

A Research on the Impact of Cost of Quality Models and Reporting System on Managing Cost of Quality

Tina Arabian¹⁺, S. M. Mehdi Jourabchi², Z. Leman³, M.Y. Ismail⁴

^{1,2,3} Department of Mechanical & Manufacturing, Universiti Putra Malaysia (UPM University)

⁴ Department of Manufacturing Engineering, Universiti Malaysia Perlis (UniMap University)

Abstract. In today's competitive market customer satisfaction plays a vital role to increase organization profit and its survival. Customers take into account service and product quality as one of the most important factors to choose a service or product. Organizations spend money to create quality, so they need to control cost of quality (COQ) to be reasonable. This paper presents a survey of current research works focusing on the assessment of the cost of quality management. These could briefly include various quality costs models to identify COQ elements as well as COQ metrics, reporting and controlling. This paper also compares different COQ models and presents the importance of implementation of COQ reporting and justifies why some organizations fail to apply COQ reporting and manage COQ efficiently and effectively.

Keywords: Cost of Quality, COQ Models, Prevention-Appraisal-Failure Costs, COQ Reporting System.

1. Introduction

What survive organization in the today's competitive market is customer satisfaction which leads to increase sales and profit. One of the most effective items that influence customer satisfaction is quality, so most of the organizations pay attention to quality and spend money to create an appropriate level of quality in their products or services. Also organizations have a special attention to the cost while the reasonable and acceptable level of cost can be another competitive weapon for them. If an organization does not consider to quality they will face with direct and indirect cost resulting from remanufacturing or lost customer respectively [1], so organizations try to reduce these costs where cost reduction will be impossible if they are not recognized and measured and managed properly, as Dane explained "to manage we must control, to control we must measure, to measure we must define, to define we must quantify"[6].

Cost of quality is the sum of conformance and non-conformance costs, the costs of conformance relate to the fee is paid for avoidance of poor quality (good quality) and non-conformance cost results in poor quality. There are some COQ models to define which cost items can be considered as a quality cost and identify and classify them as the cost of conformance(COC)or non-conformance(CONC), then some metrics should be used to measure these items and be presented to managers as a COQ report to be considered and controlled.

Unfortunately some organizations do not know about the importance of COQ management and any others have not been awarded how they can manage COQ accurately.

This paper tries to present how COQ models and reporting system can contribute to manage the cost of quality and why some organizations have not succeeded to apply related methods properly.

2. The Concept of Cost of Quality

As Machowski and Dale said "There is no general agreement on a single broad definition of quality costs" [9], however the COQ is the sum of costs incurred to guarantee and sustain acceptable quality level (cost of good quality) plus the loss for failing to achieve that specific quality level (cost of poor quality).

In other words COQ is understood as the sum of non-conformance and conformance costs while Cost of non-conformance is the cost of poor quality affected by service and product failures and cost of conformance is the fee paid for prevention of poor quality [2,9].Furthermore some other researchers identified COQ as a performance measurement tool that provides a measure of cost specifically related to the achievement or

⁺ Corresponding author: Tel.: + 60142386392.
E-mail address:t.arabian65@gmail.com.

non-achievement of services or product quality [6]. These various approaches to categorize and identify the quality costs resulted in different quality cost models.

3. Quality Cost Models

The aspect of identifying quality cost items is the core of the COQ management. Various approaches to determine quality cost elements were suggested by several researchers (Hollock, 1986; Asher, 1987; Gibson et al., 1991; Dahlgaard et al., 1992; Morse, 1993) [9], in this way there are five most common models, known as the Prevention - Appraisal - Failure (PAF) Model, the Process Cost Model (PCM), Opportunity or Intangible Cost model, Crosby’s Model, and ABC model that are explained below [14].

3.1. PAF Model

Dr Armand V. Feigenbaum developed the concept of quality cost measurement [1]; he categorized cost of quality in 3 major parts, figure 1, prevention, Appraisal, failure costs. The failure costs in this scheme are classified into two subcategories: internal and external failure costs. The prevention and appraisal costs are related to the cost of quality achievement or cost of good quality and the failure costs are due to lack of quality or are known as costs of poor quality [10].

