

QUALITY COSTS AND THEIR IMPORTANCE IN COST AND MANAGEMENT ACCOUNTING

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Özet

Küresel rekabetteki artış, üretim ve hizmet sektöründeki işletmeleri kalite anlayışlarını gözden geçirmeye zorlamıştır. Müşteriler satın almak istedikleri ürün ve hizmetlerin kalitesi hakkında daha seçici olmaya başlamışlardır. Birçok hükümet ürün kalitesi ve müşteri memnuniyeti hakkında yasal düzenlemeler yapmışlardır. Bu nedenle işletmeler ürettikleri ürünler hakkında daha dikkatli olmaya başlamışlardır. Bu da işletmeleri toplam kalite yönetimi programları uygulamaya zorlamıştır. Ne yazık ki, kalitede artış daha önce işletmelerce düşünülmemiş bazı yeni maliyetleri gündeme getirmiştir. Bu çalışma maliyet ve yönetim muhasebesi açısından kalite maliyetlerinin önemini tartışmaktadır.

Anahtar kelimeler: Kalite maliyetleri, maliyet ve yönetim muhasebesi, kalite maliyet analizi.

Abstract

An increase in global competition has forced companies, both in service and manufacturing sectors, to revise their understanding of quality. Customers have become more selective about the quality of products and services that they want to purchase. Many governments established regulations regarding product quality and customer satisfaction. Therefore, companies have become more careful in the production of their products. This required companies to implement the total quality management programs. Nevertheless, increase in quality has brought out new costs that companies would not consider of previously. This study discusses the importance of quality costs from a cost and management accounting perspective.

Keywords: Quality costs, cost and management accounting, quality cost analysis.

Introduction

Today, competition is very intense. Therefore, companies must find ways to gain advantage over competitors in order to be able to survive in the highly competitive environment. Emerging conditions have reduced the usefulness of traditional cost and

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management accounting systems and have necessitated the use of modern systems. Activity-Based costing, JIT production system, and Quality Cost System are among these modern systems. As customers have focused their attention on the importance of quality, companies have started to emphasize the production of high quality products.

In order to improve quality of the goods and services and to eliminate the errors in the production system that lead to poor quality, companies have to know and keep track of quality costs. If companies analyze the quality costs successfully, they can increase quality level and minimize the costs of quality by balancing the quality cost elements and by eliminating the root causes of factors that lead to the production of inferior products. The purpose of this paper is to identify the importance of the costs of quality from cost and management accounting perspective. This paper will be composed of two main sections. In the first section, costs of quality will be explained. Then, importance of quality costs for cost and management accountants will be identified.

1. Meaning of Quality and Quality Costs

Companies should measure and report cost of maintaining high product quality in order to achieve desired quality at an optimum cost level. Before examining the kind of costs of achieving and maintaining high product quality, meaning of quality will be explained in the next sections.

1.1. Meaning of Quality

Quality is composed of the characteristics that express the ability of a good or service to meet specific requirements (Yükçü, 1994: 64). In other words, quality represents the ability of a good or service to satisfy customers' needs. There are two concepts of quality that determine a product's degree of excellence or the product's ultimate fitness for its intended use (Hilton, 2000:496; Horngren et.al., 2000:677). These two concepts are quality of design and conformance quality.

Quality of design refers to how closely the characteristic of a product or service meets the needs and wants of customers. If, for example, car customers want very fast cars and the cars they purchase cannot go fast, it means that these products fail in the quality of their design. On the other hand **conformance quality** refers to the performance of a product or service relative to its design and product specifications. For example, if the cars break down frequently and cannot be used, they fail to satisfy the conformance quality.

To ensure that actual performance achieve customer satisfaction, companies must first design products to satisfy customers through quality of design, and they must then meet design specifications through conformance quality. Products that do not conform specifications must be repaired, reworked, or scrapped at an additional cost. If non-conformance errors remain after the product is sold to customer, even greater costs such as lost reputation may emerge. In the following section, these costs will be explained in detail.

1.2. Quality Costs

Quality costs are associated with creation of quality, evaluation of conformance with quality, and consequences of failure to meet requirements both within the factory and in the hands of customers (Feighenbaum, 1991:110). In this paper, quality costs will be covered with respect to PAF (Prevention, Appraisal, Failure) model. Under PAF model, quality costs are categorized into four main categories as prevention, appraisal (measurement), internal failure and external failure (Giakatis, 2000:156).

