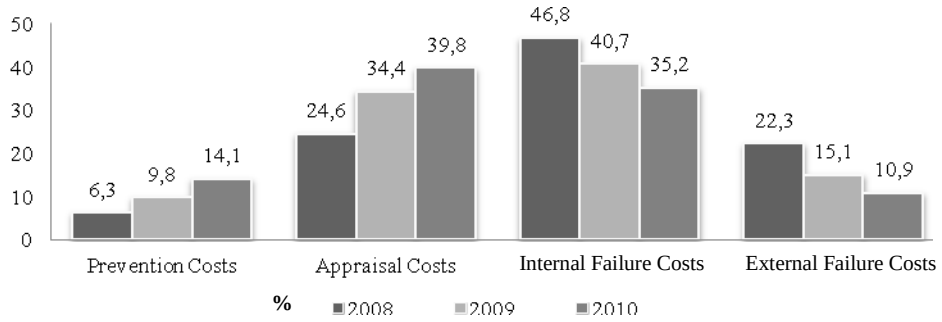


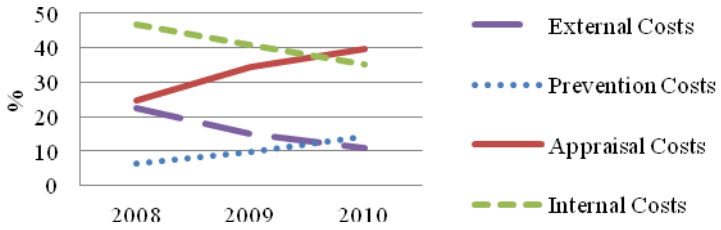
Chart 4: The Percentage Amount of The Quality Costs' Categories Through The Years

With the help of chart 4, 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

External Failure Costs

situation represents that the defects are realized after the stage of production. The chart 4 demonstrates the movements of the quality costs categorizations through the years.



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 be also 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 are bring more costs than the firm can measure.

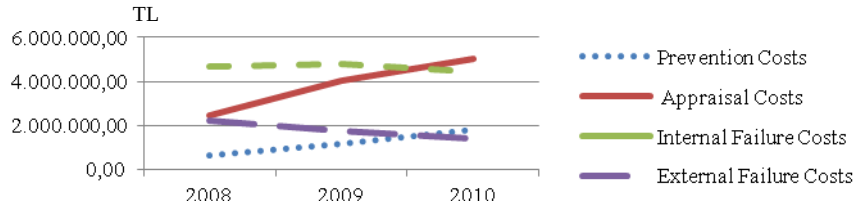


Chart 6: the Trends of Quality Costs' Categorization in TL

In the chart 6, it is again shown the trend of quality costs components. The chart 5 shows the trends as percentage value, the chart 6 shows this trends as Turkish Liras amounts. The inferences of the chart 6 are similar to the chart 5.

4.4. The Application Results and Proposals

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

Yearly reporting total quality costs is not efficient for making decisions on these costs. The measurement of prevention and appraisal costs is not making appropriately. The allocation key is generally labour costs which is 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 in order to make 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 journalese these costs according to this measurement.

5. CONCLUSION

The Total Quality Management improvements in the Turkey make the Turkish firms to recognize the importance of quality costs. In the industrialised country, the analysis of quality costs has been performed since 1960s. In our country, the quality costs analysis and reporting has gained importance for last decades. Actually, Turkish Firm are forced to analyse these costs, because of highly competitive market.

In the market, there are lots of Competitor Companies and many products of these companies. The quality of product becomes higher day by day. While increasing in quality, products are produced more cheaply. In that kind of market, if a firm want to stay alive, it has to increase its products' quality and decrease its total costs. In order to make it real, the firms need to analyse their quality costs.

Producing poor quality products have not only negative effects on the firms, but also have bad effects on the consumers and country economy. The world has limited natural resources, so every person in the world should use these resources carefully and should not be wasted these resources. In other words, the country economy would be badly affected by producing not qualified or poor qualified produce, because the poor quality products causes salvage, reproduction or repairmen of the products, so it means wasting workforce, energy and time in the economy. Thus, the natural recourses should be used effectively.

Previously, companies thought that quality control was just a waste of time. It badly affected on the productivity in production. But this thought has been changed in course of time. By effective quality control system, company can reduce the salvage, loss of labour hours and so on, which is decrease the productivity level.

On the other hand, by concentrating on conformance quality would cause performing the production control easily, which means decreasing evitable costs and producing products without defects. In addition, by reducing hitch in production process, the idle time in the production would be also reduced. This also causes increasing productivity. Producing high qualified product brings increase in sales, and the profitability would increase.

The goal of analysing quality by costs is recognizing quality and control activities' costs. After determination of costs for non-quality, the firms can compare the costs of quality with the costs of non-quality. Additionally, by determining costs of quality, the company can monitor the each quality activities and its costs. This causes to recognize the activities which bring non-qualified products.

Improving quality activities is intended to reduce the costs of failure. In other words, concentrating on prevention and appraisal activities brings low failure costs in the firms. By increasing conformance activities, the firms need to endure some costs. These costs are not more than non-conformance costs in the firm, because the non-conformance costs may most probably contains hidden costs. These hidden costs can be more harmful than visual or countable costs.

The current accounting system in Turkey is not suitable for quality costing and reporting. It is not designed for reporting quality costs separately in details. So, while establishing quality costs system in a firm, the companies should arrange their account plan in order to record quality costs properly and fully.

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 realise that the non-quality issues increase the evitable costs by too much.

The quality costs are separate concept from production costs. Some quality cost items consist of non-evitable costs in order to provide quality in produced products. Some quality costs are occurred by lack of quality and they can be reduced by effective quality costs system.

The computable costs for quality are less than non-computable costs. For example, to calculate the costs of the reputation loss which is occurred from non-qualified products is not easy. So these hidden costs should be also considered.

In the short run, investing in preventing activities can increase total quality costs, 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.

To summarise, after defining and classifying quality costs, it should be measured and reported to the management. These reports should be as costs items and functional entity of the organization. This way of reporting provide that in which department these costs come from and which cost items have the big portion of these costs and so on. These provide to take precaution about these costs and poor qualified products. The quality costs should be also reported as at least for three years in order to see trend of the quality costs. So the managers can compare the quality costs by yearly and departmentally. On the other hand, some ratios should be used for this analysis, for example ratio analysis. The firms can take the rate of total quality costs to sales or total production to see the ratio of total quality costs. And also these ratios can give more significance information to the managers.

There is a direct relationship between the quality costs and operating capacity. In the high production capacity, the quality costs realised in high amount, besides in the low production capacity the quality costs are occurred less. So, the differentiation on quality costs are occurred from the production capacity or investment amount in quality activities can be easily find out.

In the globalizing world, the firms should take into consideration of the quality of products. No company can survive in a highly competitive market with its low quality products. And the amounts of quality costs never excess the amount of poor quality costs.

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