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Project Quality Management

Critical Success Factors for Buildings

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ISBN 978-981-287-073-5 ISBN 978-981-287-074-2 (eBook)
DOI 10.1007/978-981-287-074-2
Springer Singapore Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014937268

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Project Quality Management

Abbreviations

BCA	Building and Construction Authority
BSCQ	Bonus Scheme for Construction Quality
BSI	British Standard Institution
CEA	Construction Excellence Awards
CM	Construction Management
CONQUAS	Construction Quality Assessment System
CSF	Critical Success Factor
eNPQS	Electronic National Productivity and Quality Specifications
GIP	Good Industry Practices
HRM	Human Resource Management
IQUAS	Information on Construction Quality
ISO	International Organisation for Standardisation
ITA	Independent Testing Agency
M&E	Mechanical and Electrical
MM	Materials Management
PDCA	Plan Do Check Act
QA	Quality Assurance
QC	Quality Control
QCC	Quality Control Circle
QM	Quality Mark
QMS	Quality Management System
QMU	Quality Management Unit
SCM	Subcontracts Management
SM	Schedule Management
TQM	Total Quality Management
WTT	Water Tightness Test

Abstract

Intensifying global competition and increasing demand by clients for better quality have caused more and more companies to realise that they will have to provide quality products and/or services in order to successfully compete in the marketplace. However, good quality is hard to achieve and sustain. Ensuring workmanship quality is tough, particularly in the construction sector, where clients expect the final built product to be of high quality but low cost and constructed in the shortest time possible. Hence, contractors are facing increasing complexities to improve workmanship performance.

According to Deming, without measuring something, it is impossible to improve it and this means that one needs to determine the quality management criteria and measure its effect on workmanship performance. In Singapore, there is a defined quality performance measurement system called the Construction Quality Assessment System (CONQUAS) which has proven to be a challenging task for contractors to achieve a high score. There is therefore, a practical value, of researching on the Critical Success Factors (CSFs) for achieving high CONQUAS scores by contractors.

This book primarily focuses on quality issues involved and the 33 CSFs identified as a means of developing a CONQUAS management framework for optimum workmanship quality management. These literature findings are then tested through a survey questionnaire and supported by three interviews and one case study conducted. The results show that while the CSFs identified are known tenets of quality, they are still not being followed. Thus, it is important that the Building and Construction Authority (BCA) plays an important role to implement the proposed CONQUAS management framework on a national level to compel all contractors to adopt this model on a full scale and reap the benefits of being an enthusiast of adhering to the CONQUAS workflow.

Keywords Construction quality assessment system • Critical success factors • Project quality management • Singapore

Contents

Chapter 1
Introduction

1.1 Background

Quality has been a key issue in the construction industry since the late 1980s, with 37 % of all construction projects reporting major defects (Sullivan 2010). Murray (1993) commented that the low level of quality may be attributable to the fact that the industry was impervious to modern change and was structured as if nothing had changed in the last 50 years. In fact, the construction industry consists of numerous parties, each of which has a role to play in ensuring the quality of the product. The poor performance of one party will affect the performance of the next party. In addition, excessive changes to the details of the design of a project are typical throughout the construction process (Koehn and Regmi 1990). Quality performance is thus difficult to ensure. Poor performance will lead to disputes and adversarial relations between the parties which will again put future performance at risk, thus forming a vicious cycle of poor quality performance (Kanji and Wong 1998).

As a result, the construction industry has become inundated with serious problems in quality standards and requires the successful implementation of a quality management system (QMS) to deliver a consistent quality product and a platform for continual improvement. In Singapore, a firm-industry-national framework, namely the construction quality assessment system or CONQUAS and the International Organisation for Standardisation (ISO) 9000 were implemented by the Quality Development Unit of the Construction Industry Development Board, the predecessor of the building and construction authority (BCA), to improve quality performance.

1.1.1 Quality Management System

According to Crosby (1979), quality management is a systematic way of guaranteeing that organised activities happen the way they are planned. It is a management discipline concerned with preventing problems from occurring by creating the

S. P. Low and J. Ong, *Project Quality Management*, DOI: 10.1007/978-981-287-074-2_1,

attitudes and controls that make prevention possible (Saarinen and Hobel 1990). There are various QMSs which approach an organisation through different routes with the same goal in mind, that is, to achieve and sustain a high-quality output by conforming to requirements and meeting customer satisfaction requirements (Sullivan 2010). In fact, many construction-related firms have been implementing several QMSs to provide assurance that they can meet client's requirements, sustain their competitive advantage and, most importantly, manage quality problems.