Prevention cost is the cost of infrastructure for a quality control system; **appraisal costs** are the costs of checking whether product quality is in conformance with predetermined standards; **failure costs** emerge due to poor quality. The sum of the three families of costs is called ‘the cost of quality’ (Halevy, 2000:1095). In this case, quality costs are caused by prevention of nonconformance with quality, and checking whether the product is in accordance with the predetermined requirements. In addition to these, quality costs include costs associated with failure to meet predetermined requirements. That failure will cause extra costs both inside and the outside of the company, which are known as internal and external failure costs. On the other hand, quality management activities also cost money. This cost is measuring a firm’s effort to maintain and improve the quality level (Dahlgard and Kristensen, 1992:213). Quality costs are classified in detail as follows:

1.2.1. Cost of Prevention

Prevention costs are the costs associated with the activities conducted to prevent occurrence of poor quality (Hilton et.al., 2000: 451; Chandarshekar et.al., 1999:125). These are known as prevention activities that include cost of planning, implementing, and controlling the total quality control system (Weetman, 1999:759). Prevention activities are also composed of quality planning, marketing and customer analysis, design development for products, purchasing, quality—training and work force development, product—design verification, and system development and management activities. All of these activities aim at preventing producing poor quality products. If companies want zero defects in their products, they have to increase their preventive activities. That is why, prevention costs increase as the percentage of defects approaches zero (Warren, 1998:23). The more preventive activities are performed, the less the likelihood of producing products with poor quality. Prevention costs are classified and explained in detail as follows:

Cost of quality planning: Quality planning entails the process of planning the details of quality system. Quality planning activities includes planning production methods, procedures, and instructions that will be able to translate customer quality requirements into product specifications (Feighenbaum, 1991:116). Quality planning entails planning for instructions and procedures for test, inspection, and process control. Cost of quality planning includes all the costs related to the above activities. As all these planning activities are conducted in order to prevent the production of inferior products, costs of these activities are included in the prevention costs.

Cost of marketing research and customer analysis: In order to determine customers' requirements, companies conduct market research. They try to determine customer's needs in order to produce the products that will meet these needs. When the needs of customers are satisfied, it means that the desired quality has been achieved. As marketing research is conducted to prevent the production of products having poor quality, it is accepted as a preventive activity. Therefore, time—related costs and other costs pertaining to these activities are included in the prevention costs.

Cost of developing design for products: Before starting the actual production cost of developing sample products for testing purposes is regarded as of these kinds. This activity of developing sample products aims at preventing the production of products with poor quality. Therefore, these costs are regarded as prevention costs.

Purchasing costs: In order to ensure the purchase of proper raw materials or components, companies evaluate several suppliers. This activity is performed in order to prevent the company from purchasing inappropriate raw materials. Therefore, all costs related to the evaluation of the suppliers are included in the prevention costs.

Cost of quality training and personnel development: In order to overcome errors and failures, the personnel of the company is trained. Quality training programs take time and cause some costs. As these programs are conducted to prevent occurrence of poor quality in the production, costs associated to them are regarded as the prevention costs.

Cost of system development and management: Activities related to managing quality control processes are performed to ensure that the high quality products are offered to the customers. In this case, spending on such things as salaries of managers that are also regarded as the prevention costs causes some costs for the company.

1.2.2. Measurement Costs

Measurement costs are associated with activities for testing and inspecting the products to ensure that they are in conformance with predetermined quality standards (Giakatis, 2000:157). The more tests and inspections performed the higher the measurement costs. Measurement costs may be listed and explained as follows:

Cost of testing and inspecting raw materials: These costs are associated with testing and inspecting purchased raw materials to make sure that these materials are in accordance with the predetermined quality requirements. Such costs as cost of time inspectors or testers are spent to constitute testing and inspecting costs. Also, traveling costs to vendors' plants to evaluate raw materials should be included in these costs.

Cost of laboratory—acceptance tests: These costs are related to tests provided by the laboratory personnel to evaluate the quality of purchased raw materials. These entail

cost of time that personnel spend, cost of materials used to test the raw materials, and depreciation and other costs associated with the equipment used in testing and inspecting materials.

Inspection costs: These represent the costs related to inspecting the products in the plant, such as wages of clerical and supervisory personnel. Also cost of time spent by the personnel to test the products can be given as an example to these costs. However, these costs exclude the cost of inspecting raw materials that were explained above.

