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Quality Costs And Application In A Manufacturing Enterprise

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Abstract

The concept of quality cost emerged as a result of both product development and process improvement studies, following the products produced not meeting customer expectations. Measuring and calculating quality costs is one of the important and necessary stages of the Total Quality Management program. Enhancing quality is seen as the fastest way to improve customer loyalty, decrease manufacturing costs and increase productivity. While preparing initiatives to enhance the quality, the associated costs should be taken into account. Since consumer demands need to be fulfilled at the lowest cost possible. Seeing the cost-benefit factor, as competitiveness, expense preparation should be made to improve efficiency. In this study data were gathered from a vehicle spare parts supplier. The data collected from this firm's accounting departments and other divisions were used to analyze PAF and the Quality Ratio Analysis model, quality costs, system review, calculation of production prices, and monitoring method. As a result, the company's management program has been calculated not to be effective in calculating the company's production costs according to the output assessments attributable to worker and machine costs. In this study it is concluded that the measurement and analysis of the company's quality costs should be given greater importance.

Keywords: *Quality, Quality Costs, Quality Cost Models*
Jel Kodu: *M40,M41, M49*

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Kalite Maliyetleri ve Bir Üretim İşletmesinde Uygulaması

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Öz

Kalite maliyeti kavramı, üretilen ürünlerin, müşteri beklentilerini karşılamamasını takiben hem ürün geliştirme hem de süreç iyileştirme çalışmalarının sonucu olarak doğmuştur. Kalite maliyetlerinin ölçülüp hesaplanması Toplam Kalite Yönetimi programının önemli ve gerekli aşamalarından biridir. Kalitenin iyileştirilmesi, müşteri memnuniyetini artırmanın, üretim maliyetlerini azaltmanın ve üretkenliği artırmanın en iyi yolu olarak kabul edilir. Kaliteyi artırmaya yönelik faaliyetler planlanırken ilgili maliyetleri de dikkate almalıdır. Çünkü müşteri gereksinimlerinin karşılanması, mümkün olan en düşük maliyetle yapılmalıdır. Kaliteyi elde etmek için gereken maliyet planlaması, rekabet göz önüne alındığında fayda maliyet ölçüsünü düşünerek yapılmalıdır. Bu çalışmada veriler otomotiv yedek parçası imal eden bir firmadan toplanmıştır. Bu firmanın muhasebe ve diğer bölümünden toplanan veriler PAF ve Kalite Oran Analizi modeli, kalite maliyetleri ölçüm ve raporlama sisteminin incelenmesinde kullanılmıştır. Sonuç olarak, firmanın kalite maliyetlerinin ölçülmesinde işçi ve makine maliyetlerinden dolayı kalite raporlarına göre şirketin kalite sisteminin verimli olmadığı tespit edilmiştir. Bu çalışmada şirketin kalite maliyetlerinin ölçülmesi ve analizine daha çok önem verilmesi gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: *Kalite, Kalite Maliyetleri, Kalite Maliyet Modelleri*
Jel Kodu: *M40,M41, M49*

Introduction

In the globalizing world, the survival and competition of businesses depends on quality goods and customer satisfaction. Quality is what makes it one step ahead of other businesses in customer satisfaction and business loyalty. Various definitions of quality have been made. Quality is the aggregate of a service / product's characteristics dependent on its ability to satisfy defined specifications. Quality; to meet the specifications, standards, suitability for use and customer requirements and expectations at a competitive cost. Quality cost is the cost that arises due to the measures taken to prevent poor quality (Öztürk, 2009, p.421). Significant studies that form the basis for quality costs were made by Kaoru Ishikawa in 1976, Philip B. Crosby in 1979, William Edwards Deming in 1986, Joseph Juran in 1988 and Armand Vallin Feigenbaum in 1991 (Çabuk, 2005, p.1). Quality cost has emerged as product development and process improvement studies in case the manufactured products do not meet customer expectations. Quality is a performance criterion used for both customers and businesses. Because quality has a cost to businesses. Businesses have to incur these costs in order to maintain their existing customers and gain new customers in order to maintain their existence or increase their sales (Alıcı, 2007, p.1).

