

## **Investigating the Cost of Quality in Construction SMEs**

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### **Abstract**

This paper is based upon empirical research conducted within the UK SME construction sector. It appertains to an investigation into the perception of quality and how it can be realistically costed by UK SME construction organizations. It is important to be able to quantify the true costs of a 'quality driven agenda', as this can have a bearing upon the strategy an organisation adopts in relation to the quality issue. Part of the empirical research was based upon a case study, supported by questionnaires sent to a sample selected from UK construction companies and incorporating interviews. One also needs to be able to differentiate between 'quality costs' at the design and construction phases, this aspect forms part of the study. The conclusions drawn will have valid transferability for SME construction companies in the wider European context, as the basic principles of costing are the same. The proposed outcome of the paper is to provide a valid rationale for the attainment of quality costs and further to provide a suitable evaluative model for utilisation by other European construction companies.

### **Keywords**

Quality costs, Quality costing models, Quality related to SMEs

### **1. Introduction**

On construction projects one can not think of quality in isolation as it not mutually exclusive from the other criteria of time and costs. Past studies have found that quality seems to be the first objective of a building project which may be sacrificed, in order to ensure the other two key criteria are met. This has been demonstrated on past developments within the UK. The issue of quality in construction has been instrumental in the introduction of an accredited quality system into the UK construction sector, in a drive to improve the overall quality of goods and services in the industry. This accredited quality system is known as the BE EN ISO 9000 series which was developed by the International Organisation for Standardisation (ISO) initially in 1983 (then BS 5750). Many companies within the UK construction industry are gaining BS EN ISO accreditation. This is because of the increased pressures from customers, who require confidence that the quality of building work will be that agreed and specified.

This research project investigates the issue of costing quality within SME contracting organisations operating within the UK construction industry. It examines the cost of quality within one specific specialist contractor, as well as examining the views and opinions of other construction organisations working in the UK construction industry.

## 2. Quality Defined

Quality is a very difficult term to define, especially in the context of the construction industry. Table 1 establishes a number of key definitions of quality noted by various eminent authors; however, all of these definitions make reference to the customer requirements. Therefore from these definitions quality can be defined as meeting the customers' needs, expectations and requirements.

**Table 1: Definitions of Quality (adapted from Gibson and Howarth, 2006 and Oakland, 2003)**

Definition	Author
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	Feigenbaum 1961
Conformance to requirements	Crosby 1979
Fitness for purpose or use	Juran 1985
Quality should be aimed at the needs of the consumer, present and future	Deming 1986

If all parties working on a project knew the true cost of quality they may see it as an objective which demands greater importance than the associated criteria of cost and time. Many of the problematic quality issues in construction relate to inadequate training and management of the workforce, i.e. designers and the construction labour force, which in turn creates problematic quality design and problematic quality construction work (Hiyassat, 2000). The other main problematic quality issue in the UK construction industry can be attributed to the different parties involved on a project; the client, consultant, contractor and sub-contractors, they all have their own role to play in completing a project and if any of these parties fail in their duties and responsibilities then it will adversely affect the overall quality of the project (Kanji and Wong, 1998). Table 2 provides some useful definitions related to quality costs.

**Table 2: Definitions of Quality Costs (adapted from Aspinwall and Hwang, 1996; Giakatis *et al.*, 2001 and Crosby, 1979)**

Definition	Author
The difference between the actual costs and the ideal ones (zero failure)	Campanella and Corcoran
The expense of doing things wrong. It is the scrap, rework, service after service, warranty, inspection, tests, and similar problems made necessary by non-conformance problems	Crosby
Screening, replacement of defective items, prevention of defective items and improvement in screening	Grocock
The total of all resources spent on assuring that quality standards are consistently met in any organisation	Bohan and Horney
The expenditure incurred by the producer, user and community associated with product or service quality	British Standard 4778
Costs incurred in ensuring and assuring quality as well as the loss incurred when quality is not achieved	ASQC
The sum of all costs that would disappear if there were no quality problems	Juran

### **3. Quality Costs**

There have been a number of costs of quality studies in the construction industry and each of these studies have varied slightly from one another, but all of them have identified and highlighted the continuing problem of quality costs. These quality costs can be eliminated from the industry if appropriate means of establishing costs of quality systems are implemented within contracting organisations. A study by Li and Love (2000) investigated the construction phase of two building projects and found the cost of rework for these two projects to be 3.15% and 2.40 % of the final project sum. This study was limited as it did not include the design stage where many other quality costs can be incurred. This has been highlighted by a National Economic Development Office (NEDO) survey as well as The Building Research Establishment (BSE) who found that the design stage accounted for 50% of defects in building projects (Cited by Abdul-Rahman, 1992)