Testing costs: These entail the costs that are associated with evaluating technical performance of products. Cost of materials used to test the performance of the products may be given as example to testing costs. Other costs related to the supervision and clerical personnel engaged in testing are also included in testing costs.

Cost of setup for test and inspection: These costs are associated with setting up the products and equipments for testing purposes. In other words, equipments should be prepared for testing the products and costs related to these processes are included in measurement costs. Time—related costs, material costs, and others related to the setting up equipments are included in these costs.

Other costs: Cost of power such as electricity or oil that are used to run testing/inspecting equipments is included in the measurement costs as well. In addition, cost of supplies used and depreciation, lubrication and maintenance associated with testing equipments can also be included in the measurement costs.

If a company does not spend enough time and money on preventive activities, possibility of nonconformance for quality increases. As this increases, measurement activities will be intensified. In this case, the measurement of quality is the price of nonconformance with quality, because managers should focus more on the measurement activities, as the possibility to produce products with poor quality is high.

1.2.3. Cost of Internal Failure

These costs are associated with activities conducted to deal with the products that are not in consistent with quality requirements. Inferior products cause extra consumption of resources. Extra use of time, supplies, materials and other resources will create extra costs unnecessarily. For example, defective products may be reworked or they may be repaired. Internal failure costs can be examined in detail as follows:

Rework costs: These costs are related to activities taken over to obtain the required level of quality. Extra materials, labor and other resources consumed in repairing the defective products represent rework costs. Rework costs represent the costs associated with replacing and fixing defective products before the delivery to a customer (Warren, 1998:24).

Material-procurement costs: These costs are incurred because of handling both rejects and complaints on purchased materials. They may include getting disposition from vendors (Feighenbaum, 1991:118).

Cost of engineering: These costs are associated with time that engineers spend for production problems related to quality. When products are proved to be of poor quality, production process should be reviewed so that cause of poor-quality can be identified. In this case, production process may need to be engineered again to create the environment in which production of inferior products is no longer produced. Since engineering activities are performed to correct quality-related problems, costs related to these activities are internal failure costs.

Cost of wasted time: Time which employees spend for correcting all of the quality problems will cause extra costs for the company unnecessarily. These cost are caused by the use of time unnecessarily, that is why they are the cost of wasted resources.

1.2.4. Cost of External Failure

These costs are related to dissatisfaction of customers due to nonconformities or defects after product is sold (Giakatis et.al., 2001:179; Clikeman, Paul M., 1999: 34). In other words, external failure costs are incurred if product does not satisfy customers' needs. External failure costs increase as the number of defective units delivered to a customer increases. External failure costs can be classified as follows:

Cost of complaints in warranty: When inferior products are sold to customers, company will compensate them if products include warranty. Cost of complaint in warranty is associated with investigation, repair, and replacement with regard to complaints within warranty. These costs are associated with resources consumed in investigating and finding solution to customers' complaints. Cost of insurance can be listed under these costs. Also, costs that are spent during the corrections of imperfections are related to warranty.

Product liability costs: These costs are incurred as a result of liability judgments resulting from quality failures. Customers may sue the company if products they purchase are of poor quality. If customers win the case, company may be forced to compensate these customers for the damages or losses causes by these inferior products.

Product recall: These costs are incurred as a result of recall of products from the market. When poor quality products are collected from the market, the result is wasted resources used for selling these products. When inferior products are collected from the market, extra resources will be expended to correct them. Therefore, company will incur extra costs.

Lost sales and reputation: Offering products with poor quality will discourage customers from buying that company's products. Therefore, the company's future sales

will probably decline because of poor reputation caused as a result of this. Not only does the company lose sales for the inferior products, it is also likely lose sales for other product lines. These costs are hidden costs because it is very difficult to estimate them (Weetman, 1999:497).

2. Management Accounting and Quality Costs

Information about costs of quality should be reported to managers regularly to help them make decisions (Pakdemir, 1993:27). If quality costs are grouped and reported to managers in a regular way, managers can make timely and effective decisions. Cost accountants should make these costs available in the accounting records as well as in reports. Much of the information regarding quality costs may be available from the existing accounting records. Information about quality costs can be obtained from time sheets, expense reports, purchase orders, rework reports and from many other sources. For example, by looking at the time sheets, management accountants can see how much time workers spend on rework activities. In addition, investigation of expense reports can provide managers with information about measurement or inspection costs. If any data are not available from the existing reports, estimates can be made to arrive at the required information. For example, it is very difficult to quantify lost sales that result from external failure. In this case, past data and other related information could be used to make estimates.