Quality Costs And Classification

The definition itself is not straightforward provided that there is no universal consensus on a single defined concept of service costs. However, according to (Dale and Plunkett, Quality Costing, 1995), quality costs are required to design, implement, operate and maintain quality control framework, investment costs dedicated to performance development, method, product and process deficiencies, and product or service efficiency. It is the sum of all the services and non-value adding operations that are required. Evaluating and revealing these costs is seen as a key problem for all management looking to achieve strategic leverage in today's markets. Typical dictionary meaning of quality means "degree of perfection;" quality is a subjective measure of goodness in this context. Cost is the sacrifice made to achieve the goal of quality products (Üstün, 1994, p.31). Quality costs are an indicator of quality. In order for total quality management to be implemented continuously, the pursuit of

quality must be measured and recorded. It is known that the criterion expressing the improvement in quality is price of quality. In order to present the quality targets of the companies, the monetary amount and amount of quality costs should be determined.

As consumers prefer quality products, manufacturers have tried to provide it. Businesses want to control their costs while trying to improve quality. Businesses allocate a significant share from their budgets while trying to reach their quality goals. The entire budget allocated is called quality cost (Öztürk, 2009, p.421), (https://tr.wikipedia.org/ wiki/Kalite_maliyetleri, 2019). Quality costs are expressed as preventing the production of defective products or services and the losses caused by the defects (Woolf et al., 1988, p.165 and Ulu, 2017, p.12). Quality Costs are expressed as preventing the production of defective products or services and the losses caused by the defects (Woolf et al., 1988, p.165 and Ulu, 2017, p.12). Control activities consist of avoidance and measurement practices. Control costs are the consequence of monitoring operations. Failure operations are carried out by a company or its clients in response to low results. If the reaction to low quality happens before a bad (unsuitable, faulty, defective, etc.) product is provided to the consumer, the actions are categorized as internal failure actions; otherwise, they are classified as external failure activities. Definitions of failure practices and failure costs mean that a customer's reaction to bad service will be expensive to a company. The concepts of quality dependent operations often apply to four types of quality costs: (1) prevention costs, (2) evaluation costs, (3) internal failure costs, and (4) external failure costs. (External risk of failure) (Schecter, 1992).

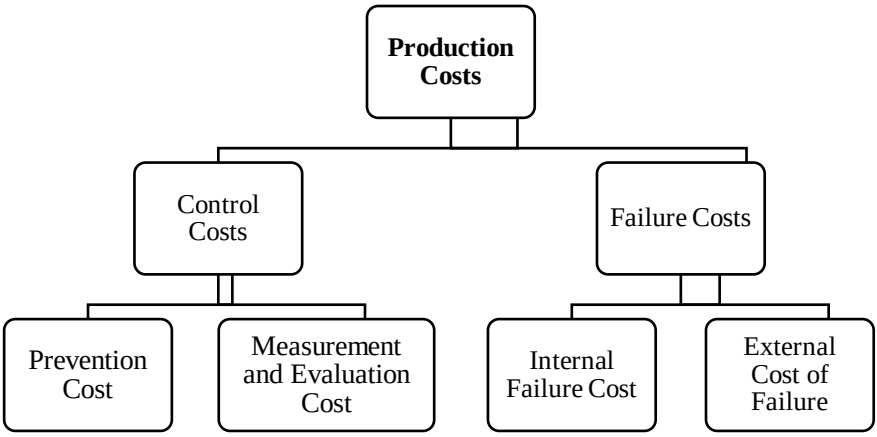

Figure 1. Distribution of Quality Costs

Prevention Costs

Preventive costs are the expenses paid to avoid low quality of products before and after the manufacturing process (Tekin, 2004, p.37). Quality engineering, quality training of workers, quality maintenance of tools, quality planning, quality reporting, evaluation of suppliers, quality control, design reviews are included in the prevention costs (Feigenbaum, 1956, p.93). It is accrued in order to avoid low quality of the manufactured goods or services. If the costs of avoidance rise, the costs of loss are projected to decline (Kefe, 2013, p.31).