The development and implementation of a sound QMS for use in the construction industry is indeed a necessity and not an option (Ramsey 1984). QMSs have to be directed and controlled with excellence so that high-quality buildings can be achieved. However, the quality of the implementation of these QMSs in individual construction companies is a matter of some debate (Conchúir 2011). Researchers claimed that the primary reason for certain companies to employ QMSs is simply to satisfy the mandatory requirement of the client rather than taking the full advantage of the QMSs to enhance their practices on a continuous basis (Ng 2005). This phenomenon is worrying as it is vital that all contractors are sincerely committed to apply practical strategies throughout planning, design and construction to achieve quality as outlined in the Project Management Body of Knowledge.

1.1.2 International Organisation for Standardisation 9000

Among various QMSs, ISO 9000 certification has been widely adopted by the construction industry of many countries (Ng 2005). The ISO 9000 series was launched to ensure quality standards are built into the operations to achieve consistency in the end product, and many contractors in Singapore have been accredited (Ofori et al. 2002). Moreover, the Singapore government has made it mandatory for larger construction and consultancy firms to achieve ISO 9000 certification as a pre-requisite for public sector projects. As of December 2012, 125 contractors, 8 public agencies and 47 consultants have been BCA ISO 9000 certified, while there are 12 property services and project management firms as well as 7 suppliers who are BCA ISO 9000 and Japan Quality Assurance Organisation certified in Singapore as compared to the extremely low figures when the scheme first started in 1991 (BCA 2012d). This shows that the IS0 9000 standards are beginning to play an essential role for contractors to have constant improvement in their processes, products and services, so much so that many contractors cannot choose to ignore the powerful influence of quality management.

Nevertheless, the ISO 9000 series only provides the foundation of a QMS. The only way to know whether a company is improving its overall quality is to measure periodically and compare the results after implementing any process or system with the historical results (Robert and Linda 2000). The way of measuring has to be as objective as possible to avoid subjective and confusing information that could lead to misinterpretations. A good measuring and fairly accurate system developed in Singapore by BCA is CONQUAS.

1.1.3 Construction Quality Assessment System

CONQUAS is used to measure the level of quality achieved in a completed building project using numerical scores. As part of the overall QMS, it provides a trusted and comprehensive assessment system to validate the contractor's workmanship excellence. It provides technical specifications for contractors to understand the required quality standards. Today, CONQUAS assessment is compulsory for all public sector projects with contract sum above S$5 million under the bonus scheme for construction quality (BSCQ) and private projects with CONQUAS requirement under individual contract agreement. It is voluntary for all other new building projects. BSCQ is set up to promote the upgrading of workmanship in the construction industry, in other words, to encourage contractors to achieve higher CONQUAS scores. Contractors will be paid a bonus for government projects or based on their individual agreements for private projects if their quality of workmanship exceeds a stipulated score. However, they will be penalised if their quality workmanship is poor. Expectations of quality standards by owners are ever-increasing, and hence, securing good CONQUAS scores should be a priority for all contractors to meet the changing demands of the construction industry.

1.2 Research Problem and Hypothesis

The demand for better workmanship of contractors has become more important in recent years (Griffith 2011). Firstly, owners and developers are better informed of good construction practices since the government stepped up stringent measures against building defects which put them in a better position to bargain and demand for quality than in the past. Secondly, the influx of reputable foreign contractors has meant a more competitive market environment and generated a need for the contractors to differentiate themselves by the workmanship quality which they can deliver (Oswald and Burati 1992). Thirdly, as local contractors are reaching out to foreign construction markets, the obligation to achieve good quality is becoming more compelling in order for them to improve their prospects abroad (Rommel 1996).

According to BCA (2012a, b), the average CONQUAS score for buildings in general has risen to 85.7 in 2011 compared to 76.5 in 2002 during the ten-year period. However, it is observed that the top performers are always from the same firms and there are still many other firms whose CONQUAS scores have not improved significantly and the expected continuous improvement in construction quality has not been realised. Furthermore, it is identified that there are merely 20 % of projects with scores above 90.1 and they only occurred in the recent five-year period from 2008 to 2012 (Fig. 1.1). This shows that much effort are still needed to raise the workmanship quality of all the contractors in Singapore, to attain a "high" CONQUAS score which according to the Cambridge dictionary,