### **4. Empirical Research: Case Study**

For confidentiality reasons the contracting organisation used within the case study section of this research project shall be named as Company X. The organisation was established in 1993. Company X is a UK contractor who specialises in the design, manufacture and installation of aluminium curtain walling, windows, doors and shop fronts. It has a turnover in excess of £10 million a year. The company is very committed to meeting their customer requirements first time, every time and is currently seeking accreditation to BE EN ISO 9001. One of the company's policies is to eliminate quality costs and the associated high numbers of occurrences of quality related issues.

#### **4.1 Empirical Research: Interviews**

The head of the contracting department was chosen for a pilot study. The heads of the production, estimating and scheduling departments as well as the managing director of the company were chosen for the main study. The names of the interviewees' will be kept anonymous for confidentiality reasons.

#### **4.2 Empirical Research: Questionnaire**

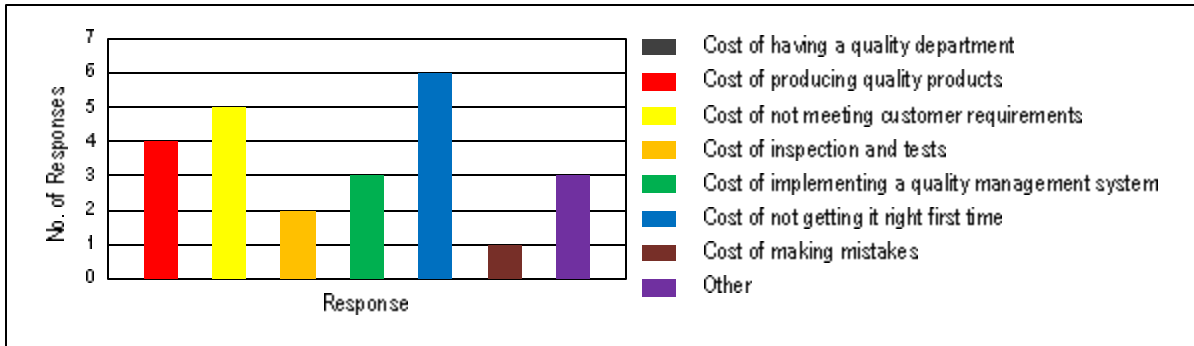
The questionnaires were distributed to contractors who work within the UK construction industry. A random sample of five contractors were chosen for the initial pilot study and a sample of 50 contractors were chosen at random for the main study from the Top 150 Contractors and House builders by Turnover List drafted by the Building Magazine UK.

The purpose of deploying three survey sample tools was to apply the concept of "Triangulation". The main focus of the empirical stage was to establish what respondents viewed as "Quality Costs". Further to establish the validity of using Crosby's (1979) Process Control Model for construction related organisations.

#### **4.3 Empirical Research: Data Analysis**

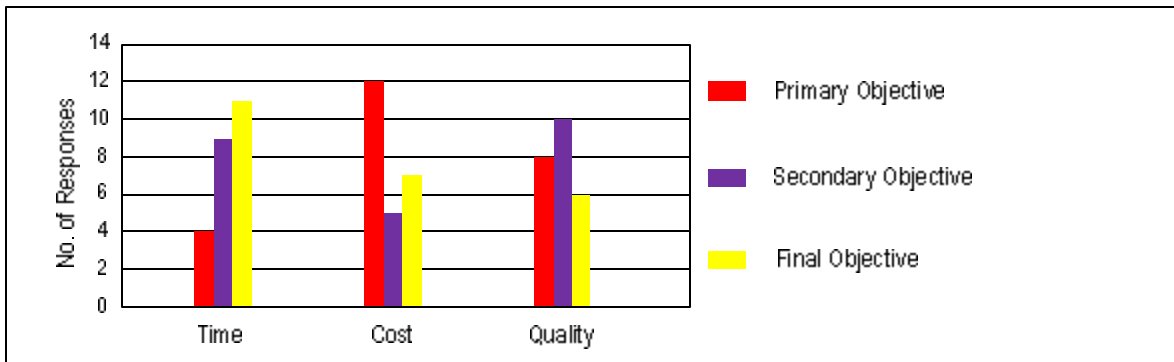
The first question related to "What do you believe is meant by the term quality costs" In total there were 5 interview responses and 19 questionnaire responses and the results are summarised in Figure 1. There was some variation on the understanding of what is meant by the term quality costs.