Evaluation Costs

It is the cost of controlling whether the product produced conforms to the criteria determined during the design phase (Aydemir and Gürsoy, 2003, p.589). It is done to determine whether products and services are in line with customer expectations. Examples comprise inspection and checking, package inspection, appraisal operation inspection, product acceptance, process acceptance, device evaluation (inspection and examination), and regulatory approvals. Acceptance of the product involves screening from finished product lots to determine whether they reach an appropriate standard of quality; if so, the products are approved. Acceptance of the procedure, inspection of the products in the procedure to see whether the process is under control and

if non-defective goods are produced; if not, stoppage of service before corrective action is taken. The key aim of the valuation feature is to avoid the shipping of incompatible goods to clients.

Internal Failure Costs

Items and services exist because they don't meet consumer expectations or standards. So the internal cost of loss is the cost of converting the faulty product into a successful one. In general, the costs of faulty and faulty goods and the costs sustained as a result of the repair efforts are internal costs of failure (Pekdemir, 1993, p.26). These are the faults found in the measurement operations. Cost of internal failure are costs arising from waste material, defective product, remeasurement, rework and redesign (Yükçü, 1998, p.487).

External Failure Costs

It occurs when goods and services do not fulfill the specifications or fail to satisfy consumer requirements after distribution to customers. This category can be the most destructive of all the service costs. Recall charges, for example, will affect a wide number of clients. Other examples include loss of sales due to poor product performance and returns and allowances due to poor quality, warranties, repairs, customer dissatisfaction, lost market share and complaint. If there is no defect, external breakdown costs are eliminated as well as internal breakdown costs (Berry & Parasurman, 1991, p.16).

Quality costs and control are of great importance. However, it is observed that many businesses still do not give the necessary importance. In a study, various reasons for not following the quality costs of enterprises are given below (Sower & Quarles, 2003, p.625):

- Unwillingness and indifference of top management on this issue
- Insufficient budget to monitor these cost items
- How should the quality costs be monitored and how managers not having enough information about
- Lack of competence in accounting information systems
- Some managers do not believe in the benefits of monitoring quality costs for businesses and focus on other issues.

Table 1. Quality Cost Elements

QUALITY COST ELEMENTS	
PREVENTION COSTS	**VALUATION COSTS**
• Quality planning	• Pre-Production verification
• Quality engineering	• Pickup inspection
• Quality measurements and design and development of test tools	• Quality control costs incurred during production
• Quality inspection and verification of design quality	• Quality control costs of finished products
• Measurement of quality and adjustment and maintenance of test tools	• On-the-job inspection
	• Laboratory examination
• Adjustments and maintenance of production tools used for quality assessment	• Acceptance of Laboratory test
	• Test equipment and Inspection
• Statistical process control	• Materials used during inspection and examination phase
• Cost accounting for production variances	
• Supplier selection	• Analysis and reporting activities of the results of the inspection and tests
Supplier warranty	
• Quality training	• Field achievement test
• Quality inspection	• Permissions and approvals
• Analysis of the latest situation and reporting of quality results	• Stock valuation
	• Maintenance of production equipment
• Quality improvement projects	• Quality inspections
• Other checks to prevent errors	• Record keeping
INTERNAL FAILURE COSTS	**EXTERNAL FAİLURE COSTS**
Residues (waste, sawdust, scrap)	Complaints
Re-inspection of reprocessed products	Transactions made under warranty
Failures due to material defects	Products that are not accepted but returned
Failure analysis	Compromise
Reconstructed production and repair operations	Sale loss
Troubleshooting and failure evaluations	Costs of contacting the customer
Deciding for inspection and tests	Product liability
Contractor's fault	Product warranty cases
Exchange Permissions and privileges	Returning repaired products
Loss of earnings due to quality non-compliance	Product services
Time losses	Commitment expenses
Cost of fixing defective products	Penalties and damages
Cost of scrapped products	Lost sales
Cost of production disruptions due to errors in production	Loss of prestige
Cost of losses caused by work accidents	

