

Assessment of Requirements for Establishment of a Framework to Enhance Implementation of Quality Practices in Building Projects

Amirhossein Heravitorbati, Vaughan Coffey, and Bambang Trigunaryah

Abstract—Quality, in construction projects should be regarded as the fulfillment of expectation of those contributors involved in such projects. Although a significant amount of quality practices have been introduced within the industry, attainment of reasonable levels of quality in construction projects continues to be an ongoing problem. To date, some research into the introduction and improvement of quality practices and stakeholder management has been undertaken, but so far no major studies have been completed that comprehensively examine how greater consideration of stakeholders' perspectives of quality can be used to contribute to final project quality outcomes. This paper aims to examine the requirements for development of a framework leading to more effective involvement of stakeholders in quality planning and practices thus ultimately contributing to higher quality outcomes for construction projects. Through an extensive literature review it highlights various perceptions of quality, categorizes quality issues with particular focus on benefits and shortcomings and also examines the viewpoints of major stakeholders on project quality. It proposes a set of criteria to be used as a basis for a quality practice improvement framework, which will provide project managers and owners with the required information and strategic direction to achieve their own and their stakeholders' targets for implementation of quality practices leading to the achievement of improved quality outcomes on future projects.

Index Terms—Construction project delivery, Continuous improvement, Project quality, Stakeholder management.

I. INTRODUCTION

The concept of quality has played a significant role in the business management literature since the improvements in production and product quality for a global market began in Japan in the 1950s. During the last decade, many construction firms have been critically challenged to achieve higher and superior quality on their projects and in recent years more attention has been paid to implementing and improving quality management in the construction sector.

However, due to the high cost of poor quality on many construction projects, additional research is still required to provide a framework for improvement of project quality outcomes [1]. Quality management philosophies have been

recognized as successful drivers for management strategies in other industries [2] but although the construction industry has seen increasing advancement of the use of science and technology within the sector, the adoption of quality management practices based on the stakeholder view of quality [3] has made an impact at a much slower pace [4]-[6].

Therefore, the development and establishment of more effective communication methodology between project participants and construction producers, in order to better align quality management actions in the construction industry both to meet the stakeholder view of quality as well as complying with specifications, is clearly one potential benefit that can result from further research and development at the present time.

This paper is based on an extensive literature review undertaken for a PhD thesis and identifies common and serious quality problems/defects in construction projects and highlights the main causes, which most often result in quality failures. Categorization of these problems/issues forms the basis for a preliminary model for a future quality improvement framework specifically for use on building construction projects.

II. QUALITY PROBLEMS IN BUILDING PROJECTS

Establishment and achievement of acceptable levels of quality in construction projects has long been a problem [7] but despite a significant amount of investigation already being undertaken to examine quality failures and their causes, construction projects are still encountering numerous quality problems. As stated by Xiao [8], poor quality performance that results in increased rework and has significant impacts on cost and schedule is among the major defects experienced in construction projects. According to Pheng [9] drawing and specification are not at satisfactory levels of quality and do not clearly always state the intention of the designer. According to Arditi [10] these documents are the final result of design phase that leads to the physical construction of the project and therefore have an effect on the quality of the final project outcomes. Seaver [11] affirms that successful companies need to meet their customer expectations through superior implementation of their quality policies, however currently many customers are still not satisfied with the quality of constructed projects. Construction materials sometimes do not meet specified standards and this also leads to subordinate quality on projects [9]. Serpell [12] points out that the lack of qualified personnel is a major barrier in the compliant implementation of quality systems, whilst in the view of Jha

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and Lyer [13], quality negligence produces many negative effects to construction companies achieving the desired levels of quality and additionally and low quality process implementation leads to the often ultimate poor quality of projects [1]. A lack of attention to a quality-based supportive work environment, wastage of materials, high fragmentation of systems [14] and manpower and duplication of cost, are among the most serious problems of quality in construction project and these unsatisfactory issues continue to plague every sector of the industry and it's projects [7]. Table I provides an overview of quality problems and shortcomings which are common during construction building projects.

