Operational Quality Failure Issues: From Client Perspective

OPERATIONAL QUALITY FAILURE ISSUES: FROM CLIENT PERSPECTIVE

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ABSTRACT

Many attempts have been made in defining, exploring and quantifying COQ in recent years. However, the occurrences of high failure and the cost in correcting it is still a significant concern to many. This study aims to appraise external failure cost within the complex construction supply chain, then to identify strategies to prevent and appraise quality as a means of reducing failure. This paper provides interim findings from an on-going study of external failure cost in the construction industry. It combines questionnaire responses, which shows the high level of maturity and influence of quality managers in dealing with external failure and interviews with seven project managers from a leading client in the UK construction industry. Interviews also showed the inter-relationship among project process, quality management systems and the occurrences of failure. Further research is needed to clarify the failure cost including an integrated measurement, yet to developed, for reducing the failure cost.

Key words: COQ, external failure cost, operational quality issues, quality management system.

INTRODUCTION

Cost of Quality (COQ) has long been recognised in total quality management (Hall, 2010) and has been robustly introduced into the manufacturing industry. Some would argue that it has also been widely accepted in the construction industry (Jaafari & Rodchua, 2014), although practitioners might disagree. The transposing and translation of the principles, practices, and techniques of quantifying COQ in manufacturing to construction is still very much an ongoing concern (Honnakkera et al., 2010). However, this is not without its challenges (Aoieong et al, 2002; Yang, 2008; Tsai & Hsu, 2010). A case study of construction project COQ by Hall and Tomkins (2001) showed an average of 18.52% of the project contract sum. Surprisingly, others have stated that 50-90% of this total COQ can be attributed to external failure cost (Snieska et al., 2013). This is significant, but may not be surprising when they are one of the most difficult quality costs to evaluate and quantify (Sower et al., 2007 and Taggart, 2014), perhaps because they arise during the operational phase of an asset. There is both a theoretical and a practical need to broaden the study of COQ (Josephson & Saukkoriipi, 2005) to prevent these highly recurrent quality costs.

There are numerous studies, that differ in the concepts that they assess and the quality of the methods they apply (Josephson & Saukkoriipi, 2005). Some fail to provide useful practical information to management (Yang, 2008), which leads to a distortion in the measurement of COQ (Ozkan & Karaibrahimoglu, 2013). Many costs are hidden and not known by an organisation that is not being included during the prevention and appraisal stage (Josephson & Saukkoriipi, 2005), quality issues are accepted as part and parcel of the construction process and so absorbed as day-to-day costs (Abd Razak et al, 2016). Without classification and learning, recurrent issues are repeated leading to higher COQ on all projects.

To reduce COQ, all costs need to be categorized in a systematic and relevant way (Josephson & Saukkoriipi, 2005). Accurate quality cost information and quantification supports an effective quality management system and creates opportunities for improvement (Aniza, 2014; Taggart, 2014; Sineska et al., 2013; Josephson & Saukkoriip; 2005). It has been understood that a wider perspective from the construction supply chain is needed as a driver for continuous improvement in organisations (Davison et. al,2013; Obided-Allah, 2015). However, few have taken the client's perspective to understand the intricacy of the high recurrence of external failure cost. None has explained its inter-relationship with quality management systems in the project process. This study examines the impact of such quality cost for the whole construction supply chain, from client through to lower tier suppliers. It quantifies the cost, the causes and the responsible parties of these operational quality failure issues and finds means of preventing and appraising the causes of failure.

COQ in Total quality management (TQM)

Today the complexity of construction and the sophisticated demands put on suppliers by customers creates a pressurised environment (Love et al., 2002) making it difficult to obtain successful TQM and to reduce failure costs (Krishanan, 2006; Ahsen, 2008; Love & Li, 2000). Root causes of failure costs are not fully understood (Miguel & Ponte, 2003), leading to a lack of control and management of these costs. Many have been forced to reassess their quality, production system and search for new ways to produce higher quality while reducing operating costs.