(Tanis, 2005, p.122) and (Yükçü, 1999, p.95) Quality costs in production processes are shown as follows (Yıldıztekin, 2005:401);

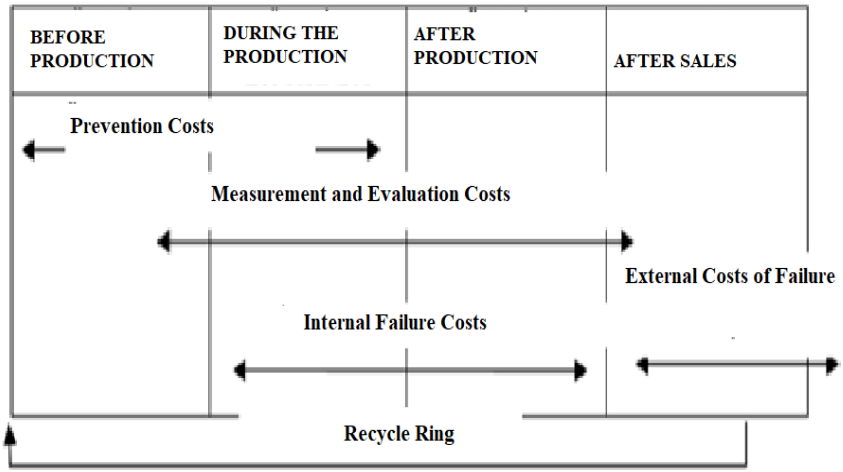

Figure 2. Quality Costs Time Phases

The stages of production that the costs expressed as prevention, valuation and failure may occur are shown in Table 2 (Topal, 2000, p.206);

Table 2. Examples of Quality Costs

BY PROCESS	EXAMPLES OF QUALITY COSTS		
	PREVENTION	ASSESSMENT	FAILURE
DESIGN	Design Evaluation	Design Verification Redesign	Redesign
PURCHASE	Supplier Assessment	Input Inspection and Control	Supplier or Product Rejection
PRODUCTION PLANNING	Evaluation of Competence in Production	Calibration of Tools	Reevaluation of Vehicles
MANUFACTURING	Personnel Training	Process Inspection and Experiment	Scrap emergence and Reprocessing
SALES	Determination of customer demands precisely	Surveys and Market Share Research	Customer Complaints, penalties and compensation

Topal (2000, p.206)

Approaches For Quality Cost Measurement

As Juran (1951) addressed quality costs, several researchers suggested different approaches to the measurement of quality costs. Reviews of the quality cost in Plunkett and Dale (1987) and Porter and Rayner (1992) literature can be found. In this section, quality cost measurement approaches will be briefly reviewed.

Table 3. General Quality Cost Models and Cost Categories

General Model	Activity Cost Classification
PAF Model	Prevention + evaluation + failure
Crosby Model	Prevention + evaluation + failure- opportunity
Opportunity or intangible cost models	Compliance + non-conformity Availability + non-compliance + opportunity Compliance + non-conformity Compliance + non-compliance + opportunity Dispute + intangible assets P-A-F (failure cost includes opportunity cost)
Scale of Process Cost	Compliance + non-conformity
Cost-Based Costing Model	Adding Value + Non-Value Adding

Schiffauerova, Thomson (2006, p.647)

PAF Model

Many cost variants are categorized according to the PAF standard. Juran (1951) first addressed the study of product costs and became a pioneer in quality costs (Türk, 2009, p.32). Following the categorization of product costs as prevention-evaluation deficiency (PAF) by Feigenbaum (1956), the PAF method for product costing was implemented almost universally. Failure costs in this package can be divided into two sub-categories: These are internal failure and external failure costs. Oakland sets down these expenses as follows (Oakland, 1993, p.186):

- *Prevention costs:* This costs are related to planning, executing, and managing the overall quality control system. Prevention expenses are anticipated and incurred in advance of operational service.
- *Valuation costs:* This expenses are attributable to the retailer and the customer's appraisal of imported goods, procedures, intermediary products, products and services to ensure that precise specifications are fulfilled.
- *Internal Failure Costs:* This costs occur where the research findings do not follow the intended quality requirements, which are identified before the consumer takes place.
- While the TQM categorization plan Does not consider operation costs, process development is a core priority of TQM. Therefore the PAF paradigm in a TQM software has limited utility.