TABLE I: QUALITY PROBLEMS

Quality Problems/Issues	Authors
Customer dissatisfaction	[7], [9], [15], [16]
Quality negligence	[13], [17]
Clean and safe construction site	[9], [16]
Non clear-precise drawing	[9], [10]
Lack of meeting standards/codes	[9], [18], [19]
Poor statistical method application	[7], [20]
ISO fault implementation	[21]-[23]
Traditional quality attitude	[16], [24]
Low quality Materials/Equipments	[1], [9], [22], [25]
Lack of qualified personnel	[12], [16], [21]
Non availability of document	[12], [13], [22]
Poor quality performance	[16], [21], [26]
Poor quality inspection	[16]
Lack of measurement and feedback system	[7], [15], [27]

As shown in Table I, despite efforts of building companies to introduce better quality processes construction projects are still encountering various quality problems. However as supported by many scholars [10], [13], [16], [19], [28], [29], one of the barriers which most often results in successive serious quality defects in construction building projects, and that is not shown in the standard list of factors, is the lack of project participant involvement in quality planning and practices.

Whilst stakeholder involvement has been emphasised as an important factor that affects quality, this issue has not been fully adopted or addressed in building projects, nor is it prevalent in previous research [12], [15], [16], [19], [21], [23], [28], [30]-[32].

III. INCORPORATION OF STAKEHOLDERS PERSPECTIVE ON PROJECT QUALITY

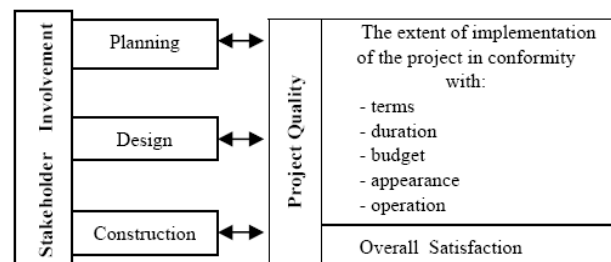
Because quality management is such an important aspect in construction and building projects, in order to increase the ultimate project quality and to reduce rework, revision and waste and failure costs over the entire project lifecycle, the importance of greater involvement of all relevant project participants in quality management issues needs to be fully understood and embraced by project teams. Additionally, it should be noted that best-practice construction project management involves meeting or exceeding stakeholder requirements and expectations and thus project teams have to develop high-quality relationships with key project members, in particular with the main customers of the project, in order to understand the perception of quality more systematically [33]. Many studies have been undertaken regarding the capability of properly

implemented quality management systems to improve the ultimate project quality [7, 19, 34-36] and the question of the affirmative influences of stakeholder involvement upon project success has also been addressed by many other scholars [37-40]. However, the creation quality teams based on the incorporation of project participants into the planning of construction and building projects has not as yet been considered significantly [41]. According to Heravitorbati [42] if project key members are not satisfied with the quality of the project, the project team will have to adjust scope, time and cost to balance the non-meeting of stakeholders requirement and expectations on quality issues. For these reasons, it is imperative that greater focus is placed on the incorporation of stakeholder points of view with regard to establishing processes and practices designed to improve the quality of building projects.

IV. POTENTIAL STAKEHOLDER IMPACTS ON QUALITY OF BUILDING PROJECT

Many stakeholders are involved in the provision of construction projects and each of them has their own role, requirements and objectives. To meet the differing demands of the various stakeholders, project managers have to involve them in planning of projects in order to increase the effectiveness and efficiency of the decisions which are made during the construction project lifecycle [43]. Wang and Huang [44] confirm that effective relationships among key stakeholders are helpful in improving quality of a construction projects and Deming [45] declares that the customer's (stakeholder's) perspective of quality levels is critically important. According to Walker [41] there is a gap in previous studies and he affirms that the implementation of quality efforts is often hindered by a lack of attention to the expectation of the stakeholders' views of quality in the construction industry.