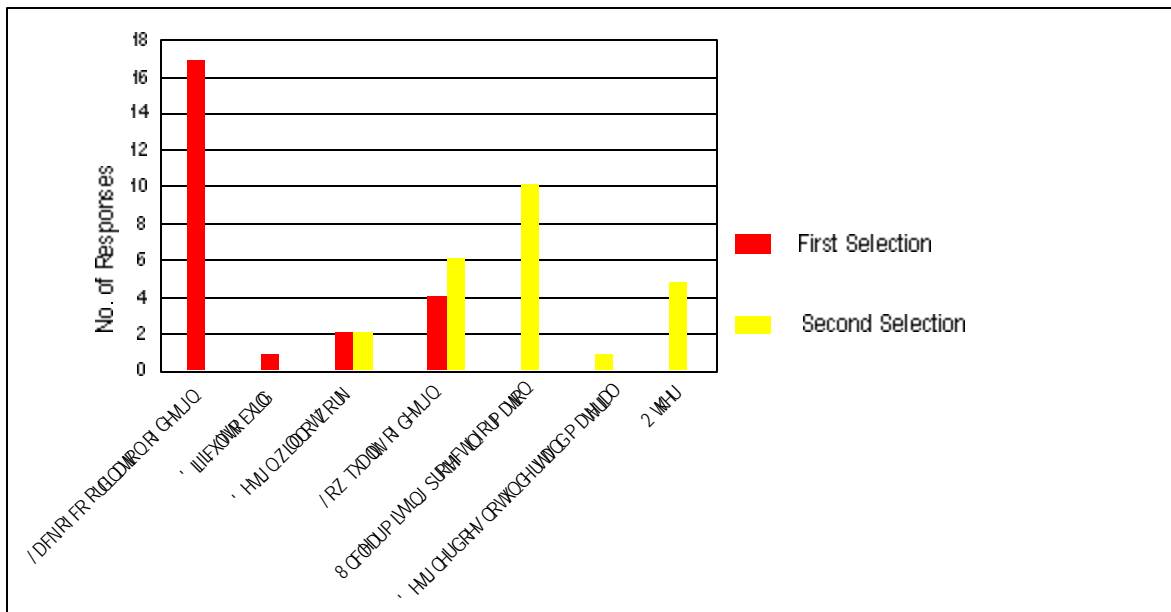
A further question was asked: "What do you believe the scale of quality costs to be in your company?" (In terms of % of turnover)



**Figure 1: Defining what is meant by Quality Costs?**

Figure 2 illustrates the overall response from the sample; it is possible to see from the table that most of the respondents' believed quality costs to be between 0-10 % of their companies overall turnover.





**Figure 4: Design Problems and Their Respective Impact upon Contractors**

**4.5 It was felt that a question should be asked relating to “Which of the following design problems adversely affects your business the most?”** (adapted from Abdul-Rahman, 1993). Figure 4 summarises the responses to this question. It shows that the main design problem experienced by contractors is a lack of co-ordination of design.

The contractors who responded to the questionnaire felt that quality should be classed as the second most important objective but in preference to time, but behind cost, which contradicts most of the literature published upon this subject. The responses from the interviews noted that many of the employees at Company X believed that quality is of equal importance to both time and cost.

Companies wishing to eliminate quality costs need a genuine understanding of the term and associated terms. This is critical in order to ensure that communication on this topic within an organisation is understood by all employees. The results obtained from the sample appertaining to terms were disappointing, especially ‘Appraisal costs’ where only six people involved in the entire research project (out of 24 participants) understood what the term meant. But many of the project participants had a genuine understanding of the term ‘Quality Costs’.

One aim of the research project was to identify the acknowledged costs for addressing the issue of cost of quality for UK contractors. To achieve this objective a past project analysis took place within the case study of the specialist contractor, which critically evaluated all of the quality problems experienced by Company X on the sample of eight projects.

The project analysis found that the total quality costs occurring within the sample of projects totaled £22,889.22. The average quality costs per project as a percentage of total project value was established at 1.19%, which is slightly lower than the quality cost figures worked out for construction projects in past studies. According to the past literature on this topic, the design stage of a project usually has a higher percentage of quality costs than the construction stage. But the analysis of Company X’s past projects shows otherwise. The quality costs for the design stage of the sample of projects analysed comes to £6,246.70, which is 27.29% of total quality costs. While the quality costs for the construction stage of the

sampled projects analysed comes to £11,400.00, which is 49.51% of total quality costs, and is therefore nearly accountable for twice as many than the design stage.