Juran's (1951) introduction of COQ to TQM was later classified by Feigenbaum (1956) and Masser (1957) into three main categories: Prevention, Appraisal, and Failure (internal and external). Despite this general classification being widely used in various industry, studies have shown many difficulties in applying COQ (Abdul-Rahman, 1993; Love & Li, 2000; Hall and Tomkins, 2001; Aoieong et al, 2002; Rosenfeld, 2009; Love & Irani, 2010; Jaafari & Rodchua; 2014). A more dynamic model needs to be integrated (Snieska et al., 2013) to support the reduction of failure. This has become a challenge to traditional COQ in delivering TQM, to not only focusing on achieving low COQ, yet to include integrated collaborative work in the construction supply chain.

External failure cost in construction project

The used of COQ can increase profitability by reducing the operating costs incurred from poor-quality processes and project failures. It is therefore key in managing a business strategy (Tye et al., 2011). External failures (failure cost during operational performance) are considered as the most significant in quality cost, but are also most difficult to evaluate (Snieska et al., 2013). Studies by Miguel & Pontel (2003) showed that external failure costs are not broadly assessed, although the study focuses on manufacturing companies, the construction industry may have similar in terms of

COQ. Many have now questioned how to calculate and estimate the failure cost to maximise benefits from COQ. For Love (2002) failure costs are hidden in the process and could be up to 25% during the construction stage. Therefore, there is an increasing necessity to understand the implementation of COQ and resolve the misalignment of incentives that work against the achievement of quality during the production process (ISO9000).

The complexity of the supply chain in the operational environment is seen as core in supporting the QMS systems in measuring COQ thus reducing failure. To achieve this, organisations must first synchronise internal sections (Jaafari & Rodchua, 2014) while at the same time improving quality (Shah & Mandal, 1999). Research is thus needed in quality costing systems and operational performance (Shah & Mandal, 1999) so as to quantify the cost of failure (Omar & Murgaan, 2014).

Notably, there has been insufficient research in regard to the external failure cost (Taggart, 2004; Mukhopadhyay, 2004; Freiesleben, 2005, Castillo et al., 2010; Snieska et al., 2013). Previous studies focus on the quantification and definition as well as the improvement of COQ. The discourse within this literature is limited to the COQ during prevention and appraisal categories (Jaafari & Rodchua, 2014). New methodology is needed to support a reduction in COQ failure during post project, i.e. the operational stage (External failure cost). Due to the complexity of project handover there are still costs accrued by the supply chain, which make difficulties in measuring COQ.

The appraisal of external failure cost

As the exploration of external failure cost has not been well explored, the level of maturity of construction industry owners and the supply chain was seen to be at low or at best moderate levels, while the ability to influence operational failure appeared to be very clear (Abd Razak et al., 2016). Thus, broadened initiative with collaboration from the whole construction industry is needed to make a significant reduction of COQ (Jospehson & Sauukkoripi, 2005). This study will combine principles, process, a framework and structured methods as suggested by Shiffauerova & Thomson (2006), and uses a focus on failure cost from the owner's perspective as the test case to understand the details of implementing COQ. As operational failure is the highest contributor when ignored (Ahsen, 2008, and Lari & Asllani, 2012) and so provides the greatest opportunity for efficiency improvement (Miguel & Pontel, 2003).

An initial study

In appraising the external failure cost, a COQ model developed by the Chartered Quality Institute (CQI) ConSIG has been used in validating the external quality cost element. Thirteen external quality costs have been identified and tested throughout the study (See Figure 1). This study is a continuation of a pilot study in appraising external failure cost (see Abd Razak et al., 2016) whose aim was to understand how the complex interrelationships of construction supply chain members may influence the existence of external failure cost. The study used an expert workshop and a trial questionnaire involving construction industry experts (both owners and their supply chains) to show the various categorisations of external failure quality cost elements and explored the complex nature of its measure through the construction supply chain.

This initial study indicates that in regards to external failure costs, the maturity within the industry is relatively low (where the sample was made up of clients, contractors and suppliers). The analysis demonstrated that quality cost is believe as an exchange/transition cost and can be classified in different ways depending on projects or sectors.