Yang [32] placed an emphasis on the recognition of the fact that there are several stakeholders whose expectations and influences must be included in the project management process. More importantly, it has been emphasized that if a project's stakeholders are not satisfied with the quality of the project management or of the ongoing project outcomes, the project team will as a result be required to adjust scope, time and cost in order to meet the stakeholders' requirements and expectations on quality issues. Bubshait [46] provides us with a clear interaction between project quality and stakeholder involvement shown in Fig. 1.



Source: [Adapted from 46]

Fig. 1. Relationship between stakeholder involvement and project quality.

This figure shows that project quality can be measured by determining the degree to which the implementation of the project is in conformity with terms and specifications,

duration, budgets, aesthetics, operation, and the stakeholders' overall satisfaction with project quality. It affirms that stakeholder integration in different phases of a project lifecycle is in direct and mutual relationship with the project quality. However, the planning phase of a project seems to be the most significant since the majority of the vital decisions are completed at this stage and success of the design, construction and post construction phases highly depends on the appropriate decision made during this phase [47], [48]. According to Griffith and Sidwell [49] the planning phase, among various phases of construction project lifecycle, has the highest ability to influence on total project cost. Additionally, Arditi and Gunaydin [7] substantiate that generating the project requirements for quality begins at project planning and according to Leszaka [50] attaining of a higher quality in the early phases of a project results in fewer defects to be found and repaired in the later parts of the process.

From such observations, it can be concluded that effective and efficient involvement of project participants in the quality planning phase will better assist in improving the total quality of a constructed project.

On the other hand, the quality of a project is influenced by a vast number of other issues, the majority of which negatively affect quality. However, appropriate realization and implementation of such issues can aid in overcoming a large amount of the more serious quality problems. The next section provides a comprehensive explanation of the most important factors and sources related to poor quality outcomes.

V. QUALITY DEFECT SOURCES AND CAUSES

A variety of authors have provided different categorizations of quality problems, but there have been few attempts to collect together and unify the major sources and factors that affect quality in a comprehensive manner. This paper utilises such classifications of quality problems in the extant literature and attempts to bring together a set of the most notable factors influencing quality and categorizing under four main headings as:

- 1) Stakeholder managerial
- 2) Technical
- 3) Environmental/material and equipment
- 4) Cultural and political

This classified list provides a source of arranged information that can be used as a foundation for proposing an improved quality framework for implementation in building construction projects.

A. Stakeholder Managerial

Key stakeholders are usually considered to be responsible for many of the current quality problems/defects that occur in construction building projects. As stated by Jha and Lyer [13] one of the most important factors which has an indisputable affect on project quality is the efficient communication between parties involved in construction projects. Although other authors such as Arditi and Gunaydin [10] confirm that high quality projects mainly depend on the relationship among parties involved, this idea of greater and more directed strategic involvement and management of the key stakeholders of a construction

project has not been considered specifically to date [24]. To achieve the desired level of project quality, one of the most substantial issues is the efficient implementation of key project management practices [51]. According to Yung and Yip [29], management roles and issues have a significant impact on project quality. Deming [45], placed great importance on the responsibility of management, regarding management to be responsible for 94% of quality problems. Additionally, one of the factors which often results in quality problems is the apparent lack of incorporation and emphasis of the views of owners in order to articulate their needs and objectives with respect to the quality issues [30].

According to Pheng and Wei [9], ignorance of quality issues by contractors is a major factor negatively affecting quality. Contractors sometimes do not have enough skills to interpret the design drawings so they are not able to provide the end products on site in accordance with the design and specifications and it is also argued that due to the lack of knowledge to establish a quality system, contractors cannot control the work properly [9, 13].

