Faculty of Business

The Influence of Total Quality Management on Project Performance: The Case of Construction Organizations in Malaysia

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DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material, which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number #RDBS-60-15.

Signature:…………………………………

Date:………30 June 2018………………..

ABSTRACT

Many studies have suggested the adaptation and implementation of Total Quality Management (TQM) is likely to improve an organization's performance. Hence, a considerable amount of literature has examined the relationship between TQM and other elements like business performance, organizational performance, and marketing performance in different industries. However, little is known of the influence of TQM in project performance in the context of Malaysian construction organizations. The objective of this study is to examine the relationship between TQM and project performance in Malaysian construction organizations. A TQM model was based on the Malcolm Baldridge National Quality Awards (MBNQA) and the project performance dimensions were developed through a literature review of previous studies. Data was collected using questionnaires from 161 valid responses having Grade 7 (G7) in the Construction Industry Development Board (CIDB) list. The relationships were tested using the Statistical Package for Social Science (SPSS 21.0). Pearson's correlations and a multiple regression analysis were performed to investigate the association of TQM practices with project performance. The findings revealed that TQM practices were partially correlated with project performance of Malaysian construction organizations. The analysis also found operation focus and workforce focus were perceived as dominant TQM practices in quality performance. Academically, this study contributes to the knowledge on TQM and project performance by providing empirical evidence on TQMs ability to improve the performance of the Malaysian construction industry. Practically, this study provides an impetus for industrial practitioners to understand the roles of TQM and its ability in enhancing project performance.

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BHP	Bakun Hydroelectric Project
CIDB	Construction Industry Development Board
CIMP	Construction Industry Master Plan
CITP	Construction Industry Transformation Programme
CSF	Critical success factor
EM	Expected Maximization
ETP	Economic Transformation Program
FA	Factor analysis
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GHC	Greenhouse gases
JPA	Jabatan Perumahan Negara
KLIA2	Kuala Lumpur International Airport 2
KMO	Keiser-Meyer-Olkin
KPI	Key Performance Indicator
MBNQA	Malcolm Baldridge National Awards
MCI	Malaysian construction industry
MHLG	Ministry of Housing and Local Government
MOV	Ministry of Work
MRA	Multiple regression analysis
MVA	Missing value analysis
NLC	National Land Code
PCA	Principal component analysis
PDSA	Plan-Do-Study-Act

PLC	Project life cycle
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
RMK11	The Eleventh Malaysia Plan (2016 - 2020)
PMPA	Project management performance assessment
SCORE	Sarawak Corridor of Renewable Energy
SEM	Structural equation modelling
SME	Small and medium enterprises
SPSS	Statistical Package of Social Science
SQC	Statistical quality control
SQMS	Self-assessment quality management system
TPPA	Trans-Pacific Partnership Agreement
TQM	Total Quality Management

CHAPTER 1

INTRODUCTION

1.0 Introduction

Total Quality Management (TQM) has proven to be a particularly successful approach in improving quality performance (Talib, Rahman and Qureshi 2013; Zehir et al. 2012), business performance (Miyagawa and Yoshida 2010), organizational performance (Mehralian et al. 2017; Shafiq, Lasrado and Hafeez 2017; Valmohammadi and Roshanzamir 2015), innovation performance (Zeng, Phan and Matsui 2015; Zehir et al. 2012), and firm performance (Sadikoglu and Olcay 2014) . TQM originated from the manufacturing industry and has received widespread praise for its noteworthy performance, such as increased productivity, decreased product cost, and improved reliability. As a result of the successful TQM implementation of in the manufacturing industry, it has become a source of innovation for other industries to adopt and implement this concept, including the construction industry.

A construction industry is vital for the development and growth of any nation. However, attainment of acceptable levels of quality in the construction industry has long been a problem. In fact, the construction industry is commonly regarded as the industry with the poorest quality compared to other sectors such as manufacturing and service (Wanderi, Mberia and Oduor 2015). Delays, cost overruns, reworks, variations, claims, and disputes have become common problems in the construction industry (Ali and Rahmat 2010). Many construction clients have expressed dissatisfaction with the quality of work achieved in their construction projects (Femi 2015; Shehu et al. 2014). A significant amount of time, money and resources, both human and material, are wasted each year in the construction industry because of inefficient or non-existent quality management procedures (Polat, Damci and Tatar 2011). The construction industry has been under tremendous pressure to improve construction quality (Razak Bin Ibrahim et al. 2010; Harrington, Voehl and Wiggin 2012).

Although TQM literature has evolved over the years, research and application in the construction industry is still limited. TQM literature has focused primarily on more developed countries, whereas any studies in the developing countries are scarce. The existing research scope has typically focused on implementation, critical success factors (CSFs), and barriers to TQM whereas the effect of TQM practices on project performance is under-researched. More recent research, which discusses the current state of the Malaysian construction industry, is required. Additional empirical research is needed to transform the TQM philosophy into practical guidelines and become inherent in Malaysian construction practices.

Since the construction industry is considered one of the major contributors to the Malaysian economy, managing TQM practices efficiently and achieving a satisfactory outcome is tactically important for gaining a competitive advantage. This study has been conducted to examine the real-time situation of TQM practices and application for the improvement of the construction organizational project performance in Malaysia. The research results are to be applied by the project management practitioners in their current construction practices to reduce the construction problems facing by the Malaysian Construction Industry (MCI) and enhance the future project success rate.

1.1 Background of the Study

The Malaysian construction industry is considered as a primary economic sector in Malaysia, generating of RM 1,012.5 billion, RM 1,062.8 billion, and RM 1,016.1 billion for the years 2014, 2015, and 2016, respectively, as shown in Table 1-1 below. The construction industry's economic output is relatively small compared to other sectors in Malaysia's economy. For instance, the construction industry's contribution to the GDP accounted for 3.17% in 2010 and increased to 3.9% in 2014, while manufacturing's contribution to the GDP was 25.3% in 2010 and 24.2% in 2014. Albeit a small output in terms of GDP, its contribution is fundamentally crucial for the national development. The construction industry acts as a fundamental component in the nation's social and economic development by providing basic infrastructure developments for the country and it also allows all the other sectors to grow. The Malaysian construction industry enables the growth of other industries through its extensive backward and forward linkages with other sectors of the economy, such as manufacturing, financial services, and professional services, generating one of the highest multiplier effects. It is a major indicator and determinant of Malaysian economic performance.

Table 1-1: Malaysian construction sector contribution.

Year	GDP (RM billion)	Construction sector output at 2010 constant prices (RM billion)	Construction sector contribution to GDP (%)	Construction sector growth (%)
2012	912.3	34.9	3.53	18.1
2013	955.1	38.6	3.73	10.6
2014	1,012.5	43.1	3.9	11.7
2015[p]	1,062.8	46.6	8.2	8.2
2016[a]	1,106.1	50.4	4.4	7.9

[p] Preliminary

[e] Estimate based on BNM Annual Report 2015

Source: Bank Negara Malaysia and Department of Statistics Malaysia

However, the construction sector has been criticized for poor performance where numerous problems have arisen while delivering quality construction projects. For instance, Razak bin Ibrahim et al. (2010) and Shehu et al. (2014) reported that the Malaysian construction industry is accompanied by problems, such as delays, cost overruns, and poor quality work in government projects, such as school buildings and community college buildings. Likewise, a local newspaper reported on similar problems during the construction of the new Kuala Lumpur International Airport 2 (KLIA2). It was continuously reported to have quality problems after completion, such as cracked runaways, uneven taxiways and sinking aircraft parking bays, recurring flooding, and water ponding at the apron. All these quality problems have raised the public safety concerns (Shagar 2014) and the quality standards of the Malaysian construction industry has been directly questioned.

The TQM implementation in Malaysia was initiated due to its impressive results in other countries. One of the sectors in Malaysia that have already benefited through TQM implementation is manufacturing. TQM has extended to other sectors of the economy including construction with the hope it may help to solve the poor performance record of the Malaysian construction industry. Considering the situation and problems associated with this industry in Malaysia, it seems relevant to study the effect of TQM implementation in Malaysian project environments. Thus, it is important to gain some insights on the role of TQM in enhancing the performance of the Malaysian construction industry.

1.2 Need of Research

Based on the issues discussed above, the following are research gaps that need to be addressed:

1.2.1 Lack of TQM - Performance Study in the Construction Industry

The contributions of numerous researchers and practitioners have made the current TQM literature abundantly rich. Some of the studies conducted in the construction industry are related to TQM implementation (Burati and Oswald 1993; Pheng and Teo 2004; Harrington, Voehl and Wiggin 2012; Altayeb and Alhasanat 2014; Kakkad and Ahuja 2014), barriers and benefits of TQM implementation (Hoonakker, Carayon and Loushine 2010; Polat, Damci and Tatar 2011), investigations on the TQM revolution (Lau and Tang 2009), and TQM critical success factors (CFSs) (Metri 2005). Another study had proposed a TQM oriented self-assessment quality management system (SQMS) by adopting TQM constructs for the construction industry (Lam, Lam and Wang 2008). There is a lack of studies on the link between TQM and the performances of project environments as mentioned by Leong et al. (2014) in his review of the quality management systems in the construction industry. The researchers also stated one of the areas of quality management system in the construction industry that is under researched is project performance.