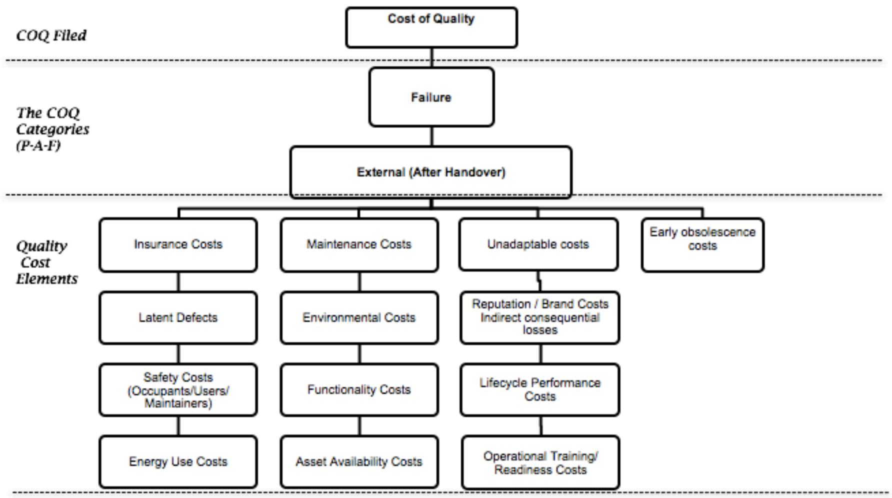

Figure 1.0: The COQ field and classification of quality cost elements (Sources: Chartered Quality Institution)

It was found that external failure costs were not only categorised and incurred differently by various members of the owner and supply chain, but these costs were absorbed into day-to-day operational costs and not categorised or quantified.

Research Method

Building off the first stage, this paper refers now to the second stage, which explores the perspective of the client (owners) in regards to the occurrence of these external failure costs. This study consists of first a web-based survey (n=17) and then case study interviews (n=7). An expert Delphi review has been used in selecting the sample for both surveys and interviewees.

The web-based survey was issued to quality managers from owners and contractors in the UK construction industry who have experience from more than 50 projects ranging from PFI (n= 6), Private sector (n=5) and central government (n=2) projects. Half of the participants had experiences within airport construction, five others within railways and hospitals. The overall budget of annual capital programmes ranged from £500million to £1 billion and the budget for quality management was said to range from 0.3% to 0.5%.

The case study interviews were conducted with a major UK construction industry repeat client. As the first stage of the interviews, six projects have been identified and seven project managers from each project have been interviewed to understand the operational quality issues, specifically they explored (see Figure 2.0) how external failure elements occurred within the project –specific operational issues. It is to see how the project context and structure influenced operational delivery and quality and finally to understand the cause of operational quality issues (failures).

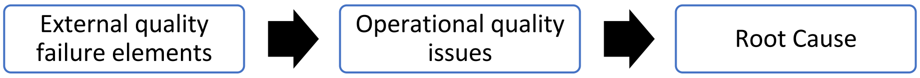

Figure 2.0: The methodology process

Questionnaire Findings and Discussion

The finding from the questionnaire shows that quality managers perceive that they understand and well manage external failure quality cost elements (see Table 1.0). There was strong agreement by quality managers on maturity. Most elements were perceived to be “managed”, however one element - “unadaptable” was less well defined and some believed that they were unaware of this cost element. These finding show significant contrast from previous research (see Abd Razak et al., 2016) that showed that the maturity of other supply chain members is perceived to be relatively low. Maturity in dealings with COQ is crucial in implementing a successful quality management programme (Schiffauerova & Thomson, 2006). The dissimilarity of maturity levels between quality managers and other in the supply chain shows incoherent in terms of information transmission of the quality management system during the project process within the construction supply chain. Thus, the complexity within all supply chain partners to deal with these external failure elements requires further investigation and a new mechanism to share and align capabilities among all those in the supply chain to reduce external failure cost is needed.