Pheng and Wei [9] continue this theme by noting that one of the main challenges in better implementation of quality is the involvement of subcontractors into quality planning and implementation. Since subcontractors are the ones who actually carry out the onsite work, their incorporation and communication to get to the quality initiatives has a high significance [9, 16, 19]. The necessity for supplier involvement in any programme for quality improvement also has been pointed out by a number of scholars [15, 20, 31] and Arditi and Gunaydin [10] affirm that supplier involvement can help in decreasing divergence in the construction process.

B. Technical

There are however number of other factors that result in poor quality in construction building projects. As stated by Pheng and Wei [9] most of the time drawings and specifications do not indicate clearly the intentions of the designers and since drawings are the only documents given to the constructor to illustrate the design concept, size and scope of the work, number and dimension of materials or items, then provision of inadequate information by way of poor drawings and specifications leads to a lower quality of final constructed project [7]. It has also been emphasised that the relationship between non clear/precise drawings and poor coordination among project participants has a similar detrimental effect [9]. On a related issue, Arditi and Gunaydin [7] argue that the establishment of a data collection system can help construction companies to set up an information base which can lead to an earlier recognition of defects (including quality defects).

However creating such a system is difficult in the construction industry and results in recurring defects; as Leonard [16] states, quality tools and techniques have been disregarded by considerable numbers of construction companies which in turn has lead to a less comprehensive overall understanding of quality [52] and ineffectual problem-solving methods.

C. Environmental, Material, Equipment

Environmental issues and the use of incorrect or low quality construction materials have been regarded as factors with notable impacts on projects quality. As stated by a

number of scholars, construction projects usually have some specific factors which can adversely affect quality and customer satisfaction [13, 20, 21, 53, 54]. Some of these factors include project nature, uniqueness [21, 26], project size and scope [13], environment and complexity of project [21].

In addition lack of attention to appropriate resources such as financial, material, human resource, technical, etc., are also causes which result in poor quality projects [20, 29]. These researchers also advocate that the availability of resources is an important issue that needs to be considered. According to Pheng and Wei [9] construction materials which are chosen by a consultant do not always meet the standards of building control authorities and this has an negative impact of project quality.

D. Cultural, Political

Although generally cultural and political issues have the lowest impact on project quality, they still need to be taken into account. Lack of motivation and care have been regarded as most frequent human errors in the origins of quality defects [12, 55].

As stated by Leonard [16] quality culture is a significant factor in successful implementation of quality and if employees of a construction project recognize the value of their performance in an appropriate manner and with the appropriate amount of care, then motivation will be a necessary driver of their quality culture [22, 56] and stakeholders therefore need to set up a number of actions in order to achieve workers' commitment to any quality improvement systems [12].

According to Marosszky [23] a low tendency to teamwork among project employees is the consequence of variety of factors and management teams are responsible to eliminate such a dynamic. Inappropriate tendering procedures also lead to poor quality. For example, aggressive competition during tendering forces participants to quote lower than the feasible actual price for completion of the project and also to allow them to make a reasonable level of profit. Such a perspective subsequently results in the application of imperfect materials and provision of an inferior technical performance and this causes lower quality on projects [13, 21].

Fig. 2 provides a comprehensive checklist of the sources of quality defects in construction building projects.

VI. DISCUSSION

As shown in Fig. 2, quality failures originate from various sources of defects such as technical, environmental/material/equipment and cultural/ political defects. However, poor stakeholder management appears to be one of the most fundamental and important causes of quality failures in many cases and the critical roles played by owners, management team, consultants, contractors, sub contractors, suppliers and final customers on project quality success has been supported by many researchers [7, 16, 19, 29, 57]. Contribution of the key project participants in assisting to prepare quality management plans and shaping quality practices not only facilitates construction companies to solve those problems which are directly related to

stakeholders, but is also a great help to overcome other problems which arise from other sources of defects such as technical, environmental and cultural. For instance, as stated by Pheng & Wei [9], appropriate incorporation between stakeholders in the design and construction phase can result in higher quality of drawing and specifications. Arditi and Gunaydin [10] also recognise management as being responsible for encouraging employees to work as a team and advocate the significant influences of teamwork on final project quality.