A literature review led by Ebrahimi and Sadeghi (2013) have shown numerous studies have been conducted on the impact of quality management and firm performance. Moreover, among the possible metrics discussed in the literature operational performance, quality performance, financial and market performance, innovation performance, and customer satisfaction were the most cited, or in other words, gained more interest from the researchers. However, studies examining the effect on project performance in the construction trade are scarce. TQM practices and performance relationships need a far more extensive investigation (Ebrahimi and Sadeghi 2013), especially in the construction industry.

The studies which examined the effect of TQM in the construction industry were from Bryde and Robinson (2007), Kuo and Kuo (2010), and Alotaibi, Rushmani, and Rabiul (2013). However, none of these studies has exclusively examined project performance. One study examined the relationship between TQM and project performance (Shieh and Wu 2002). However, the study was conducted on the building-planning phase (pre-construction phase). As a possible extension to this study, an empirical study on the link between TQM and project performance at the post-construction phase will be a significant contribution to the construction industry. A further study on how quality management practices, such as TQM affect project performance and to determine the effectiveness of TQM practices, are worthwhile (Leong et al. 2014). This study fills this gap by emphasizing the link between TQM practices and project performance to determine the effectiveness of TQM practices in the construction phase.

1.2.2 Lack of Empirical Studies

Thiagaragan, Zairi, and Dale (2001) stated that the possible reasons for the lack of TQM empirical research were because it is a new discipline outside Japan, its origin lies mainly outside of the academic world, and there is no single and universal theoretical framework of TQM. Many of the TQM studies are based on personal perception and experience, which is not empirical and may lead to the loss of creditability of TQM as an effective management philosophy. In fact, criticism has been directed at TQM claiming it is just a 'fad' theory and lacks any normative standards. One of the articles questioned the quality management by arguing that:

"...it remains unclear in the literature whether quality management is a management of philosophy, a management method, a strategy, a theory for managing the entire enterprise - or all of the above?"

As cited in Fotopoulos and Psomas (2010), one of the crucial ways to transform TQM into a consistent management discipline is by testing a large number of empirical studies using analytical models as stated by Rahman and Sohal (2002). Therefore, to strengthen the fact that TQM is not just a ‘fad’, empirical evidence must be applied, which is lacking in the current literature.

1.2.3 Lack of Empirical Research Outside Developed Country

There is no single, universal, normative approach to TQM implementation (Burati and Oswald 1993) in the construction industry. The effectiveness of each TQM implementation guideline differs across regions, from one industry to another and from one organization to another. TQM practices in one industry may not be directly transferable to another without some adaptations, as the context may vary among industries. Each organization must develop its own framework and take into account the willingness of managers to implement quality management, as the solutions cannot be directly transferred (Harrington et al. 2012).

Some studies suggest successful TQM implementation can bring many benefits to an organization. Greater customer satisfaction, improved product quality, and a higher market share can be achieved by meeting the quality requirements of TQM implementation in the construction industry (Love, Edwards and Sohal 2004; Pheng and Teo 2004; Islam and Mustapha 2008; Rumane 2010; Polat, Damci and Tatar 2011). Among the construction organizations that have witnessed the successfulness of TQM implementation are the Morrison Construction Group, Takanaka Corporation, and Shui On Construction Co. (Wong 1999).

Although a majority of the articles claimed the benefits of adopting TQM management philosophy in various types of organizations, others argued that TQM does not work (Harari 1993; Sila and Ebrahimpour 2002). Some studies found that TQM firms do not outperform non-TQM firms (Ebrahimi and Sadeghi 2013) or have either no effect or negative effects on the firm performance (Kober, Subraamanniam and Watson 2012; Mehmet and Emre 2012; Curkovic, Vickery and Dröge 2000).

Despite the mixed results of TQM implementation presented in the literature, a better verification is through an empirical examination. However, although there are numerous studies on TQM in the more developed world, few empirical studies have been done in developing nations, especially in the ASEAN region (Thiagaragan, Zairi and Dale 2001; Lam et al. 2011; Lam et al. 2012). As reported by Zakuan et al. (2010), the adoption of a quality management system has not occurred at a similar rate in all parts of the world. For this reason, it is empirically significant to study the adoption of TQM practices and its effect on project performance in the context of a developing country, like Malaysia.

1.2.4 Malaysian Construction Industry (MCI) as A Focus of Research

Malaysia is one of the fastest growing developing countries. Furthermore, its construction industry plays a crucial role in enhancing the nation's social and economic development by providing essential developments for many other sectors to develop. The Malaysian construction industry generates one of the highest multiplier effects through its extensive backward and forward linkages with other sectors of the economy (Ibrahim et al. 2010). It stimulates raw, semi-processed, and processed materials manufacturing, such as steel and cement, in backward linkages and encourages the financial and professional services in forward-type linkages. The Malaysian government understands the importance of an efficient construction industry to the national economy and has created policies to support this industry.

With the launching of Vision 2020, the Malaysian government has proposed a fully industrialized country by the year 2020. However, with the current condition of the Malaysian construction industry, traditional ways of performing and managing construction processes will only exacerbate the existing problems. The construction organizations have to reconsider their construction practices. One strategy is to adopt Total Quality Management (TQM) more widely.

However, with the present research gap, clear guidelines for showing managers how to implement TQM is impossible and may result confusion. Managers, researchers, and quality management practitioners continuously show interest in TQM and its performance relationship and know which TQM practices to adopt to achieve successful implementations. The main reason to conduct this study is to determine which TQM practices are essentially to a successful project performance in the Malaysian construction industry.

1.3 Problem Statement

Total Quality Management is regarded as the management philosophy and company practices that aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization (BIS 1992). The philosophy and guiding principles implemented by TQM form the foundation of a continually improvement and sustainability to any organizations that implemented it (Tingey 1997). The final objective of TQM is to meet the needs and satisfaction of internal and external customers plus improving the performance of companies (Ooi et al. 2013). This quality-conscious management is regarded as the most effective methods for improving the holistic competitiveness of any firm by bringing higher customer satisfaction, better quality products and higher market share (Pheng and Teo 2004).

The complexity of the construction industry and its customer has grown both in intensity and diversity resulting in many construction companies facing difficulty in maintaining the project performance especially the expected satisfaction required by its customers (Oakland and Marosszeky 2006). The quality of construction services and facilities is still the root cause of many problems such as high fragmentation, low productivity, poor quality and etc. (Lam, Chan and Chan 2008). The ineffective management of the construction project performance not only arose from the technical issues but also managerial issues (Lam, Chan and Chan 2008). Hence, sustainable improvement in project performance is extremely difficult to achieve in the construction and the construction industry is still struggling to achieve quality objectives in totality in many years (Low and Peh 1996).

TQM originated in the manufacturing industry and there is a considerable body of TQM literature that has examined TQM implementation in this industry all over the world. Studies were conducted to investigate TQM in various performance dimensions, including firm performance, operational performance, quality performance, financial and market performance, innovation performance, and customer satisfaction (Ebrahimi and Sadeghi 2013). In Malaysia, there has been a number of research studies conducted on TQM in manufacturing (Rahman and Tannock 2005; Arumugam, Ooi and Fong 2008; Talib, Rahman and Qureshi 2013) and services industries (Samat, Ramayah and Mat Saad 2006; Ooi et al. 2011). However, research that specifically focuses on TQM and project environments is still lacking (Bryde and Robinson 2007), especially in Malaysia. Leong et al. (2014) has indicated that limited studies have been conducted in the construction industry but one of the areas worth further exploration include, what types of quality practices (i.e. TQM) are recommended for improved project performance.

There have been a few TQM studies conducted in the construction industry. Altayeb and Alhasanat (2014) studied the TQM implementation in the Palestinian construction industry. Meanwhile, Harrington et al. (2012) examined the TQM implementation of in the construction industry in general. Bakar, Ali, and Onyeizu (2011) examined the TQM practices in Oman construction companies, while Mir and Pinnington (2014) determined the relationship between project management performance and project success in UAE project-based organizations. Kuo and Kuo (2010) investigated the relationship of corporate culture, TQM, and project performance in Taiwan. However, all these studies are limited to different regions in which the characteristics and practices in these developed countries are very different from Malaysia, which is a developing country. Notably, none of the studies focused exclusively on the link between TQM and project performance of the construction organizations.