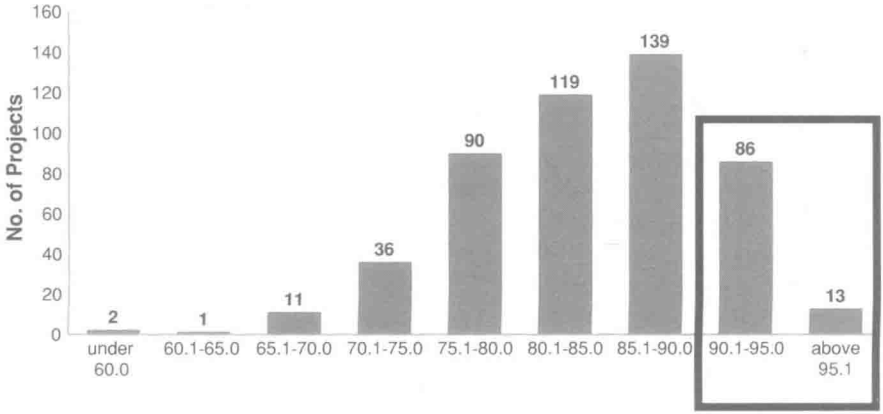

Fig. 1.1 Distribution chart of CONQUAS scores from 2008 to 2012. *Source* BCA (2013a, b)

means "greater than the usual level or amount". As Fig. 1.1 clearly presents that the construction industry has a low record in surpassing a score above 90, it will be taken to mean "high" CONQUAS scores in this research.

At the same time, these 99 projects with "high" CONQUAS scores (above 90.1) imply that there are certainly many ways in which a construction firm can achieve high CONQUAS scores. However, many projects do not seem to have formulated a comprehensive CONQUAS management program which is instrumental in achieving high CONQUAS score and ensuring that projects are run smoothly on site. On top of that, the variability of CONQUAS scores among the firms leads to the following seven sets of hypotheses about the critical success factors (CSFs) which will be subjected to testing and subsequent acceptance or rejection, following the analysis of the research results in Chap. 6.

Null Hypothesis, $H_{1.0}$: The more important CSFs do not show greater influence on the CONQUAS score.

Alternate Hypothesis, $H_{1.1}$: The more important the CSF is, the greater the influence it has on the CONQUAS score than CSFs which are not as important.

Null Hypothesis, $H_{2.0}$: The higher adoption rates of the CSFs do not show higher CONQUAS score.

Alternate Hypothesis, $H_{2.1}$: The higher the adoption of the CSFs, the greater the resultant CONQUAS score will be than when the CSFs are not adopted.

Null Hypothesis, $H_{3.0}$: The extent of variation of the usage level of the CSFs cannot be attributable to the variation in its importance rating.

Alternate Hypothesis, $H_{3.1}$: The extent of variation of the usage level of the CSFs can be attributable to the variation in its importance rating.

Null Hypothesis, $H_{4.0}$: The importance level of each of the CSFs does not correlate to the importance level of other CSFs.

Alternate Hypothesis, $H_{4.1}$: The importance level of each of the CSFs is correlated to the importance level of other CSFs.

Null Hypothesis, $H_{5.0}$: The extent of adoption of each of the CSFs does not correlate to the extent of adoption of other CSFs.
Alternate Hypothesis, $H_{5.1}$: The extent of adoption of each of the CSFs is correlated to the extent of adoption of other CSFs.

Null Hypothesis, $H_{6.0}$: The responses received from A1 contractors do not differ from A2 contractors with regard to the importance level of the CSFs.
Alternate Hypothesis, $H_{6.1}$: The responses received from A1 contractors differ from A2 contractors with regard to the importance of the CSFs.

Null Hypothesis, $H_{7.0}$: The responses received from A1 contractors do not differ from A2 contractors with regard to the extent of adoption of the CSFs.
Alternate Hypothesis, $H_{7.1}$: The responses received from A1 contractors differ from A2 contractors with regard to the extent of adoption of the CSFs.

1.3 Research Aim and Objectives

Although studies (Low et al. 1999; Ong 1997) have provided suggestions for construction firms to consider to attaining higher CONQUAS scores; at best, a prescribed list of items was proposed but they have not been evaluated and quantified in detail (Low 2001a, b). Furthermore, the study by Calingo et al. (1995) stated that little has been written on the nature and extent of journey of contractors towards achieving good workmanship quality in Singapore.