	Failure cost elements												
	Insurance	Latent Defect	Safety	Asset availability	Energy use	Maintenance	Environmental	Lifecycle performance	Functionality	Unadaptable	Early obsolescence	Reputation	Operational Training
Level of maturity	QM	QM	QM	QM	QM	QM	QM	QM	QM	QM	QM	QM	QM
Unaware	1									1	1		
Aware	1		1		2	1	1	1	1	3	1	2	2
Defined		3	2	3	2	1	2	3	2	2	2	2	
Managed	6	5	4	5	4	5	4	4	5	1	4	4	5
Optimising			1	1		1	1						1

Table 1.0: Quality Managers (QM) level of maturity in measuring external failure cost elements

In terms of the level of influence, quality managers were confident in their ability to influence operational failure but not with their tier 1 contractor’s and tier 2 and 3 suppliers’ (see Table 2.0) This finding is similar to previous research which showed there is a strong capability to influence the operational failure from the owner and supply chain (see Abd Razak et al., 2016).

Efficient and advance quality systems have a strong relationship in reducing operational failure. Yet, who influences the implementation of quality systems in coordinating quality cost requires further investigation. Some qualitative comments by quality managers showed they had a significant influence on operational failure as they had full control of operational issues, they are well aware of operations and maintenance and well established/defined in the link of collaborative working, these need further clarification.

Level of maturity	Tier 1 contractor's QM	Tier 2 and 3 supplier's QM	Overall ability to influence QM
Unaware	1	1	
Aware		1	
Partial implementation	1	1	1
Managed	2	1	2
Optimising	1	1	2

Table 2.0: The level of maturity in influencing optimisation, integration and continuous improvement of operational quality issues ascribe to Quality managers (QM)

Case Study Interview Findings and Discussion

Semi structured interviews were conducted to get greater insight in appraising external failure cost. Table 3.0 shows initial context analysis derived from the interviews with seven project managers. Operational quality failure issues were identified in different projects using the external failure quality cost elements (Figure 1.0). Careful description of operational failure was used in getting a great variation and severity in language deficit across participants and gaining multiple project- specific issues. It is also to prevent confound behavioural from participants. Thus, an interactive open conversation has been achieved with all client project managers in exploring the operational quality issues. This may not be experienced when it involves contractors and suppliers who have more risk in taking responsibility for failures.

The table shows that different quality cost elements arise in different issues with at least more than two elements incurred in each quality failure issue. A project is seen as complex and evolving process; thus COQ is embedded and dynamic. Table 3.0 shows that ‘maintenance cost’, ‘asset availability cost’ and ‘lifecycle performance cost’ are most frequently occurred across the six projects. It is interesting where these quality cost elements were ascribed to be incurred with either as cost of poor quality or saving to COQ, the distribution of COQ at some point is seen as giving a long term saving in some of the quality cost elements. As an example, the cost of correcting the quality issues may lead to further savings in ‘maintenance’ or ‘life cycle cost’ of a project. This require greater investigation in the next stage of this study on how the distribution of COQ could lead to future savings of total quality cost.

	Project A							Project B			Project D		Project C				Project E				Project F			Total
Interviewee	PM (1)				PM (7)			PM (2)			PM (4)		PM (3)				PM (5)				PM (6)			
Project Budget	£150m				£150m						£30m-50m		£30m				£30m				£30m			
Operational quality issues	*I1*	*I2*	*I3*	*I4*	*I1*	*I2*	*I3*	*I1*	*I2*	*I3*	*I1*	*I2*	*I1*	*I2*	*I3*	*I4*	*I1*	*I2*	*I3*	*I4*	*I1*	*I2*	*I4*	
Who was involved																								
a. Owner/operator	•	•		•	•			•			•	•	•	•	•			•	•		•	•		
b. Integrator/main contractor	•	•	•	•	•			•				•	•	•	•	•		•	•		•	•		
c. Advisor/consultant/designer		•		•	•			•													•			
d. Supplier/sub-contractor	•				•							•												
Quality elements																								
1. Insurance costs			✓			✓	✓			✓		saving					✓				✓			7
2. Latent defect Cost	✓	✓	✓		✓	✓	✓		✓				✓				✓				✓		✓	11
3. Safety costs for operators	✓	✓	✓								saving		✓				✓							6
4.Asset availability costs	✓		✓						✓	✓	saving	saving	✓	saving		✓	✓	saving	saving		✓	✓	✓	15
5. Energy use cost	✓										saving			saving					saving					4
6. Maintenance costs			✓	✓	✓	✓	✓	✓	✓	✓	saving	saving	✓	saving	saving		✓	✓	saving	✓		✓	✓	19
7. Environmental costs	✓	✓	✓												saving									4
8. Lifecycle performance costs		✓	✓	✓				✓	✓		saving	saving	✓	saving	saving			saving	saving			✓	✓	14
9.Functionality costs		✓	✓						✓		saving	saving			saving									6
10. Unadaptable costs			✓								saving			saving										3
11. Early Obsolescence costs													✓				✓	✓						3
12.Reputation/Brand costs (Indirect consequential losses)			✓			✓	✓				saving	saving				✓	✓						✓	8
13. Operational training/ readiness costs	✓	✓	✓		✓				✓	✓	saving		✓	✓						✓	✓			11
Total	6	6	**11**	2	3	4	4	2	5	3	9	6	7	6	4	2	7	4	4	2	4	3	5	