A few Malaysian studies have been conducted on the construction industry. Abdul Rashid (2002) completed a study on the realities of applying TQM in the construction industry. Din et al., (2010) studied the elements of performance between certified and non-certified construction organizations. Leong et al., (2014) reviewed on the quality management system research in the construction industry. There is no evidence to suggest there has been any empirical and statistical research examining the relationship between project performance and TQM in Malaysia. There is also a lack of studies, which have examined the association of quality management and project management in Malaysia. As mentioned by Thiagaragan, Zairi, and Dale (2001), the development of empirical research on TQM still lags far behind, especially in the construction industry (Leong et al., 2014).

Hence, there is a gap detected in the existing TQM literature in the context of the Malaysian construction industry. Therefore, this study focuses on explaining the empirical evidence for the relationship between TQM and project performance in the Malaysian project environment. Coupled with the current pressure to improve the level of quality in the construction industry in Malaysia, there is indeed a need and urgency for research to determine if TQM implementation can improve project performance. This research not only focuses on investigating if a link exists, but also providing a more refined and detailed examination on how any links may provide a possible contribution to the construction organizations in terms of improving their project performance through TQM implementation.

1.4 Research Questions

In the context of the Malaysian construction industry, this study established the following pertinent research questions to investigate:

1. Is there a relationship between TQM and project performance?
2. Which TQM practices have a greater association with project performance?
3. What is level of TQM and project performance in Malaysian's construction organizations?

1.5 Research Objectives

The key objective of this research is to analyze the association between TQM practices and project performance in the Malaysian construction industry:

1. To determine the dimensions of TQM and project performance applicable to the Malaysian construction industry.

2. To determine the relationship between TQM and project performance in Malaysia's organizations.

3. To identify which TQM practices have a greater impact in Malaysia's construction organizations.

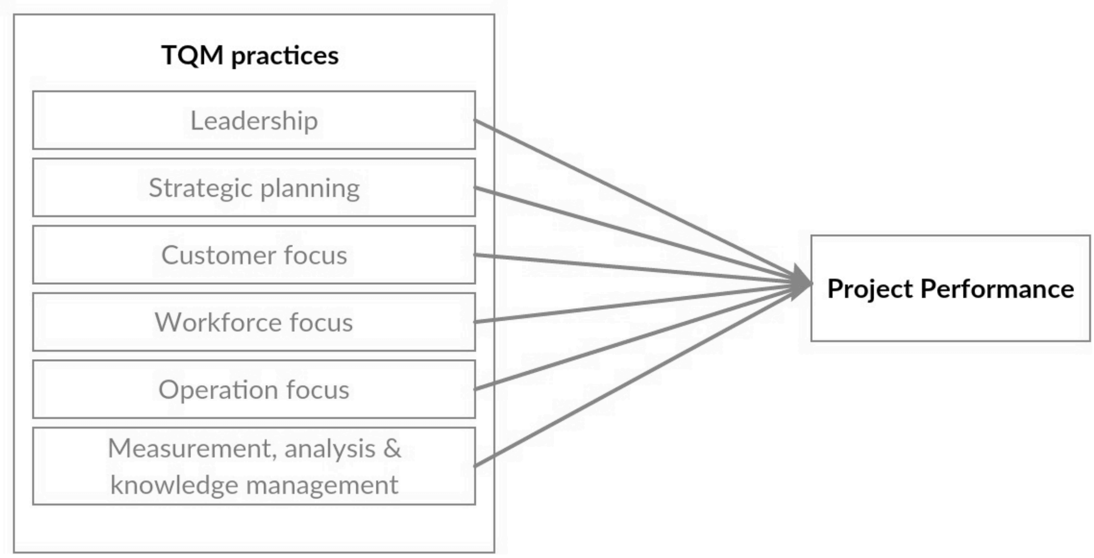


Figure 1-1: Conceptual framework of the study.

1.6 General Conceptual Framework

Based on the research objectives, the following general conceptual framework was developed to guide the study. An overview of the hypotheses that concern the relationships between the constructs in this study is illustrated in Figure 1-1. TQM practices of leadership, strategic planning, customer focus, workforce focus, operation focus, measurement, analysis, and knowledge management were developed as independent variables, and project performance as the dependent variable. This model was constructed to measure the influence of the independent variables on the dependent variable. Given the above discussion, the following hypotheses were therefore proposed in Table 1-2.

Table 1-2: The summary of hypotheses.

Hypotheses	
H_1	There is a significant positive relationship between leadership and project performance.
H_2	There is a significant positive relationship between strategic planning and project performance.
H_3	There is a significant positive relationship between customer focus and project performance.
H_4	There is a significant positive relationship between workforce focus and project performance.
H_5	There is a significant positive relationship between operation focus and project performance.
H_6	There is a significant positive relationship between measurement, analysis and knowledge management and project performance.

1.7 Scope of the Study

The present study aims to examine the relationship between TQM practices and project performance in the environments of the Malaysian construction organizations. The scope of the study covered the Malaysian construction organizations registered under the Construction Industry Development Board (CIDB), Malaysia. CIDB is one of the semi-government entities established in 1984 to act on behalf of the Malaysian government to register all construction companies operating in Malaysia. CIDB regulates and registers the construction companies under relevant grade (ranking from G1 to G7) according to the company's experience, financial status, and personnel capability. By 1 January 2009, CIDB had implemented a new regulation in which all Grade 7 contractors are required to obtain the ISO 9001 certification.

In this study, all Grade 7 contractors registered under CIDB were selected as population. The Grade 7 contractors were chosen because they are qualified based on their status (i.e. experience, financial status, and personnel capability). Most importantly, the G7 contractors' commitment to quality standards (i.e. ISO 9001 certified) is the primary attribute for this study, because this population is an accurate representation of the Malaysian construction industry as adopted in the study of Din et al., (2011).

Surveys conducted among the selected population regarding TQM practices and its influence on their projects' performance have yielded useful and practical insights into this particular industry, which is trying to improve its performance and poor image (Ibrahim et al. 2010). These surveys add to the limited empirical evidence concerning TQM in the context of the Malaysian construction industry.

1.8 Research Contributions

This research contributes findings and outcomes that are useful and practical in several areas.

1.8.1 Academic Research

This study will positively contribute to the applied knowledge for academicians as it sheds light on how the implementation of TQM results in a better project performance in the Malaysian construction industry. While the majority of TQM initiatives and practices are carried out in Western countries, this study evaluates the concept of TQM and its relationship with project performance in Malaysian construction organizations, which is a non-western, multi-racial developing country. The findings of this study could substantially and significantly benefit academicians in assessing the current state of TQM within the context of the Malaysian construction industry and how it application differs from other countries.

1.8.2 Construction Organizations

This study was designed to investigate the management system, which has been adopted, by the construction organization and their relation to enhancing the project performance. The findings of this study provided empirical evidence and contributed to the methods to improve the construction organizations' project performance.

1.8.3 Malaysian Construction Industry

As mentioned in the study of Razak Bin Ibrahim et al. (2010), the Malaysian construction industry has been continuously plagued with problems of delays, cost overruns, low productivity, and low quality of work. The empirical results of the association between TQM practices and project performance from this research can be used as guidelines for the practitioners in the construction industry to enhance the project performance. Through this research, the Malaysian construction industry will be exposed to TQM knowledge and its benefits to the industry regarding project performance. In addition, the findings of this research may act as an incentive to increase the adoption and implementation of TQM as a quality management system in managing construction projects. This research will increase the level of awareness of and the implementation of TQM in the construction industry and consequently improve Malaysia's current overall construction image.

1.9 Organization of Chapters

This thesis consists of six chapters. Chapter 1 introduces this research. Chapter 2 provides a brief introduction to the Malaysian construction industry. Chapter 3 is a review of the literature on this topic: TQM and project performance. Chapter 4 discusses the research methodology. Chapter 5 reports on the findings from the data analyses. Finally, Chapter 6 discusses the conclusions, implications, limitations and future study possibilities for this topic.

The content of each chapter is briefly outlined in the sections below:

Chapter 1 gives an introduction to this research starting with some background information regarding the study and the research needs. The problem statement is then discussed together with the research questions and research objectives. A general conceptual framework and the scope of the study are subsequently presented ad lastly ending with some research outcomes and the organization of the chapters, which outline the flow of the thesis.

Chapter 2 gives an overview of the Malaysian construction industry by examining the nature of the industry including a discussion on the latest CITP (Construction Industry Transformation Programme): Four Strategic Thrusts and the Bakun Hydroelectric Project (BHP). The discussion analyses the industry's problems, which have led to the low quality issues in the Malaysian Construction Industry (MCI).