Alternatives to the PAF

Alternative solutions to the PAF classification system include the division of service costs into conformity and non-compliance, visible and intangible, controllable and uncontrollable, voluntary and irreversible costs.

Crosby splits the quality cost into two groups (Crosby, 1984, p.86):

(1) The conformance price (POC), despite the apparent quality-related costs of ensuring for the first time items are handled correctly; and

(2) The non-conformance price (PNOC) which covers all costs incurred for the first time the standard is not right. The POC at Crosby covers costs of detection and monitoring, while the PNOC covers internal loss and external costs of loss (Shank & Govindarajan, 1994, p.6).

At Xerox, quality costs split into three categories : (1) enforcement costs (prevention and assessment); (2) non-compliance costs (incapacity to meet consumer expectations before and after delivery); and (3) missed potential costs (Carr, 1992, p.72).

Juran's categorization program reflects on the expense of commodity breakdowns and highlights the value of intangible cost factors that are more critical in the long term than cost reduction.

Another solution suggested by Dale and Plunkett is to manage retailer, business (in-house) and consumer specific operations in the group PAF. While this approach retains the advantages of PAF categorization, it also has new categories closely related to business activities (Dale and Plunkett, Quality Costing, 1991, p.26).

Methods To Reduce Quality Costs

The main purpose in reducing quality costs; it is the minimization of total quality costs while maintaining the level of quality. For this purpose, increases in prevention costs result in a much greater reduction in failure costs. In this way, the total quality costs are expected to decrease. If there is no reduction in failure costs despite the increase in prevention costs, prevention costs have come to a saturation point. After this stage, prevention costs will exceed the savings to be made (Mazman, 2016, p.69).

Service costs in most organisations will typically vary from "10 to 30 percent of revenue" or "25 to 40 percent of operational expenses" . Some of these effects are clear, some are concealed (Oberlender, 2000). Juran believes that

Quality costs are the prevention, detection and correction of defective work. These costs are enormous, between 20 and 40% of sales. As a result, companies shouldn't stop spending money on prevention costs because it costs less to prevent a bug than to try to fix it. The relationship between these costs is expressed in Rule 1-10-100 as seen in Figure 3; one dollar spent on mitigation saves $10 for assessment and $100 for failure costs (Omachonu and Ross, 2004, p.34).

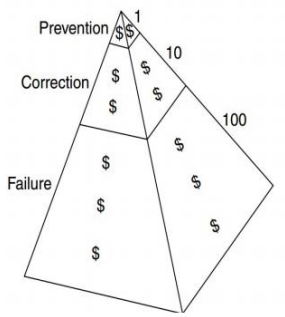

Figure 3. 1- The Rule of 10-100

Quality improvement means reducing quality costs. If problems in production are identified in enterprises and improvement is achieved with corrective actions, costs can be reduced. (Kurgun, 1997, p.219).

The following strategies can be followed to reduce quality costs:

- Evaluating issues with all affected personnel.
- Creating a request for a solution.
- Providing directive support in planning and research.
- Following up ongoing problems.

Statistical Analysis Of Quality Costs

Quality cost analysis is the examination, evaluation and solution methods of the costs of product or service quality to enterprises (Yükçü, 1999, p.291).

Quality cost analysis may involve comparing the total cost of quality with appropriate metrics such as net sales, cost inputs or direct labor costs. Consequently, a relationship may be formed between the amount of work completed and the quality costs. The data obtained in quality cost analysis should be classified according to quality cost types. According to these results, the decision to optimize the quality cost should be made by the management (Yükçü, 1999, p.292).