Hence, this research aims to bridge the knowledge gap by identifying the CSFs for achieving high CONQUAS scores by contractors from the time the project is awarded to the time the project is completed. CSFs are the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation (Leidecker and Bruno 1984). It should be noted that CONQUAS does not measure the quality of building design, the materials specified nor the level of maintenance found in a building (Low 1993). It also does not cover latent defects that may appear after handing over as such defects cannot be foreseen or visible during CONQUAS assessment. Therefore, the CSFs that will be covered only involve the few key areas relating to construction workmanship quality which must be done right the first time according to the specifications and requirements of the consultants. The CSFs are those areas in which contractors must excel in order to be successful towards CONQUAS management.

Furthermore, it is important to not only evaluate the achievement of high CONQUAS scores by the CSFs during the project's construction phase, but perhaps to consider other influences from the various stakeholders of the project as well as corporate-wide performance and overall QMS of the company. Hence, to accomplish the aim of this research,

1. The whole CONQUAS process (Fig. 1.2) will be examined thoroughly to present the idea of CONQUAS and its assessment approach which have given rise to a certain quality trend.

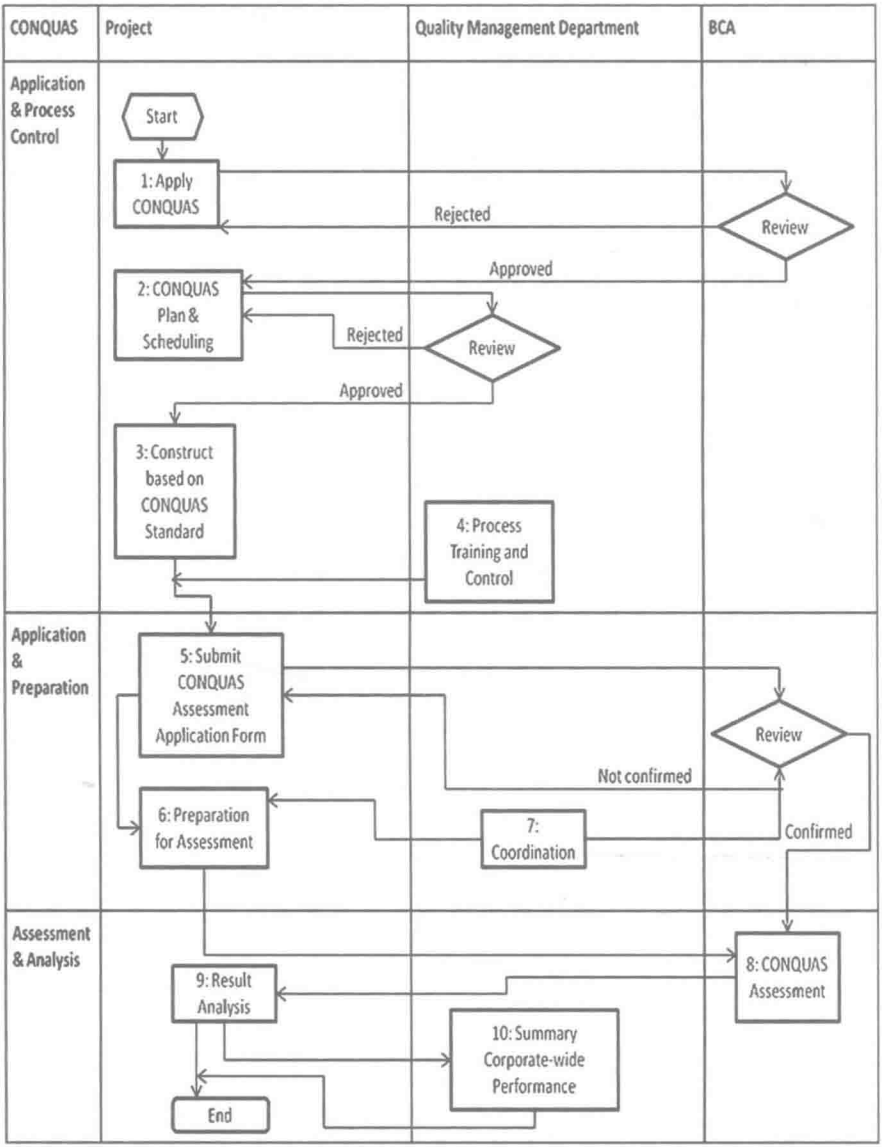

Fig. 1.2 CONQUAS flowchart. *Source* BCA Academy (2012c)

2. The QMS will then be investigated to explore its application to managing CONQUAS effectively.
3. Finally, CSFs for achieving high CONQUAS scores will be identified from secondary sources and they will then be verified from primary sources in order to develop a CONQUAS management framework for contractors to adopt in their future projects.