Chapter 3 presents a concise review of the quality concepts and standards in the construction industry. An analysis of these standards and practices is relevant in order to establish sufficient understanding of TQM and project performance.

Chapter 4 justifies the quantitative research method adopted in this study as well as discusses the sampling, data collection, and data analyses.

Chapter 5 presents the findings and outcomes of the data analyses on research objectives and hypotheses. This is followed by a detailed discussion of the findings discovered.

Chapter 6 draws conclusions and implications from the study regarding managerial and theoretical aspects and finally a discussion on the limitations and future study recommendations for this topic.

1.10 Definition of Key Terms

Total Quality Management: "A management approach of an organization, centred on quality, based on the participation of all its members, aiming at long-term success through customer satisfaction, by bringing benefits to all members of the organization and to the society." – International Organization for Standardization (ISO)

Project: "A temporary endeavour undertaken to create a unique product or service." – The Project Management Institute (1996)

Performance: “ A task or operation seen in terms of how successfully it is performed.” – Oxford English Dictionary

Construction: “ New construction, alteration, repair and demolition. Installation of any machinery or equipment which is built-in at the time of the original construction is included, as well as installation of machinery or equipment after the original construction but which requires structural alteration in order to install.” – Statistics Department Malaysia

Industry is defined as “ a group of economic establishments all of which are primarily engaged in the same kind of activity or in producing the same kind of product.” – Statistics Department Malaysia

1.11 Summary

This chapter discusses the overall orientation of the study. The study began by addressing the background of the study and the problem statement. The research questions and research objectives of the study followed. The study was conducted by following the guidelines of the research framework. Meanwhile, the scope of this study focused on the Malaysian construction organizations. This chapter ends by mentioning some of the practical and theoretical contributions of the study and a brief summary of the rest of the chapters in this thesis.

CHAPTER 2

MALAYSIAN CONSTRUCTION INDUSTRY

2.0 Introduction

In this chapter, an overview of the construction industry is introduced by describing its performance and role for the nation. The types of development process conducted in Malaysia are described next. There are two kinds of development process, namely land development and property development. They are two distinct processes but have merged in creating the nation's construction industry. The diagram, Figure 2-5 illustrated below explains the process of development from the initial land purchase to the finished product, and outlines the complicated construction process. In addition to comprehending the nature of the construction practices, there are multiple stakeholders involved in each development process. The Construction Industry Transformation Programme (CITP), established by the Construction Industry Development Board of Malaysia, establishes four strategic thrusts: Quality, Safety and Professionalism, Productivity, Environmental Sustainability, and Internalisation. A review of the current Malaysian construction industry (MCI)'s status, problems, and future direction, in the context of the four strategic thrusts provides a clear picture of the construction industry today. A discussion of the MCI problems, based on the literature and substantiated with a recent case study of the Bakun Hydroelectric Project (BHP), represents the real-life obstacles faced by the MCI. The associated construction problems, which inevitably came with serious consequences, are discussed in the last section of this chapter. Last but not least this chapter ends with a summary of this chapter's discussions.

2.1 Overview of the Malaysian Construction Industry (MCI)

Malaysia's Vision 2020 was created to express the government's objective to achieve a high-income status and encourage the nation towards a robust and dynamic economy. This vision involves an intensive transformation of the nation's economic structure, in conjunction with the Eleventh Malaysia Plan (RMK11) and the Economic Transformation Program (ETP). A healthy construction industry is vital to execute the nation's strategic plans through critical physical infrastructure developments. The Construction Industry Transformation Programme (CITP) is a five-year plan, following the Construction Industry Master Plan (CIMP) with the intention of leading the construction industry to become more advanced, more productive, and a major economic sector contributing to Malaysian's aim of becoming a high-income nation by 2020. One of the key features of CITP is to equip Malaysia's construction industry to become a global competitor at the international level.

Table 2-1 shows the contribution of different economic sectors to the Gross Domestic Product (GDP). The table confirms the service industry is the largest contributor to the GDP, while the construction industry is the smallest. However, the contribution by the construction industry is showing signs of improving. As shown in Table 2-3, the construction industry had been in decline until 2008 when it contributed only 2.7% to GDP. It then began to increase in 2009 and currently contributes 4.4% to the GDP. In fact, while the other major industries have recently show signs of stagnating, the construction industry continues increasing. It is targeted to contribute 5.5% to the GDP by 2020 (RMK11). In 2014, Malaysia's economy grew at 6.0% with all sectors recording a positive growth. The construction industry continued double-digit growth by registering 11.8% and became the fastest growing industry among all others.

Table 2-1: GDP by kind of economic activity at 2010 prices – RM million.

	2011	2012	2013	2014	2015*	2016**
Agriculture	88,555	89,406	91,097	92,979	93,904	93,576
Mining and quarrying	85,373	86,751	87,789	90,645	94,917	98,211
Manufacturing	202,960	211,921	219,216	232,868	244,247	254,215
Construction	29,524	34,880	38,646	43,190	46,728	50,398
Services	449,854	479,300	507,935	541,185	569,046	594,025
(+) import duties	8,654	10,004	10,577	11,639	13,805	15,675
GDP at purchasers' prices	864,920	912,261	955,260	1,012,506	1,062,647	1,106,100

* preliminary

** forecast

Source: Department of Statistics, Malaysia and Bank Negara Malaysia

Table 2-2: GDP by kind of economic activity at constant 2005 prices- percentage share to GDP.

GDP by kind of economic actibity at constant 2005 prices - percentage share to GDP

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	**2015***
Agriculture	8.3	8.3	7.9	7.8	7.9	7.6	7.6	7.3	7.1	6.9	**8.9**
Mining and quarrying	13.3	12.4	11.9	11.1	10.5	9.8	8.8	8.4	8.1	7.9	**8.8**
Manufacturing	27.5	28.0	27.2	26.1	24.2	25.2	25.0	24.9	24.5	24.6	**22.9**
Construction	3.0	2.8	2.9	2.7	3.1	3.2	3.2	3.5	3.8	3.9	**4.4**
Services	46.8	47.5	49.2	50.9	53.2	53.2	54.2	54.6	55.2	55.3	**53.8**
(+) import duties	1.2	1.0	1.0	1.2	1.1	1.2	1.2	1.3	1.3	1.4	**1.2**
GDP at purchasers' prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**

* at constant prices of 2010

Source: Department of Statistics, Malaysia and Bank Negara Malaysia

Table 2-3: GDP by kind of economic activity at constant 2010 prices – annual percentage change.

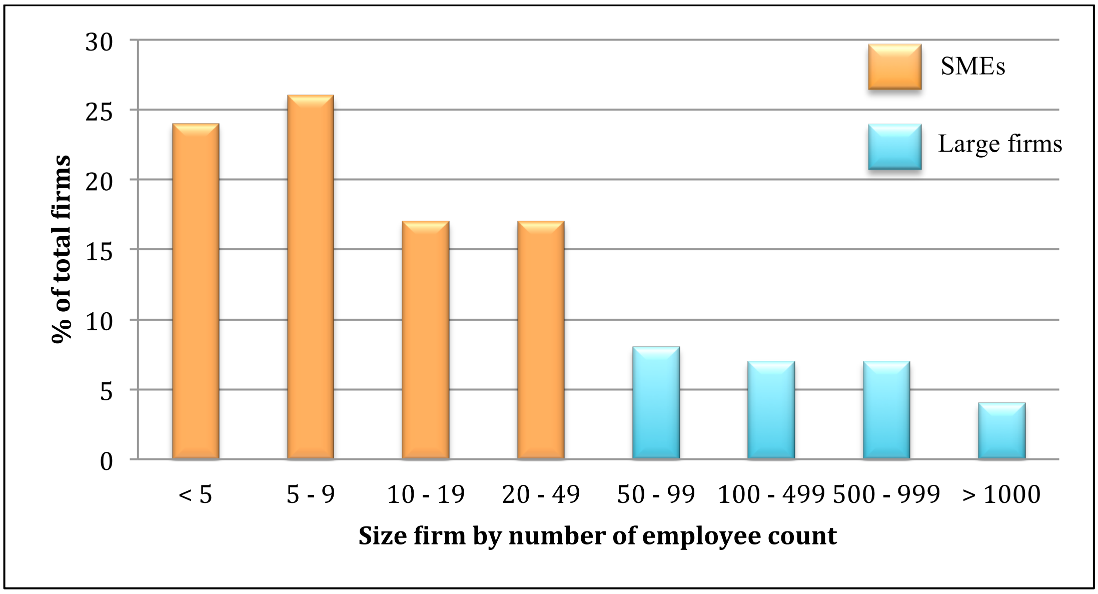
	2011	2012	2013	2014	2015*	2016**
Agriculture	6.8	1.0	1.9	2.1	1.0	-0.3
Mining and quarrying	-4.9	1.6	1.2	3.3	4.7	3.5
Manufacturing	5.4	4.4	3.4	6.2	4.9	4.1
Construction	4.6	18.1	10.8	11.8	8.2	7.9
Services	7.0	6.5	6.0	6.5	5.1	4.4
(+) Import duties	12.8	15.6	5.7	10.0	18.6	13.5
GDP at purchasers' prices	5.4	5.5	4.7	6.0	5.0	40 ~ 4.5

* estimate

** forecast

Source: Department of Statistics, Malaysia and Bank Negara Malaysia

MCI acts as an economic engine to stimulate the growth of the nation's economy. The industry has demonstrated a strong correlation with economic development and has correlated positively with the country's GDP. A study by Chia (2012) showed that there is a unidirectional causality running from the construction sector to Malaysia's aggregate economy. The study indicated from 1970 until 2009, it was the growth in construction that drove the Malaysian economy. Currently, the growth in the construction industry continues to stimulate and sustain the expansion in the other sectors and raises the overall growth of the economy. The MCI plays a pivotal role in supporting small and medium enterprise (SME) development. Ninety percent of the firms in the construction industry are SMEs.