After the collection of quality cost data, these costs are gathered for analysis and decision-making, improvement and problem solving (Sönmez, 2005, p.49). Analysis of quality costs provides maximum quality opportunity at the most affordable cost (Dalcı and Tanis, 2002, p.143). The most used statistical methods in quality cost analysis; Ratio Analysis, Trend Analysis, Pareto Analysis and Regression Analysis (Mazman, 2016, p.99).

Implementation Of Exposure And Quality Cost Ratio Analysis Model In A Production Facility

General Information About the Business

The Z production enterprise, on which the work was carried out, was established in 1973, and became a Limited Liability Company in 1985 and a Joint Stock Company in 2016, a family owned SME company. The business includes about 100 types of tractor spare parts; It manufactures front axle, four-wheel front axle, rear axle, side arm head and also performs contract manufacturing. The enterprise is established on 50 decares of land and has two separate facilities with approximately 5.000 m closed area. The first facility has mold, design-project, heating, steel forging processes, and the second facility has a sandblasting, machining and storage section. Also in the factory; There are also departments of directorate, accounting and finance, marketing, production and quality control.

Quality control processes are carried out both during the production phase and after sales, based on the TS-EN-ISO 9001: 2008 standard series of the Turkish Standards Institute. In quality control; three-dimensional measuring instruments, calipers, micrometers, etc. tools and devices are used.

The raw materials that come for production are first checked visually (if it is steel, such as curvature, crack and slit, then the diameter if the shaft, the width if the billet). Analysis reports are requested from the supplier company for the purchased raw materials. Steel components and steel quality are checked according to these reports. If deemed appropriate, the acceptance process is carried out. If not eligible, it will be rejected. Quality control processes are applied at every stage, starting from the initial stage of materials that match the quality, until the product becomes finished and packaging. If there are

production errors in this process, they are either revised or separated as waste.

After sales, customer complaints are examined in case of the return of the product related to the products. Complaints are recorded and it is investigated whether there is a manufacturing or user error on the returned product. If there is a user error, this situation is reported to the customer. If there is a manufacturing error, a new product is sent to the customer or the product is returned. Quality control procedures are carried out under the supervision of a mechanical engineer.

Analysis and Method

Many models have been proposed regarding quality costs. This research was conducted according to the most used PAF model. The most important feature of the PAF model is that it defines the main and sub-components of quality costs one by one. The basic assumption of the model; It is that spending on prevention and evaluation activities will reduce the costs of failure.

Taking into consideration the data of the applied enterprise for the nine-month period of January-September 2019, first of all, quality costs data such as prevention, measurement-valuation, internal failure and external failure costs are tabulated and at the same time, quality costs have been analyzed using some ratio analysis.

The total quality costs for the nine-month period of the enterprise Z are 512.629.96 TL, among which total prevention costs are 15.450.00 TL and the percentage is 3.01%, the total measurement-evaluation costs are 39.975.00 TL and the percentage is 7.80%, the total internal failure costs 472.374. Is 96 TL and its percentage is 88.25% and the total external failure costs are 4.830.00 TL and the percentage is calculated as 0.94%. Internal failure costs (88.25%) have the largest share in the quality costs of the business, the most important of which are nonconformity costs and scrap costs, second place is measurement-valuation costs 7.80%, followed by prevention costs 3.01% and external failure costs%. It took the last place with 0.94.

Some income statement and cost items of the business are as follows (These figures are taken from the trial balance and production department of the last month examined) :

Sale	:10.034.077,20 TL
Direct Labor	: 1.754.377,90 TL

Total Production Costs : 8.392.704,33 TL
Cost of Goods Sold :8.472.927,52 TL

Table 4. 9 Months Quality Cost Report of Enterprise Z (according to PAF Model)