Measurement, analysis, and reporting of cost of quality items provide managers with information about how quality system works. This process also helps managers to evaluate the success in achieving quality goals. Thus, information about the quality costs can serve as a measurement tool. Breaking down quality costs into segments makes it possible to obtain monetary measurement on each quality activity. For example, money invested in preventive quality planning can be measured with respect to reduced failure costs which should result from quality planning, and reduced appraisal costs which should result from effective inspection methods. That is, reporting of quality costs can show whether goals determined in budgets have been achieved or not.

Furthermore, information about costs of quality can be used as a budgeting tool. For example, if managers want to attain long—range high product reliability, they have to invest in areas such as quality planning and quality engineering. Knowledge about quality costs can help managers to budget costs for these activities.

2.1. Allocating Quality Costs to Products

As explained above, quality costs should be included in the accounting records. In addition, they should be reported to managers to help them make decisions. Cost of quality can be organized in accounting records according to basic cost of quality categories such as the prevention, appraisal, internal failure, and external failure costs. When costs of quality are regularly recorded, they can be summarized and allocated to appropriate cost pools.

In this case, quality costs related to marketing and selling should be allocated to marketing expenses. Besides, quality costs related to administration should be

allocated to administrative expenses. For example, cost of marketing research that is included in prevention costs should be transferred to marketing and selling expenses because marketing research is related to marketing.

On the other hand, quality costs related directly with production should be allocated to production costs. Costs that can directly be traced to specific product lines should be assigned to them. For example, cost of direct materials consumed to rework certain products can be assigned to their product lines directly. However, quality costs that cannot be traced to specific products should be included in manufacturing overhead costs. In turn, costs of quality gathered in manufacturing overhead costs should be allocated to products by using appropriate cost drivers. For example, inspection and testing activities are performed to test the raw- materials and finished products. Inspection activity is included in measurement activities. Therefore, inspection activity results in measurement (appraisal) costs and occurs in the manufacturing function. Furthermore, inspection and testing activities are performed for all products rather than for specific products. Therefore, cost of inspection and testing should be allocated to all products by using appropriate cost drivers.

First, all related costs such as materials used to test the products, depreciation of equipment used for testing purposes, and cost of energy consumed should be gathered in inspection-cost pool. Then, the total cost of inspection and testing activities should be allocated to product by using proper cost driver. For example, number of inspection-hours can be used to allocate inspection and testing costs to products because inspection-hours has a good cause-and effect relationships with the inspection costs. In this case, different products should receive portion of inspection and testing costs in direct proportion with regard to the consumption of inspection-hours.

The following figure is assumed to show the total inspection costs for the period. This information can be obtained from the accounting records. In addition, cost of materials, depreciation, and wages of employees who perform testing and inspection activities are assumed to constitute the total inspection and testing costs.

<i>Materials used for testing</i>	<i>\$ 2,000</i>
<i>Depreciation cost of testing equipment</i>	<i>3,000</i>
<i>Wages of employees</i>	<i><u>1,000</u></i>
The total inspection and testing costs	\$ 6,000

If the total inspection time to be expended is assumed to be 1,000 hours, cost per hour can be calculated as follows:

$$\begin{aligned} &\text{The total inspection and testing costs} \div \text{The total inspection-hours} = \\ &\quad \text{Inspection cost per hour} \\ &\quad \text{\$6,000} \div \text{1,000 hours} = \text{\$6 per hour} \end{aligned}$$

After calculating inspection cost per hour, proportion of inspection costs that should be allocated to specific products can be calculated by multiplying cost per hour (\$6) by the total inspection-hours consumed by each product.

The above example is just for testing and inspection costs. The same calculation can be performed for other costs in each of the quality cost categories such as prevention.

2.2. The total Quality Control

After analyzing cost of quality in detail, managers may compare different quality cost segments and determine relationships among them. Furthermore, by classifying quality costs, managers can see proportion of each cost of quality item in the total and make effective decisions. For example, after analyzing different cost segments, managers may determine that as preventive activities are intensified, more reductions are achieved in failure costs. Based on these findings, managers may decide to invest in preventive activities and reduce internal failure costs. In this case, making some more investment in preventive activities companies can achieve significant reductions in failure costs.