Source: Construction Industry Transformation Programme 2016-2020

Figure 2-1: Number of firms in construction by employee count.

The construction industry has generated one of the highest economic multiplier effects (Ibrahim et al. 2010). It has extensive backward and forward linkages with other sectors of the economy. 120 other industries depends on the construction sector for their growth and sustainability (CIDB 2016). The construction industry is one of the biggest consumers of Malaysia's manufacturing sector for ceramic, cement, metals, and other building materials. In fact, 15% of the total manufacturing output is consumed by the construction industry (CIDB 2016). Furthermore, the construction industry's potential forward linkages, consuming a range of services such consultancy, engineering, and a wide range of financial-related services, accounts for 5% of total output from the Malaysian services sector (Department of Statistics).

The MCI contributes significantly to the national employment rate. It is Malaysia's fourth largest employer. The construction industry consumed 9.5% of Malaysia's total workforce, accounted for 1.2 million registered workers. Seventy-five percent of the workforce in the construction industry is Malaysian nationals. A multitude of professionals are involved in the industry such as architects, engineers, planners, surveyors, skilled and non-skilled construction workers. Every year Malaysia institutions produce thousands of young graduates to enter construction related fields.

The construction industry will continue to contribute to the employment rate and play an increasingly critical role in the national economy, as Malaysia becomes a more developed nation.

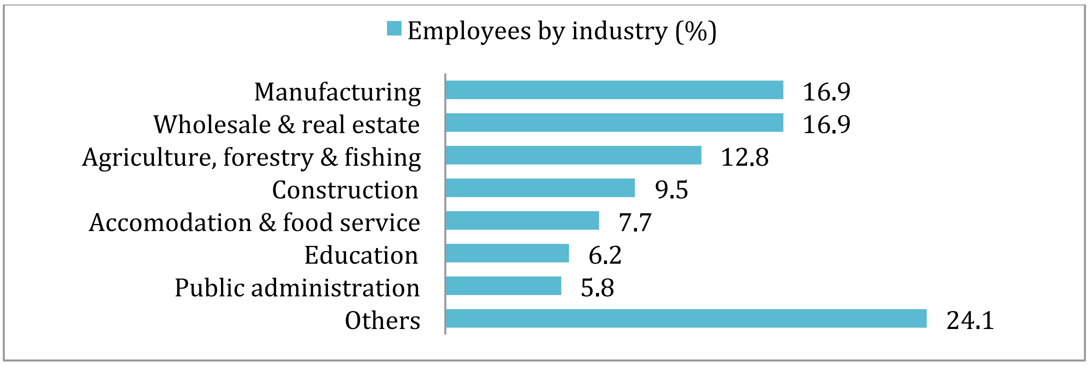


Figure 2-2: Composition of workforce by industry (2013).

The MCI also plays a significant role serving Malaysia's economic and social needs (Giang and Pheng 2011). Malaysia's unique geography is composed of Peninsular Malaysia (often referred to as West Malaysia), and Sabah, and Sarawak (both states located on the island of Borneo). Each of the two areas – West or Peninsular Malaysia and East or Malaysia Borneo is treated as a distinct entities by the government, which has resulted in complications in infrastructure planning and development. In fact, Peninsular Malaysia has historically been the biggest beneficiary of infrastructure development compared to Sabah and Sarawak, in which wide disparities have occurred. The Malaysian government has been encouraging the infrastructure development in the rural areas to achieve a balanced development throughout the nation (Naidu 2007). Basic infrastructure, amenities, and facilities for instance, roads, airports, railways, shipping ports, power generation, communication utilities, and other essential infrastructure provides the basic developments to improve the life quality and living standards of the society.

2.2 Malaysian Property Development

There are two types of developments in Malaysia, which are the land development and property development. Land development in Malaysia refers to the conversion of original use of any alienated land approved by the State Authority includes. The conversion includes the change of the land's conditions, interest, restriction and category of land use. Under the National Land Code (NLC), land development takes place in certain forms.

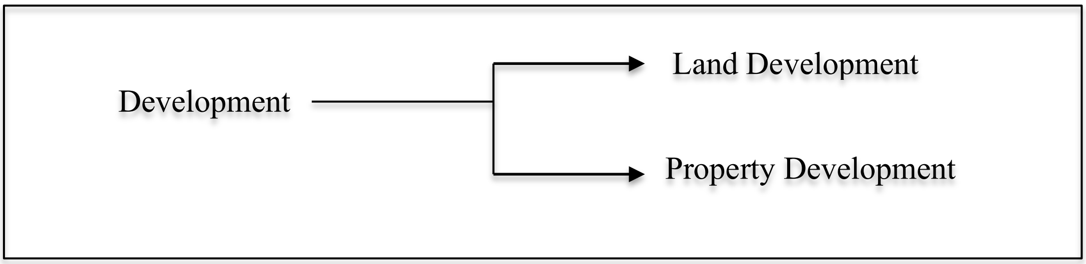


Figure 2-3: Types of Malaysia's development.