QUALITY COST REPORT

	MONTHS									
2019 YILI	**JAN.**	**FEB.**	**MAR.**	**APRIL**	**MAY**	**JUNE**	**JULY**	**AUG.**	**SEPT.**	**TOTAL**
PREVENTION COSTS										
Quality planning	208,3	208,3	208,3	208,3	208,3	208,3	208,3	208,3	208,33	
K.Ö. And test equipment design and development	216,6	216,6	216,6	216,6	216,6	216,6	216,6	216,6	216,6	
Review of K. and the birth of design	383,3	383,3	383,3	383,3	383,3	383,3	383,3	383,3	383,3	
K.Ö. And test equipment adjustment and maintenance										
Adjustment and maintenance of Kal.D.Ure.production equipment										
Supplier warranty										
Quality training	366,6	366,6	366,6	366,67	366,6	366,6	366,6	366,6	366,6	
Quality inspection	466,6	466,6	466,6	466,6	466,6	466,6	466,6	466,6	466,6	
Final situation analysis and analysis of quality information	75,0	75,0	75,0	75,00	75,00	75,0	75,0	75,0	75,0	
Quality improvement programs										
Total Cost of Prevention	1.716,7	1.716,7	1.716,7	1.716,7	1.716,7	1.716,7	1.716,7	1.716,7	1.716,7	15.450,0
Percentage of Total Cost (%)	3,39	1,80	4,46	4,83	2,39	3,21	3,04	3,80	2,62	3,01
MEASUREMENT-EVALUATION COSTS										
Pre-production verification	1.000,0	1.000,0	1.000,0	1.000,0	1.000,0	1.000,0	1.000,0	1.000,0	1.000,0	
Receiving (acceptance) inspection										
Laboratory acceptance test										
Inspection and testing	3.000,0	3.000,0	3.000,0	3.000,0	3.000,0	3.000,0	3.000,0	3.000,0	3.000,0	
Inspection and test equipment										
Materials consumed during ins and testing										
Test and inspect. result analysis and report	208,33	208,3	208,33	208,3	208,3	208,33	208,3	208,3	208,3	
Field achievement test										
Permissions and approvals	233,3	233,3	233,3	233,3	233,3	233,3	233,3	233,3	233,3	
Stock valuation										
Total Measurement-Valuation costs	4.441,6	4.441,6	4.441,6	4.441,6	4.441,6	4.441,6	4.441,6	4.441,6	4.441,6	39.975,0
Percentage of Total Cost (%)	8,78	4,65	11,54	12,51	6,18	8,31	7,85	9,84	6,78	7,80
INTERNAL FAILURE COSTS										
Scrap	7.306,1	8.780,2	7.535,0	15.220,3	14.574,9	12.127,0	10.543,8	13.690,4	15.783,0	
Replacement, remanufacturing, repair	36.168,3	79.675,4	23.852,9	13.179,6	50.136,0	34.226,9	38.901,0	24.334,7	42.589,0	
Elimination of faults, fault / failure moment.										
Inspection test revert										
Subcontractor error										
Exchange permits and privileges										
K. Loss of earnings due to non-compliance	416,6	416,6	416,67	416,67	416,6	416,6	416,67	416,6	416,6	
Time losses										
Total Cost of Internal Failure	43.891,1	88.872,4	31.804,5	28.816,5	65.127,5	46.770,6	49.861,5	38.441,7	58.788,7	452.374,9
Percentage of Total Cost (%)	86,7	92,9	82,61	81,1	90,68	87,4	88,1	85,17	89,7	88,2
EXTERNAL FAILURE COSTS										
Complaints										
My obligation fulfilled during the warranty period.										
Products that are not accepted, returned	416,67	416,67	416,67	416,67	416,67	416,67	416,67	416,67	416,67	
Compromise										
Sale loss										
Cost of customer contact	120,00	120,00	120,00	120,00	120,00	120,00	120,00	120,00	120,00	
Total External Failure Costs	536,67	536,67	536,67	536,67	536,67	536,67	536,67	536,67	536,67	4.830,00
Percentage of Total Cost (%)	1,06	0,56	1,39	1,51	0,75	1,00	0,95	1,19	0,82	0,94
TOTAL QUALITY COSTS	**50.586,1**	**95.567,4**	**38.499,5**	**35.511,5**	**71.822,5**	**53.465,6**	**56.556,5**	**45.136,7**	**65.483,7**	**512.629,9**