Table 3.0: Distribution of external failure quality cost elements in operational failures

The occurrences of operational quality failure were also elucidated to have a huge relationship to the project procurement approaches. For example the quote below from a PM shows that the client frequently relies on the contractor's 'self-assurance' or 'self- certification', while the speed of delivery and the contractor's capability may lead to non-compliance issues. Thus, the procurement process plays an important role in preventing operational quality issues.

> *"Unfortunately, because of the contract model we use it [is] supposed to be competent contractors [self-certification]…one thing that I've always questioned is if you have a contractor that's one thing, but you are reliant on those people to know how to do exactly as the designer says."* [PM]

The project manager also stated that the quality issues are recognisable, but that the expertise and the responsibility for resolving an issue is key (as in the quote below). Urgency in completing the project was deemed to be a more important point in avoiding reputational cost, but this then led to a lack of problem fixing.

> *"…we still did managed to get into a situation where everybody took a picture of something that was wrong, so at some point people didn't know what they were doing. .. it was time constraint because it was slightly behind and we need to get it finished…"* [PM]

Operational delivery on time was considered to be the overwhelming factor that caused quality issues as the quote below shows.

> *"…because that end date doesn't move, you will eventually end up with quality issues that will impact operations and nobody has any real influence over them. They don't know..Not even the client I think…yeah, No. Because there's a much bigger picture. "*

There was awareness among project stakeholders that there were failure costs emerging on the project, however, "doing it right first time" was not always delivered on because of the strong emphasis on delivering the programme and achieving the project deadline as stated in the quote below.

> *".. the technical experts or technical team would critique something, but because of the nature of the schedule, [these] would almost pale into insignificance because – yeah whatever. We've got to get it done."* [PM1]

Project success was predominantly focused on a strong need for working together as a team. a dependency on experienced people, and the availability of technical expertise. Also, the need to deal with failures as opportunities that require solutions, rather than blaming others as is shown by the following quote, which makes reference to a successful project which averted failure (as these quotes below show).

> "*…we were all in creative environment, we were all in it together…If I fail, security couldn't operate properly..there's no blame..just, purely, we need to push it over the line" and "When we find a problem, let's just crack on with it. Keep going, keep going and keep going… And that's what we did. So, it was just, that team culture actually."*

This shows that external failure costs can if identified be managed to reduce cost. Long term savings will be realised by organisations that spread learning throughout their construction supply chain and support collaborative working.

Conclusions

The nature of COQ is still in its infancy in terms of its application in construction. From the client's perspective, the interdependency amongst the supply chain is still lacking in considering how COQ could be of benefit to all. This initial stage of appraising external failure cost shows, the quality management team must work with the whole supply chain to deliver improvements in quality.

Understanding of COQ may help to integrate measures to understand the distribution of external failure cost across the supply chain. It may also allow prevention and appraisal of failure to reduce the occurrence of failure. However these studies have shown that a quality management system that addresses COQ must be well managed to build strong collaborative quality relationships between all parties.
The finding presented in this paper are the result of an ongoing research study on the failure cost in construction industry. Further research is needed to develop and integrate measures into the complex construction supply chain.

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