This is sometimes known as quality cost improvement program. The aim of this program is to shift the costs from the failure category to prevention (Keogh et.al., 1998:142). Quality costs theory states that investment in preventive and measurement activities will reduce the internal failure and external failure costs over a period (Kamlesh and Purnendu, 1999: 1093; Shah et.al., 1998: 484). Therefore, managers can make decisions to affect the costs in segments in order to minimize the level of the total quality costs.

However, managers should be very cautious when drawing conclusions about the distribution of quality costs because every industry has its own scheme. For example, according to a study (Can and Erdal, 2000:229) conducted in the Turkish aeronautical sector, prevention costs constitute majority part of the total quality costs. This is the case for aeronautical industry because in that industry preventive activities must be extremely intense to prevent external failure since the effect of external failure could be fatal (Can and Erdal, 2000:229). In other industries, however, proportion of quality cost items may vary.

The managers must be cautious because as the program progresses and most cases of failure costs are brought under control; but further prevention effort may not pay off. For this reason, if resources spent in preventive activities are more than needed, the total quality cost will increase unnecessarily. Thus, a balance is required between money spent in preventive efforts and money saved as a result of reducing failure costs. As a result, managers should balance all of the activities and find out optimum quality-cost level if quality-costs are reported to managers in a regular way.

2.3. Analysis of Quality Costs

By analyzing quality costs the managers receive some useful information to make important decisions. For example, determining the proportion of quality costs in the total costs leads managers to take some corrective actions if they constitute majority part of the total. In addition, determining proportion of each quality cost item in the total quality costs will provide managers with the opportunity to bring the total quality costs

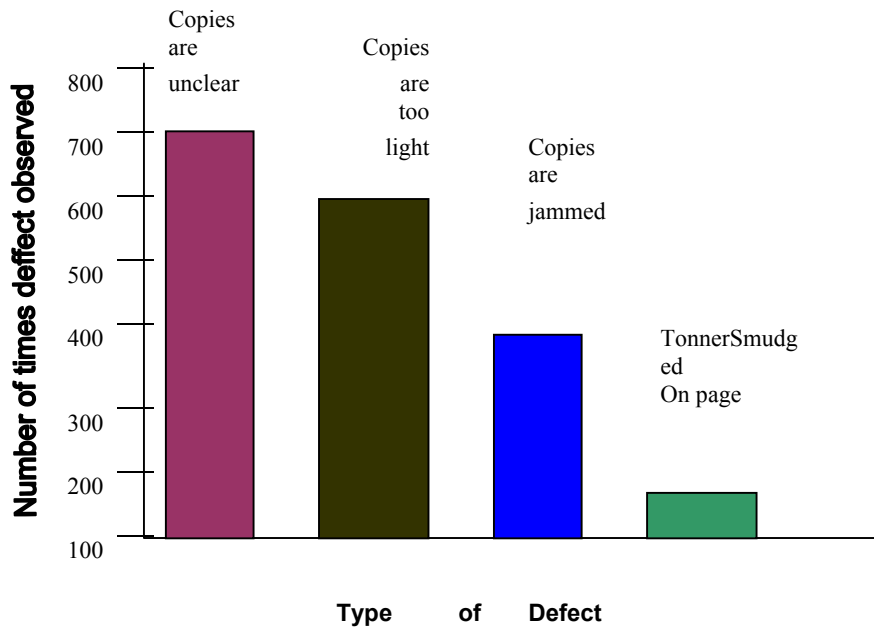
to the optimum level. As explained in the previous section, this can be achieved by finding the optimum proportion for each quality cost item. Furthermore, analyzing the root causes of quality costs enables managers to minimize the total quality costs. In other words, analysis of quality costs provides managers with the opportunity to maximize the quality level at an optimum cost level. The following methods may be used in analyzing quality costs:

Ratio analysis: A ratio of quality costs to sales or total production costs helps managers to make important decisions. These ratios can be compared to the ratios of other companies operating in the same industry. In addition, these ratios can be compared with the ratios of previous periods. For example, if the proportion of the total quality costs to the total production costs is much higher in current period than they were in the previous periods, the underlying reasons can be determined and corrective action can be taken.