From such observations it can be concluded that stakeholder incorporation within quality management planning and proceeding will facilitate greatly in solving large numbers of quality problems in building projects.

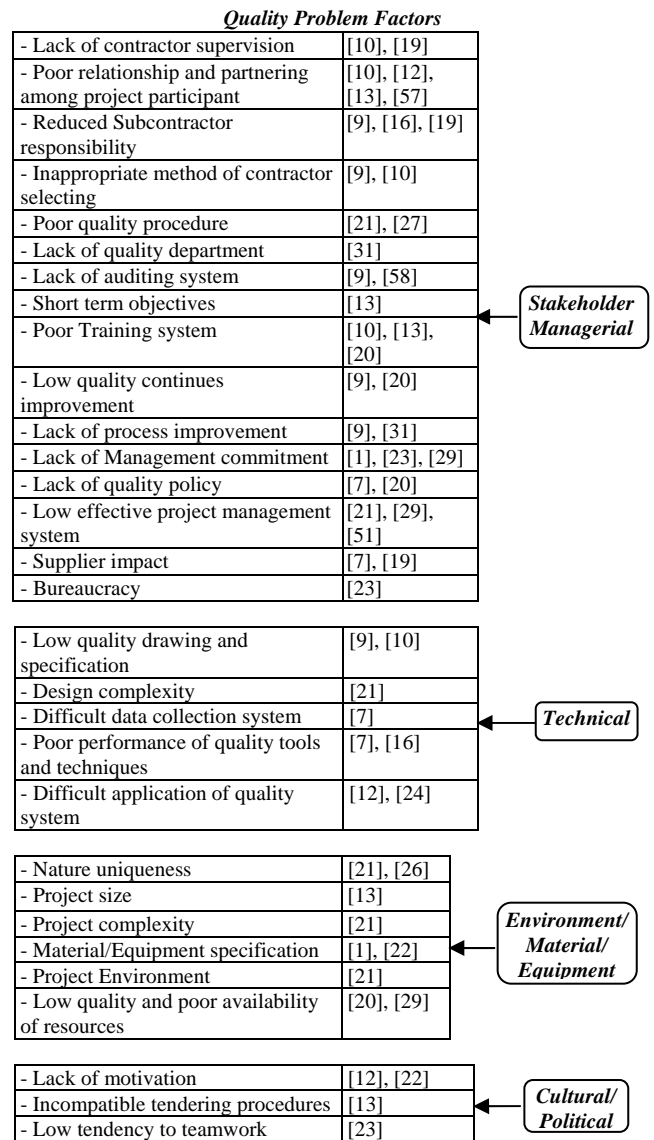


Fig. 2. Sources of quality defects in building projects.

VII. CONCLUSIONS

Good quality management and full stakeholder involvement are clearly regarded by many authors and researchers as two major success factors in construction projects. The research described in this paper has extracted and identified current quality defects, problems and issues which commonly arise during a typical project lifecycle and

categorized them under four main headings, namely, stakeholder managerial, technical, cultural/political and environmental/ material/ equipment. Based on this set of classifications the next phase of this research will undertake a number of surveys and case studies from which to develop a framework for better and more focused implementation of quality practices on building projects, designed to encourage and utilize better stakeholder integration within critical quality management procedures. The paper also affirms the role of project participants as having an undeniable impact on quality of projects and highlights the fact that whilst lack of stakeholder involvement is indeed a major problem and results in subsequent defects found within construction building projects, incorporation of greater stakeholder involvement into quality planning and practice is a immense help in solving considerable amount of quality failure issues and accordingly improving construction project quality outcomes.

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