

# Cost of quality in Dubai: An analytical case study of residential construction projects

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## Abstract

In a city like Dubai, where one of the biggest and fastest growing construction markets in the world exists, the need to estimate the cost of quality in the construction projects becomes a vital task. This research used the prevention–appraisal–failure (PAF) model to evaluate the cost of quality (CoQ) and to determine its optimum value – the level of quality that minimizes the total CoQ – for the residential construction projects in Dubai. The results revealed that the CoQ in such projects in Dubai represents 1.3% of the total project civil work cost and that the optimum CoQ value was estimated to be 1.34% of the total CoQ. Failure costs, on the other hand, were estimated to be .7% of the project cost.

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## 1. Introduction

The construction sector in the Arab Gulf Cooperation Council (GCC) countries has been witnessing a booming expansion; with more than \$800 billion of active projects in the Gulf and this figure is growing by up to \$10 billion a week. Trends indicated this market to worth over \$1 trillion in 2007. Dubai, the Gulf's regional centre, was expected by the Middle East Economic Digest (MEED) to be preparing to invest up to \$200 billion mainly in residential, tourism, transport and utility projects by 2025 [1]. According to recent statistics, up to five million residential units are under construction in the GCC, including more than 1,400 new high-profile developments collectively valued at over US\$ .66 trillion. In 2006 there was about 2100 projects either planned or underway in the Gulf region, of which the UAE and Saudi Arabia made up 29% and 20%, respectively [2].

In the United Arab Emirates (UAE), particularly in the Emirate of Dubai, the construction sector is one of the leading sectors of economic growth in the country (growing by 10% in 2005), and is among the biggest and fastest growing construction markets in the world. The growth in construction has, in turn, fueled the growth of the UAE economy contributing 8% of the country's overall growth domestic product (GDP) and representing 11% of the non-oil-related GDP in 2005 [3]. According to a study by the Dubai government, "Dubai construction sector's absolute contribution to the GDP is on an upswing, achieving an increase of 23% during the period 2000–2004, and an annual growth rate of 5% [4]". In 2005, there were 304,983 workers employed in the construction projects in Dubai [4]. A prominent feature of the construction activity in Dubai is the construction of large-scale projects with very high standards, such as the Emaar Marina Complex and Burj Dubai – the world's tallest tower. Obviously, these types of projects require very high scale of quality management. Unfortunately, construction contractors working in Dubai rarely have a realistic idea of how much profit they are losing to attain an acceptable level of quality. In addition, they don't

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realize the relationship between the costs incurred to prevent defects – through prevention and appraisal techniques – and the costs incurred to rectify defects.

The competitive pressures facing firms in today's environment have led to increasing reliance on quality-oriented, results-based improvements. As a way of meeting the challenges they're facing today, organizations throughout the world have made quality a priority in the form of total quality management (TQM), continuous improvement (CI), and similar initiatives [5]. Organizations' ability to measure costs related to quality has, thus, become a necessity; "unless it can become measurable, it cannot be manageable [6]."

In such a rapidly growing construction market in Dubai, the need to estimate the cost of quality in the construction projects becomes a vital task. However, any serious attempt to improve quality must take into account the costs associated with achieving quality since the objective of achieving a product with a good quality is not only to meet the customer requirements, but also to do it at the lowest cost. This can only happen by reducing the costs needed to achieve quality, and the reduction of these costs, in turn, is only possible if they are identified and measured. Therefore, measuring and reporting the cost of quality (CoQ) should be considered an important issue for companies [7].

The objectives of this research are: (1) to use the prevention–appraisal–failure (PAF) model to evaluate the cost of quality (CoQ) as a percentage of the overall cost of residential construction projects in Dubai; (2) to determine the optimum value for CoQ; and (3) to test the relationships among different variables affecting CoQ.

Following the introduction, the rest of this paper is organized as follows. Section 2 briefly reviews the cost of quality concept and the PAF model. The research framework is given in Section 3 followed by findings and analysis in Section 4. Finally, conclusions are given in Section 5.

## 2. CoQ and the PAF model

Businesses lose money every day due to poor quality; from fixing a warped piece on the assembly line to having to deal with a lawsuit because of a malfunctioning machine or a badly performed service. Juran, along with Armand Feigenbaum, were primarily accredited for the writings that led to the development of the current CoQ concepts and models [5,8–11]. CoQ is usually understood as the sum of conformance plus non-conformance costs, where cost of conformance is the price paid for the prevention of poor quality and cost of non-conformance is the cost of poor quality caused by product and service failure [7]. CoQ was also described as the cost associated with the quality of a work product [5]. In other words, CoQ is the amount of money a business loses because its product or service was not done right in the first place.

According to Besterfield [12], cost of quality is defined as the cost associated with the non-achievement of product or

service quality as defined by the requirements established by the company and its contracts with customers and society. Simply stated, it is the cost of poor products or services. Based on the above definitions – and many others – it can be concluded that different labels have been used to describe the costs related to quality. However, there appears to be agreement as to the basic set of CoQ categories; prevention, appraisal, internal failure, and external failure [5].

CoQ analysis links improvement actions with associated costs and customer expectations, and this is seen as the coupling of reduced costs and increased benefits for quality improvement. Therefore, a realistic estimate of CoQ and improvement benefits – which is the trade-off between the level of conformance and non-conformance costs – should be considered an essential element of any quality initiative, and thus, a crucial issue for any manager [7]. Companies rarely have a realistic idea of how much profit they are losing through poor quality. Smaller firms most often do not even have any quality budget and do not attempt to monitor quality costs [13,14]. Large companies usually claim to assess quality costs [15–17]; however, even though most managers claim that quality is their top priority, only a small number of them really measure the results of quality improvement programs [18,19]. Top management is usually reluctant to establish a rework account. Mistakes are buried and the extra costs incurred are treated as poor productivity. This act indicates poor management attitude and takes away any room for improvement. Quality costing, on the contrary, allows cost quantification of failure events and, thus, using it as a means for initiating improvement actions [20].

There are many operational benefits that can be realized from the use of information generated from a CoQ system: the recognition of deficiencies in the organization's quality system [11]; pertaining to the return on quality related and quality enhancement expenditures [11,21]; the identification and elimination of the organizational activities that do not provide or enhance quality [21,22]; a means for monitoring operational performance and identifying areas for improvement with respect to costs [23]; provide financial justification for future quality initiatives [23,24]; the introduction of a bottom-line orientation to quality [21]; a guide for making cost-related, fact-based strategic decisions [24]; a managerial tool in assessing cost-related expenditures, for tracking costs, and to augment other forms of information in the operational and strategic decision-making process [25].

The prevention–appraisal–failure (PAF) model is the most widely used model for determining the cost of quality [26]. Within this context, prevention costs are those resulting from quality activities used to avoid deviations and errors [27]. Preventing non-conformity before a product is manufactured or prepared to serve the customer is clearly the most appropriate action in reducing appraisal and failure costs because it is always the least costly, least time consuming, and least troublesome approach for pro-

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