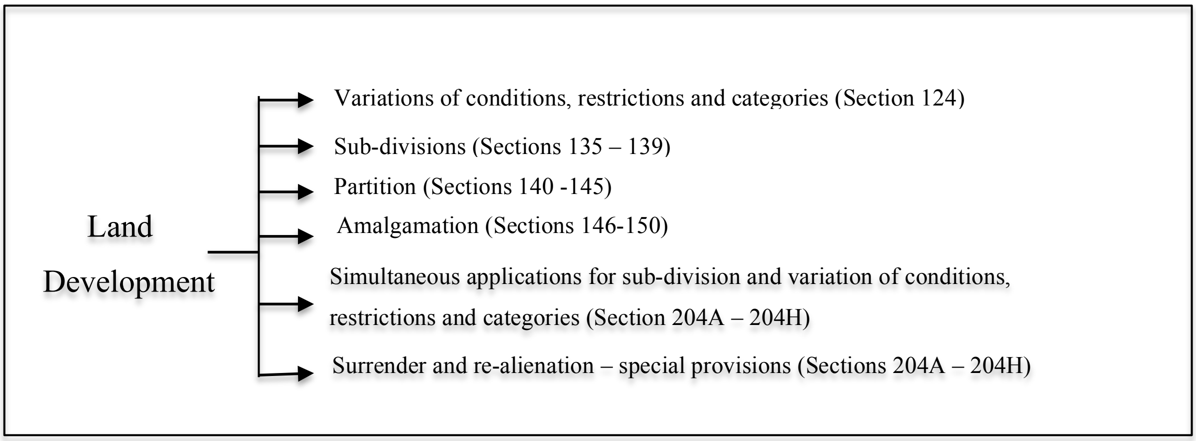
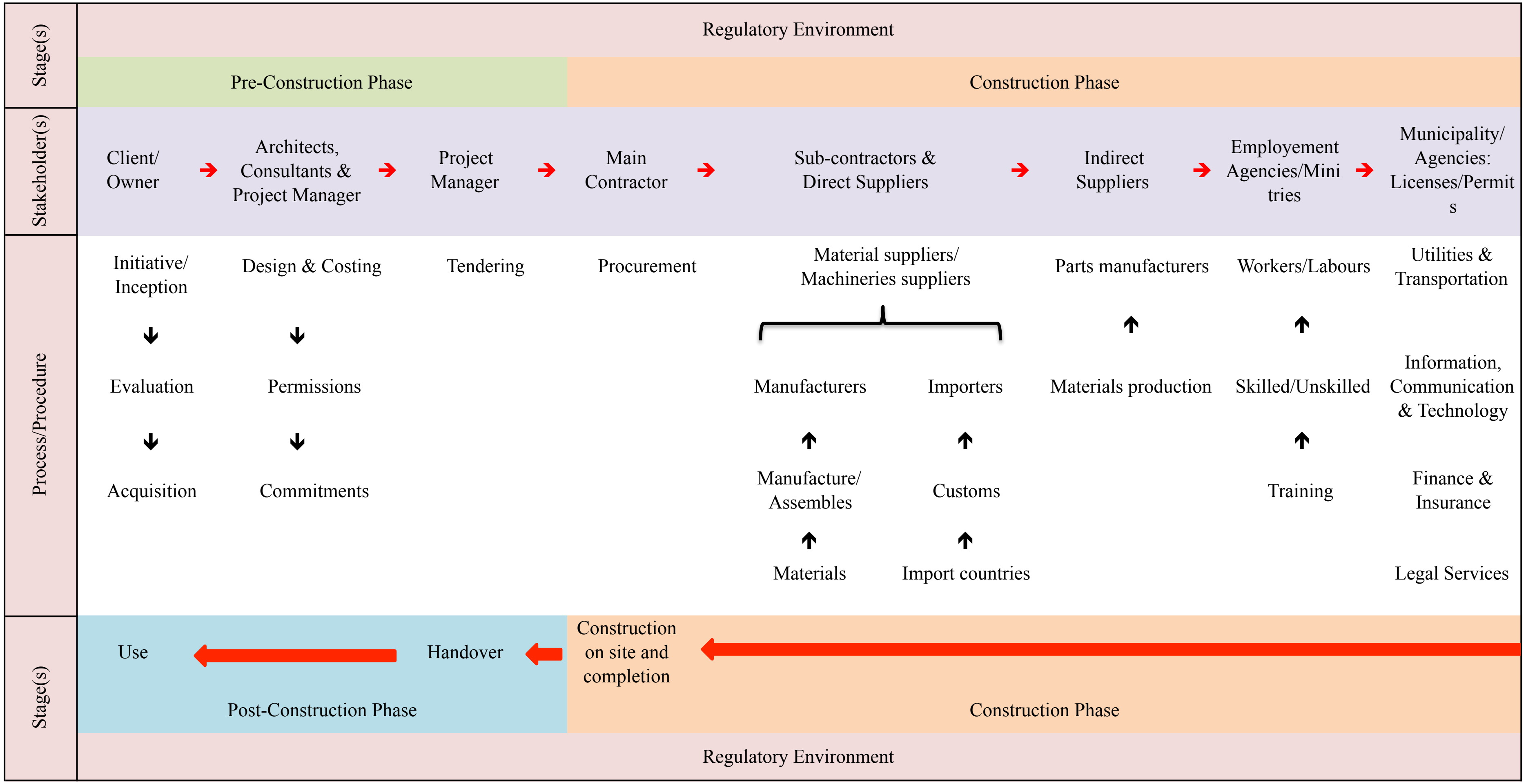


Figure 2-4: Forms of land development.

According to the Town and Country Planning Act 1976 (Act 172) Malaysia defines property development as "*the carrying out of any building, engineering, mining, industrial or other similar operations in, on, over or under land, or the making of any material change in the use of any buildings or other land, or the subdivision or amalgamation of lands*."

Although land development and property development have different definitions, they are interrelated in the process of developing land into a more valuable property. Land development happens in the initial stage or the ‘pre-construction stage’ when the land requires conversion into another value-added form. This is then followed by the property development activities such as preparation of architectural plans, statutory approval, and construction. The details of the project development process will be explained in the following section.



Source: Personal collection.

Figure 2-5: Diagram of a development process.

2.2.1 Project Development Process

Every project development inclusive in Malaysia will undergo the project life cycle (PLC) i.e. predevelopment stage, construction stage and post development stage (Kerzner and Kerzner 2017; Abdullah, Harun and Abdul Rahman 2011). The development process commences when a piece of land is potentially considered to have the best value for another purpose by the developer (Nik Jaafar). The decision to develop the land can be initiated by the landowner or developer, who is the main stakeholder in the development process. In other cases, the public sector and government agencies play the role as the developer.

The evaluation process of the proposed development involves activities such as market research and financial appraisals to guide the developer(s) throughout the process (Nik Jaafar). Professional registered property appraisers are appointed to assist in the developer's decision-making process (VAEA 1981). Upon instruction, the appraiser(s) will conduct a market or feasibility study and analyze the current market demand and supply.

Next procedure is the acquisition to possess the land. Before the land acquisition, legal matters such as land ownership, planning permission, compensation, ground investigation, and financing need to be investigated (NLC 2008). The legal investigation can either be carried out by the developer or through engagement of a lawyer (solicitor). In some cases, the public sector is involved when it comes to a large site with many occupiers and landowners (Abdullah, Harun and Abdul Rahman 2011). The Malaysian government procure the compulsory legal powers to acquire the site for any development purpose for the nation (NLC 2008).

The estimation of plans and cost estimations for the proposed development would be undertaken at the next stage of the development process (Nik Jaafar). Qualified professionals such as architects, quantity surveyors, and building surveyors develop the building plans according to the client's budget and requirements (Abdullah, Harun and Abdul Rahman 2011). The appointed, qualified professionals are either in-house or outsourced depending on the client's company profile.

Once the development plans are ready, planning consultants or architects will submit the plans to the local planning authority on behalf of the developer to obtain the planning consent before the commencement of the actual development (Abdullah, Harun and Abdul Rahman 2011). In some cases, an application to the state authority is necessary if conversion and sub-division of the land are involved (NLC 2008). Later, land surveyors will conduct the land survey and measurement. Planners from the local authority are responsible for approving or disapproving the development proposals submitted (Abdullah, Harun and Abdul Rahman 2011).

Contracts and agreements regarding land development between the stakeholders will take place under Contract Act, 1950 (CA 1950). For example, the main contractor appointed through tendering and a contract between the main contractor and the developer. The tendering and contract process to appoint a main contractor happens at this stage. The lawyers or solicitors will govern the legal agreements between the developer, contractors and the professional team of consultants.

The implementation of development plans or actual construction can now begin. All the main and supporting stakeholders come together during the construction stage to perform their relevant roles. The main contractor plays a vital role, undertaking and monitoring the entire construction stage. The developer may be the main contractor with in-house expertise or in other cases, outsourcing a subsidiary company on a contract basis. The main contractor is also the management contractor who manages the various sub-contractors. This stage involves many supporting stakeholders, such as architects, quantity surveyors, building contractors, engineers (civil, structural, mechanical, and electrical), and project managers.

The final stage is when the completed property is handed over to the owner as required and stipulated by the Housing Development Act (HDA 2010). This stage also involves securing a willing purchaser or occupier at the estimated rent or price by way of letting or sale. In the case of sell-build-transfer, this stage proceeds immediately with the handover to the occupier. In another scenario, a property agent or sales person (in the case where the developer is the landowner itself) is responsible for the post-construction process to sell or lease.

2.2.2 Project Stakeholders

According to the Project Management Institute (PMI), the term project stakeholder refers to "an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project".

Many parties are involved throughout the process of project development commencing from the initiation of the project development until its completion. The stakeholders in a project are categorized into two groups, the main stakeholder(s) and the supporting stakeholder(s). The main stakeholder is the party who has a direct financial interest in the development project, and they are normally the landowner, developer, or in some cases, the public sector. Meanwhile, the supporting stakeholders are the secondary tier stakeholders who are the appointed parties in support of completing the project. The main and supporting stakeholders are both involved in the development stages as shown in the Table 2-4 below.

Table 2-4: Summary of project stakeholders.