The main quality issues which are affecting Company X, are order errors, materials lost on site, damages on site and incorrect size of components delivered. If Company X were able to reduce or eliminate these quality problems they would increase their overall profit significantly. It seems that Company X needs to concentrate on improving the efficiency and effectiveness of both design and contracting departments. Also there appears to be an issue with the skills and competences of employees, and more care needs to be taken by employees when working to avoid excessive wastage. The noted problems within the design and construction stages seem to affect many contracting organisations. The respondents from the questionnaire survey highlighted the main design issues as a 'Lack of co-ordination of design' and 'Unclear/missing project information', and the main construction issues as, a 'Lack of skill and a Lack of care from tradesmen'.

Both the specialist contractor and the contractors, who responded to the questionnaire show that there is a large financial problem with quality costs in their organisations and if quality costs were to be reduced or removed completely, then the contractors would increase their profits, in the case of Company X this would be an increase of 1.19% per project (based on the sample of projects). In times of an economic recession it is imperative that costs are reduced as much as possible, to ensure the survival of construction companies.

## **5. Models for Quality Costing**

There are two main models for quality costing and these are the PAF model and the Process Cost Model. Other quality costing models include the Cost-Benefit Model and Juran's Tangible and Intangible Cost Model. The first quality costing model developed was the PAF model by Feigenbaum and Masser back in 1956. Since then many other models have been developed by other experts in the field of quality costing. These models help to identify the different quality costs within an organisation and formulate an overall percentage value of quality costs. The objective of all quality costing models is to find the level of quality that minimises the total cost of quality (Schiffauerova and Thomson, 2006).

Part of this research project was concerned with the development of a framework for assisting contracting organisations in addressing the quality cost issue. The ideal framework for Company X and the other contracting organisations involved in the research project which would empower them to reduce quality costs is the process cost model concept developed by Crosby in 1979. This model very much suits the construction industry; this is because the model can be developed for any construction process through the use of flowcharts. These flowcharts will identify all of the key activities within the project. The cost of conformance and the cost of non-conformance can then be identified for each of the key activities involved in the project. The model is exactly what the participants' need, as they require a system which will monitor the different processes within the organisation (Aoieong *et al.*, 2002). An example of a suitable process cost model for a construction process is depicted in Figure 5.

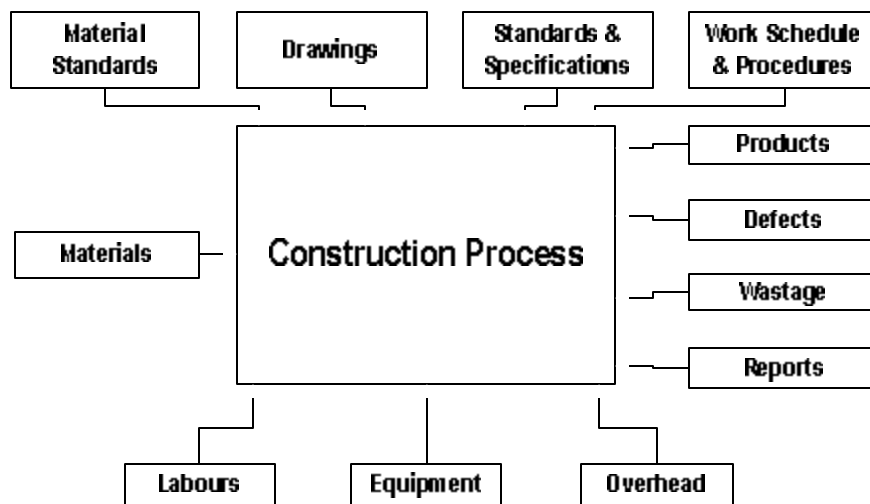


Figure 5: Typical Process Model for Construction Processes (adapted from Aoieong *et al.*, 2002)

## 6. Concluding Remarks

This research project has established that quality costs are still a problematic issue for UK construction SME's, as was the case previously. The UK construction industry seems to be very susceptible to increases in quality costs, and thus has the most to gain by eradicating these costs, this being very important during times of economic recession and hence increased competition. It seems to be the case that smaller contractors do not possess the resources to communicate effectively either information, or knowledge and understanding relating to the cost of quality throughout their organisation. This aspect could be one of the reasons why quality costs are still a critical issue for SME's. Finally the research has established that the construction stage of a project incurred higher quality costs than those of the design phase, which does not corroborate with the theoretical published texts on this topic.

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