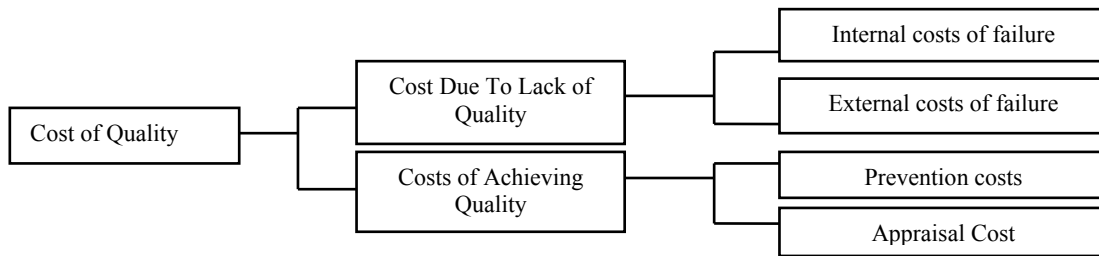


Fig.1: PAF Quality Cost Categories [1]

Table 1 is proposed to demonstrate a brief description of each category and their elements.

Table 1: PAF Quality Cost Categories, Definitions, and Elements [10, 19]

Types of cost		Description	Elements
Prevention Cost		Related to activities designed and trained to guarantee good quality and prevent poor quality in services or products.	<ul style="list-style-type: none"> • Process design/change • Quality education and training • Knowledgeable human resource recruitment • Preventive maintenance • New product review
Appraisal Cost		Related to measuring or inspecting services or products to achieve performance requirements and quality standards.	<ul style="list-style-type: none"> • Sampling and measurements • Evaluations and assessments • Problem analysis • In-process and final inspection/test • Product or service audits and detection
Failure Cost	Internal	Affected by products or services not conforming to customer/user needs and are identified before delivery.	<ul style="list-style-type: none"> • Retesting, Rework and Repair • Unscheduled and unplanned service • Defect removal • Lost process time/Delay and shortages
	External	Affected by deficiencies which are found after delivery of services or products to external customers, which causes customer to be dissatisfied.	<ul style="list-style-type: none"> • Complaints/Liability claims • Repairing goods and redoing services • Losses due to sales reductions • Warranties • Returned products and customer’s bad will • Poor safety/availability

3.2. Process Cost Model (PCM)

In some industries such as the construction industry, the PAF model is not suitable to identify and measure the cost of quality, so the PCM model was developed by Ross (1977) and first used for quality costing by Marsh (1989); this model focus on process rather than services or products [4]. Each process

contributes to some cost element that can be classified in four categories: people, equipment, materials and environment. Each of cost elements must also be identified as a cost of conformance or cost of non-conformance .The process cost is the total of COC and CONC for a particular process [7, 12].

3.3. Opportunity or Intangible Cost Models

This model considers to costs of losing opportunities, these opportunities are associated with losing customer which the customer may go somewhere else next time or even can be the cost of losing experienced employees. These costs should be considered and estimated because they effect on the organization profit, revenue and reputation [3, 15].

3.4. Crosby’s Model

Crosby sees quality as “conformance to requirements”, and therefore, explains the cost of quality as the sum of conformance and non-conformance price in his model (Crosby, 1979). The price of conformance is the cost involved to make sure that things are done right at the first time and the price of non-conformance refer to the money which is wasted when activities fail to meet customer needs [3, 20].

3.5. ABC Model

In manufacturers and organizations, accounting system takes into account two main categories, indirect and direct costs, certainly there is some indirect or overhead cost that are related to the cost of quality.

Two main approaches, Prevention-appraisal-failure (PAF) and process cost still cannot provide perfect methods to consider and contain overhead costs in COQ systems. Activity-based costing (ABC) which was established by Cooper and Kaplan of Harvard Business School could overcome this deficiency. ABC is a costing approach that assigns resource costs to cost objects including departments, services, products, channels and customers, based on activities performed for each object. The foundation of this costing approach is that, a firm’s service or products are the results of some activities that use organizational resources which incur costs [8]. In this way ABC uses the two-stage procedure to calculate the accurate costs of different cost objects, firstly resource costs (including overhead costs) are assigned to activities, and then costs of activities will be traced to cost objects [7,13].

It is noticeable, based on ABC model categories the costs allocated to activities can be either value-added or non-value-added.