Property Development Stages	Main Stakeholder(s)	Supporting Stakeholder(s)
Pre-Construction Stage		
Initiation	Landowner Public Sector	Accountant Commercial Agent/Estate Agent
Evaluation	Developer	Professional/Economic Consultant (e.g., Registered Property Appraiser)
Acquisition	Developer Public Sector	Solicitor Accountant Financier Land Surveyor Appraisers
Design and Costing	Developer	Architect Quantity Surveyor Building Surveyor
Permission (including conversion, division, and ligation)	Planning Authority	Planning Consultant Architect Land Surveyor

(Continued)

Property Development Stages	Main Stakeholder(s)	Supporting Stakeholder(s)
Commitment	Land Owner Public Sector Developer	Solicitor Building Contractor Architect Quantity Surveyor Engineer Supplier
Construction Stage		
Implementation	Developer Building Contractor Project Manager	Sub-contractor Architect Quantity Surveyor Engineer Supplier
Post Construction Stage		
Let/Manage/Dispose	Land Owner Developer Occupier	End Financier Lawyer Estate Agent Appraisers

2.3 Construction Industry Development Board (CIDB)

The CIDB, which was established in December 1994, has become the main regulatory agency for the construction industry in Malaysia. The main functions of CIDB in the construction industry under subsection 4(1) of Act 520 can be classified into three (3) main categories: Development and Facilitative, Advisory, and Regulatory. The functions laid out in the Act are:

- To promote and stimulate the development, improvement, and expansion of the construction industry
- To advise and make recommendations to the Federal and State Governments on matters affecting or connected with the construction industry
- To promote, stimulate, and undertake research into any matter related to the construction industry
- To promote, stimulate, and assist in the export of services related to the construction industry
- To provide consultancy and advisory services to the construction industry
- To promote quality assurance in the construction industry

- To initiate and maintain the construction industry information system
- To encourage the standardization and improvement of construction techniques and materials
- To provide, promote, review, and coordinate training programs organized by public and/or private construction training centers for up-skilling construction workers and construction site supervisors
- To certify and register contractors and to cancel, suspend, or reinstate the registration of any registered contractors
- To recognize and certify skilled construction workers and construction site supervisors

2.3.1 Registration of Contractors

CIDB main function is to regulate and register construction firms. Malaysia construction companies are compulsory to be registered with CIDB before performing any construction work. There are seven grades from G1 to G7. The categorisation of these grades depends on the company's experience, financial status, and personal capability. The relevant grades will define the value of work allowed for the company. The registration is on a one to three years basis. According to CIDB, a construction company can be registered under more than one categories and subspecialty under certain registration requirements. There are three specialist categories in CIDB, which are building construction (B), civil engineering construction (CE), and mechanical and electrical construction (ME). The specialist categories are further subdivided into subspecialties. There 19 subspecialties from B01 to B19 for building construction. Civil engineering construction has 20 subspecialties from CE01 to CE22. Meanwhile, construction mechanical has 15 subspecialties (M01 to M15), and finally electrical has 10 subspecialties (E01 to E10). Table 2-5 shows the value of work for which approved construction companies can tender.

There are three specialist categories in CIDB, which are building construction (B), civil engineering construction (CE), and mechanical and electrical construction (ME). The specialist categories are further subdivided into subspecialties. There 19 subspecialties from B01 to B19 for building construction. Civil engineering construction has 20 subspecialties from CE01 to CE22. Meanwhile, construction mechanical has 15 subspecialties (M01 to M15), and finally electrical has 10 subspecialties (E01 to E10).

Table 2-5: CIDB contractor grades.

Grade	Paid-up capital (RM)	Tender capacity (RM)
G1	5,000	< 200,000
G2	25,000	< 500,000
G3	50,000	< 1,000,000
G4	150,000	< 3,000,000
G5	250,000	< 5,000,000
G6	500,000	< 10,000,000
G7	750,000	No limit
G8		Recommended by CIDB

Source: CIDB Directory (2004)

2.3.2 Grade 8

In the latest Construction Industry Transformation Program (CITP), CIDB suggests a new classification of contractor, which is the G8. It is an initiative to recognize the leaders in the construction industry who demonstrate the specifically stated criteria. The contractor has to be in the category of G7 with minimum standards and certifications before can be classified for G8. Other than that, internationally recognised quality certification such as the Total Quality Management and ISO 9000 are strongly encouraged for the contractors in the pursuit of G8 qualification. It is the milestone of the CITP to achieve 50 Malaysian companies to earn the G8 status.

2.4 A Review of Construction Industry Transformation Program (CITP)

The transition of Malaysia into a developed nation under the Eleventh Malaysia Plan (RMK11) and the Economic Transformation Program (ETP) will require the construction industry to continuously improve and become increasingly critical to the national economy. Hence, the CITP -the construction industry transformation program - was developed to serve the increasing demand for modern and efficient infrastructure projects with the aim of becoming an advanced nation. The CITP was established in collaboration with the Ministry of Works (MOV), the CIDB, key stakeholders, and the industry as a whole, with important strategic goals to bring Malaysia's construction industry to the next level, encompassing four strategic objectives: Quality, Safety, and Professionalism, Environmental Sustainability, Productivity and Internationalisation. The MCI issues were identified under each strategic objective and the outcomes projected for 2020 will be discussed in the following paragraph.

2.4.1 Four Strategic Thrusts

The CITP reviewed the current MCI practices and concluded there were some major issues and problems with the MCI achieving the four strategic objectives. The initiatives recommended and the targeted goals to be achieved under each strategic objective are discussed below. This discussion is an attempt to clarify the current issues encountered by the MCI today. These initiatives can be implemented in response to the issues examined under each strategic objective and hence, improve the performance of the MCI and raise it to a higher recognized status in the world.

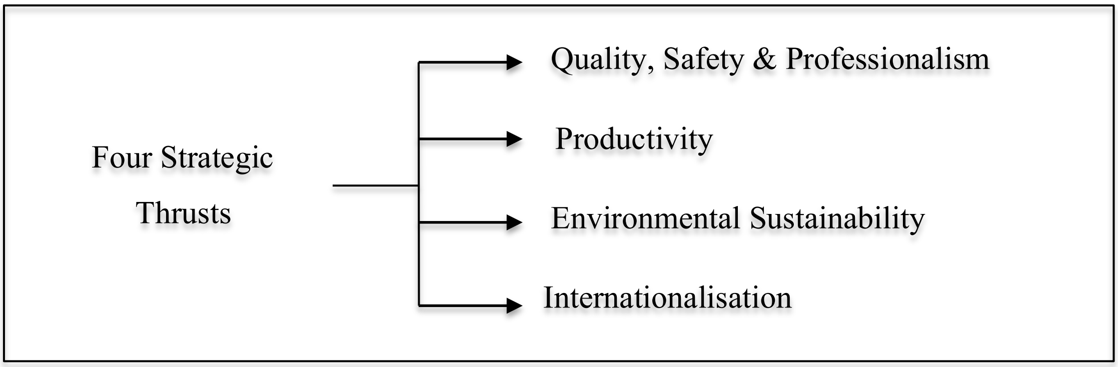


Figure 2-6: CITP's strategic thrusts.

2.4.1.1 Quality, Safety, and Professionalism

The Malaysian construction industry is yet facing the major issues of poor quality work, delays, high accident and fatality rate, lack of safety awareness and culture.

These problems affect the construction industry cycle from the general public to the consumers. Most importantly, these issues impede the nation towards achieving the target to be a developed nation by 2020.

The aim of the first strategic thrust is to embed professionalism, quality, and safety culture in the construction industry. The quality standards are strongly emphasized by the CITP to ensure the best quality in the construction environment, reduce accidents and remove the barrier of regulatory constraints. A quality-conscious industry certainly contributes to the transition of Malaysia to a developed nation.

2.4.1.2 Environmental Sustainability

Malaysia is in the effort of becoming a sustainable, low-carbon and resource-efficient nation. In accordance to that, Malaysia has set a voluntary target to reduce the greenhouse gases (GHG) emission intensity of its Gross Domestic Product (GDP) up to 40% by the year of 2020.

The aim of the second strategic thrust is to accomplish the goal of Malaysia becoming model of sustainable infrastructure country in the world. Develop a more resilient and sustainable infrastructure through reducing the emissions of carbon in the construction industry. Some initiatives to achieve the second strategic thrust have been suggested by CITP. Establishment of recycling centres in high levels construction activity areas for the construction waste, tighten the rules and regulations against illegal dumping and enforcement of taxation on excessive waste.

2.4.1.3 Productivity

The construction is considered as one of the lowest productivity sector in the nation's economy. The construction industry is facing the phenomena of largely low-skilled workers and high dependence on low-skilled foreign workers. It relatively reflects on the slow uptake of modern technologies and practices in the industry.

The aim of the third strategic thrust is to improve the construction industry productivity more than double, matched by higher wages. More specifically, CITP targeted to increase productivity by 2.5 times, the average value contributed by each worker per worker to US$ 16,500. It is to increase the construction industry productivity and to become one of the major contributors the nation's high-income by the year of 2020.

2.4.1.4 Internationalisation

The nation participation in Malaysia's Free Trade Agreements (FTAs) and the upcoming Trans-Pacific Partnership Agreement (TPPA) has given MCI the opportunity to be exposed to a larger consumer market as well as to encourage the intrusion of the foreign companies in local market. The exposure to the international market means increased competition and scrutiny for the MCI players to survive. Higher performance and standards are to be fulfilled by the MCI players in order to sustain in the relatively competitive market.

The aim of the fourth strategic thrust is to establish Malaysian champions that can lead and take charge locally and globally. It is targeted to achieve the goals of fifty companies with G8 status, ten companies with 5-star SCORE rating, and ten more companies to export construction services in the global market. The Malaysian leader companies will contribute to the high-income goal by winning back domestic market share and be able to survive the competitions in overseas market.