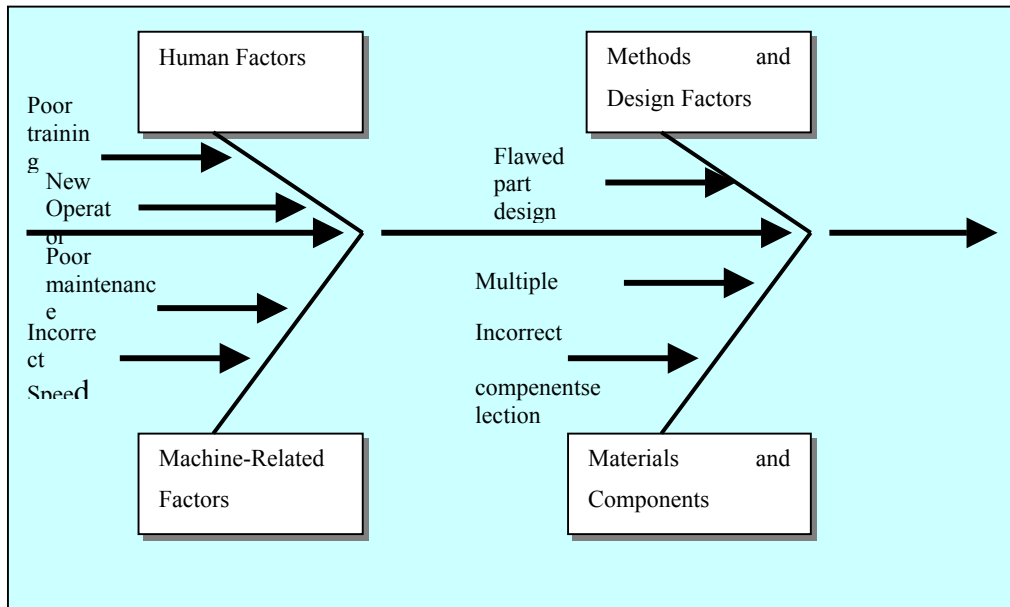
Trend analysis: Trend analysis provides the managers with an opportunity to compare current period's quality costs with previous periods' costs. This analysis can be done either for each quality cost item or department so that negative trends can be determined and corrective action can be taken. In this case, trends in quality costs can be determined and problem areas can be identified.

Pareto analysis: The basic causes of the factors that lead to the production of inferior products can be determined with the help of Pareto analysis. In other words, factors that lead to increase in quality costs are figured out so that corrective action can be taken to eliminate the root causes, and in turn, reduce the amount of quality costs. In this case, factors that constitute the majority part of quality costs are eliminated. Pareto analysis can be conducted on the basis of product lines and segments. Pareto diagrams indicate how frequently each type of failure occurs.

The following Pareto diagram shows types of quality problems with respect to photocopying machines. As seen in the diagram, unclear copies are most frequently occurring problem. With the help of Pareto diagrams, managers can see the most frequently occurring problems. Therefore, managers can focus on eliminating these problems and reduce the amount of total quality costs. In order to eliminate the root causes of most frequently occurred problems, cause and effect diagrams can be used.



Cause- and- Effect Diagrams: The most frequently recurring problems identified by the Pareto diagrams are analyzed using cause-and-effect diagrams. A cause-and-effect diagram identifies potential causes of the problems. Thus, managers can see the root causes of frequently recurring problems and can take corrective actions to eliminate them. The following cause-and-effect diagram shows the root causes of unclear copies that occur most frequently. In the diagram below, the basic causes of potential failures are classified as human factors, method and design factors, machine-related factors, and materials and components factors. The arrows are added in order to show main causes with respect to each factor. For example, poor training is one of the root causes of unclear copies with respect to the human factors. In this case, managers can focus on providing machines operators with better training to eliminate this problem. As a result, all of the root causes with respect to each factor can be determined and eliminated with the help of cause-and effect-diagrams.



Summary

To be competitive in today's business world, companies must successfully manage their quality programs in order to provide customers with high-quality products. If the companies learn how to offer products that can satisfy customers' needs, they are able to survive in highly competitive environments. When the companies try to increase the level of quality, they have to take the costs into account to do so. On the other hand, if a company cannot learn how to offer high-quality products, internal and external failure costs will emerge. Costs that will be caused by quality control that aims to achieve high quality, and the costs that result from poor-quality should be followed and controlled in order to optimize the total quality costs in achieving desired quality level. Therefore, information about quality costs should be included in accounting records, and that information should be reported to managers within specific intervals. If managers can receive information about quality costs regularly, they will be able manage them. As a result, the company, the customers and the country in general will benefit.

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