COQ models can be compared based on their various categories and orientation, table 2 illustrates these differences.

Table 2: The comparison between cost of quality models in terms of categories and orientation [7, 14]

Generic Model	Cost Categories	Orientation
PAF Model	Prevention + appraisal + failure	Focus on cost of activity
Process Cost Model	Conformance +non conformance	Focus on cost of process
Opportunity or Intangible Cost Model	Conformance + non-conformance +opportunity Tangibles + intangibles P-A-F (failure cost includes opportunity cost)	Focus on intangible costs and cost of losing opportunities
Crosby’s Model	Conformance + non-conformance	Focus on cost of activity
ABC Model	Value-added + non-value-added	Focus on cost of activities and assigning overhead cost to each activity.

4. COQ Elements

In according to calculate total quality cost, a list of quality cost elements should be identified under the quality cost model specially PAF. These lists just act as a guideline for quality costing. Most quality experts suggest that every organization should identify these elements base on its organizational structure and accounting system rather than just being borrowed from other organizations [7].

5. COQ Metrics

After that the COQ elements were identified, the organization needs some appropriate global and detailed metrics to know the costs and benefits of approaching the best quality level. Table 3 illustrates some examples of these metrics [5].

Table 3: COQ metrics (indices) [5]

Detailed Metrics	Global Metrics
<ul style="list-style-type: none"> • Cost of assets and materials • Cost of appraisal labor • Cost of defects per 100 pieces • Cost of reworks • Number of complaints 	<ul style="list-style-type: none"> • $ROQ = \text{increase in profit} / \text{cost of quality improvement program}$ • $\text{Process quality} = (\text{available time} - \text{rework time}) / \text{available time}$ • $COQ(\text{failure}) = \text{external failure cost} / \text{Total cost of quality}$ • $\text{Quality rate} = ([\text{input} - (\text{quality defects} + \text{start up defects} + \text{rework})] / \text{input})$

Organizations can use global metrics to determine the benefit of investment to improve and sustain quality in all levels in comparison to the cost of implementing the improvement program, such as ROQ that is a global metric to define the return on quality, also sometimes they need to determine what is the cost of each quality activity by using detailed metrics to conclude which one should be improved [18].

6. COQ Reporting and Controlling

Organizations need to top manager's commitment as a crucial factor to implement TQM initiatives because many resources should be invested in quality improvement projects [8]. The COQ reporting system as a strong management tool can create manager's commitment by providing a communicating link between top and line management [5]. This system is essential for managers to get the information that they need to evaluate, determine, prioritize and implement necessary actions and also assist them to know about the efficiency of quality activities [6, 16]. In addition, based on Schiffauerova and Thomson view, a suitable COQ reporting enables companies to achieve some competitive advantages in the market [4].

Cost of quality reporting assist managers to control COQ, however some organizations has not succeeded to apply it properly due to lack of awareness and understanding of COQ principles [16], and how they should use the information received from the COQ reporting system.

Fundamentally, the failure costs will be decreased if organizations invest in prevention or appraisal activities properly but some organizations can not accomplish this result because they don't know which areas (such as Method, Man (human resource), Material, Machine, Maintenance) are more essential to be considered for investing to fulfill customer expectation in terms of both quality and price[19]. Managers can get useful information from COQ reporting to recognize weak areas to invest and get help from some experts and effective methods (such as 5S or Six Sigma) to improve and control cost of quality [11,17].

7. Conclusion

In today's market, organizations achieve competitive advantages when they offer their products and services with higher quality and lower price. For creating this, organizations need to invest in COQ management to control the price and their total cost by paying attention to the quality level of their products or services.

To manage the COQ, manufacturing and service industries, both should identify COQ elements and organize a COQ measurement system to determine quality costs through global and detailed metrics and also a reporting system that is very necessary to control the cost of quality. The most popular model is PAF model but the selected COQ model must suit the Situation, environment, purpose and company needs in order to have a chance to become a successful systematic tool in a quality management program.

It will be effective if managers shift the majority of COQ to the Appraisal and prevention costs so the COQ will not only be reduced significantly, but it will also be more predictable and more manageable.

Successful Organizations audit different areas, consult with experts and use efficient methods to determine some areas to invest and improve, in addition to these factors, organizational culture can contribute significantly to smooth the process of applying COQ management throughout the organization.

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