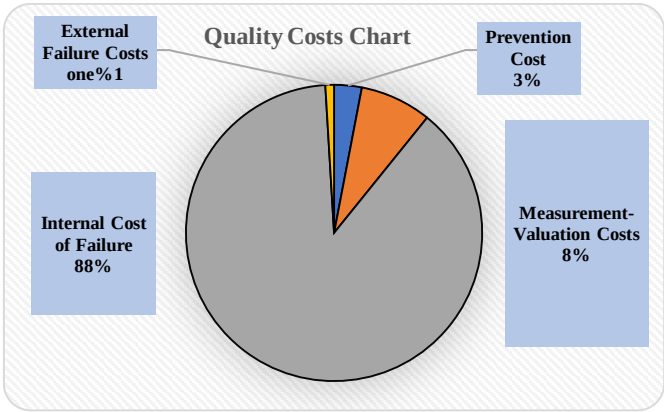

Figure 4. Quality Costs of Enterprise Z Pie Chart

Table 5. Quality Cost Ratio Analysis of Enterprise Z

QUALITY COST RATIO ANALYSIS					
a) By Direct Labor					
Internal Failure Cost	452.374,96	=25,785=or	Prevention Costs	15.450,00	= 0,88
Direct Labor	1.754.377,90		Direct Labor	1.754.377,90	
b) According to Production Cost					
Total Quality Costs	512.629,96	= 6,11=or	External Success Costs	4.830,00	= 0,06
Total Production Costs	8.392.704,33		Total Production Costs	8.392.704,33	
c) By Unit					
Measurement-Evaluation Cost	39.975,00	= 14,77=or	Total Quality Costs	512.629,96	= 189,39
Produce amount	270.670,00		Produce amount	270.670,00	
d) Based on Sales Basis					
Total Quality Cost	512.629,96	= 5,11=or	Internal Failure Cost	452.374,96	= 4,51
Sales	10.034.077,20		Sales	10.034.077,20	
e) Based on Cost of Goods Sold					
Total Quality Costs	512.629,96	= 6,05=or	Internal Failure Cost	452.374,96	= 5,34
Cost of Goods Sold	8.472.927,52		Cost of Goods Sold	8.472.927,52	

As for the interpretation of quality cost ratio analysis, according to direct labor data; internal failure costs about 26% and prevention cost 1%, according to production costs; the total cost of quality is about 6% and the external cost of failure is .01% on a unit basis; production quantity measuring approximately 15% of the valuation cost, and on a sales basis; total quality costs around 5% or internal failure costs around 5% and according to cost of goods sold; Total quality cost is 6% and internal failure costs are around 5%. It is seen that the unit quality cost per each production quantity is 1.89 TL.

Conclusion

Production costs are increased if the goods do not follow design requirements (and are thus related to performance standards). Costs of quality fall into four categories: avoidance, estimation, internal failure and costs of external failure. Losses in avoidance are costs borne in avoiding poor production. Assessment costs are the incurred costs to locate poor quality, internal defect costs are costs incurred where goods do not meet specifications and this lack of compliance is detected before being shipped out. Exteriors. External costs of loss are the losses borne if the goods do not meet the after-sales criteria.

If the costs incurred for the sake of quality are followed carefully, the positive effects of this on businesses can be easily felt. If a balance is struck between the costs incurred to ensure the quality of the product, the competitive power of the product in the market will increase. Achieving this balance will be possible by monitoring, controlling and evaluating quality costs. Collecting this cost information accurately and completely is important in terms of making accurate decisions about quality management (Kendirli and Çağıran, 2002, p.135).

When assessing the quality costs of Enterprise Z, the proportion of avoidance, measurement-assessment and operational failure costs in overall quality costs is considerably low (12% in total), while internal failure costs constitute 88% of the total quality costs. Nonconformity and scrap costs have a large place in internal failure costs. It is predicted that this enterprise can produce higher quality goods and reduce internal failure costs by increasing its prevention and valuation activities. Examining the factors that cause internal failure, recording them and applying the necessary measures meticulously will make it possible to reduce the costs, which are the most important competitive tool, to the most appropriate level.

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