Table 2-6: Summary of the review on strategic thrusts.

Strategic Thrusts	Current situation	Aims
Quality, Safety & Professionalism	Limited emphasis on quality and assessment, limited safety awareness as well as added regulatory constraints within the industry.	Quality, safety, and professionalism to be ingrained in industry culture.
Environmental Sustainability	Prevalence of construction practices that are inefficient and risk harming the environment.	Malaysia's environmentally sustainable construction to be a model for the emerging world.

(Continued)

Productivity	Largely low-skilled construction workforce, with the industry highly dependent on low-skilled foreign workers. Industry productivity levels are one the lowest in the economy and as compared with developed economies, with slow uptake of technology and modern practices.	Productivity of the industry is more than doubled, match by higher wages.
Internationalisation	Malaysian construction players yet to emerge as real contenders on the global stages and facing decline in local market share.	Malaysian champions to lead the charge locally and globally.

2.5 Problems in the Malaysian Construction Industry (MCI)

Problems faced by the construction industry have been discussed globally in a wealth of literature. Over the years, CIDB has continuously outlined the problems faced by the MCI. For example in the Construction Industry Master Plan 2006 -2015 (CIMP), it emphasised the weaknesses in the construction, which include low productivity, low quality, highly dependence on foreign workers followed by various ensuing health and social problems.

Master Plan for the Occupational Safety and Health in Construction Industry (2005-2010) also highlighted serious MCI problems such as shortage of manpower, delays, low quality, poor image, delays, shortage of manpower, lack of data and information, and low productivity. In the latest Construction Industry Transformation Programme (CITP), CIDB once again reviewed the construction problems enclosed the real and substantial issues, which still persist in the construction industry. These include largely low-skilled workforce, over-dependence on foreign labours, low productivity, low quality awareness, risk harming environment, inefficient construction practices, low adaption on modern technologies and practices, decline in local market share, low competency as global contenders.

Some of the local writers have also reported the problems in the MCI such as Abdul-Rahman and Alidrisyi (1994), Razak Bin Ibrahim et al. (2010); Sambasivan and Soon (2007), and Hamid and Kamar (2010) have showed their concerns for the MCI to modernise and reform the issues being raised by the clients and stakeholders. The issues being mentioned include low quality on building finishes and infrastructures, lack of partnering initiatives, contractors' poor performance, lack of procurement strategy, and lack of building systems and green construction knowledge.

Ibrahim et al. (2010) found that low usage technology is the main cause of low productivity in the industry. Although the Government has set out policy to use and implement modern technology to boost the industry's performance and productivity, however, Ibrahim et al. (2010) commented that efforts by CIDB to realise this policy were insufficient. He further commented that the major issues faced by the contractors, such as the absorption, usage, and benefits of the new technology were not fully considered. Very often, the guidelines and recommendations made failed at the implementation stage and did not succeed to go through the construction phase.

Kamal et al. (2012) identified that the characteristics of the construction industry and current construction practice have led to serious problems in the industry. The MCI is highly fragmented, non-standardised, and constitute a multitude of professions, occupations, and organisations. There is a major separation between client, consultants, main contractors, sub-contractors, and workforce at site. The long-chain subcontracting culture: outsourcing various jobs to sub-contractors and project tendering system based on competitive price, has resulted in variations of design, cost, and other claims that led to dispute.

Pratt (2000) mentioned in his report that the Malaysian construction projects particularly in the magnificent projects were not function and cost effective. The construction projects exceeded the budget, never complete on time, and did not meet the quality standard. The problems and issues in MCI have been long discussed along the construction development. It is noticeable some of the construction problems remain persistent in the industry despite the efforts being made by the Government. These construction problems would definitely bring some negative effects to MCI itself as well as the nation's economy. The effects of the MCI problems will be discussed in the following paragraph.

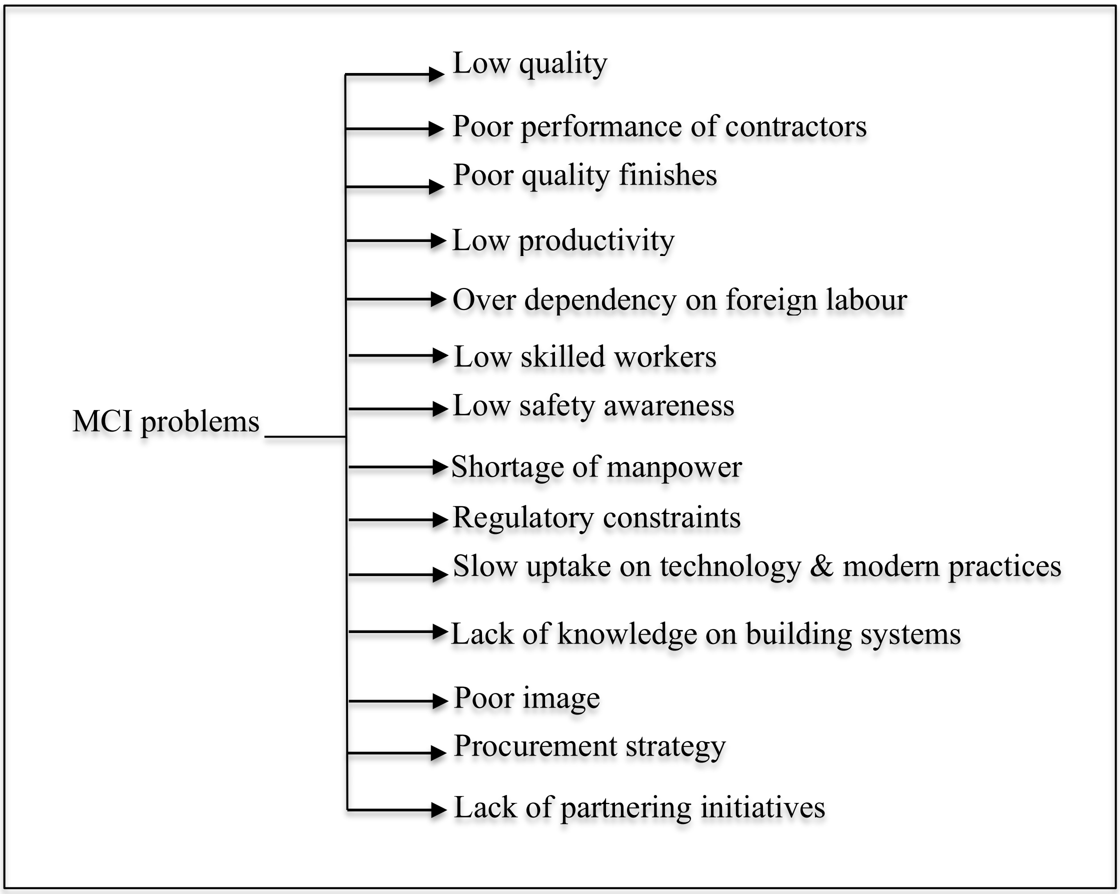


Figure 2-7: Summary of MCI problems.

2.5.1 The Case of Bakun Hydroelectric Project (BHP)

The Bakun Hydroelectric Project (BHP) in East Malaysia will be used as a case study to investigate the current status of the MCI. The BHP is one of the Sarawak Corridor of Renewable Energy (SCORE) projects intended along with dozens of other dams, to attract energy-intensive industries, create jobs, and grow the economy. However, it has been reported there were many problems and challenges involved in the project.

One of the challenges faced by BHP was cost overrun. Sovacool and Bulan (2012) reported the initial project cost was quoted at RM 6 billion and it later increased to

RM 8 billion resulting in 33% over the initial budget. Rani (2010) argued that the true cost of construction swelled to RM 15 billion, which would be a 60% cost overrun. Most of the time, the consequences of project cost over runs is the responsibility of the companies involved, whereas in this case, Sime Darby one of the contractors of the dam building, suffered a RM1.7 billion cost overrun for the BHP. They regarded this as “a very expensive lesson to learn”. Cost overrun becomes an evitable occurrence regardless of what construction project type is planned in the MCI.

Moreover, the study revealed some additional obstacles: lack of associated infrastructure, excavation and construction difficulties, and coordination of contractors and skilled manpower. Furthermore, lack of Malaysian technical capacity and skilled manpower were the other issues for the BHP. Five to seven thousand workers were imported from other countries for the project. Contracting with foreign partners for their expertise such as, Alstom (France) and IMPSA (Argentina) for the electrical and mechanical engineering work, MCH-JV (a joint venture between Sino Hydro and Sime Darby) for the civil engineering work, Dong-ah (South Korea) for diversion work, Global Upline for building the auxiliary coffer dam, SESCO for constructing the transmission line and hundreds of other subcontractors and bureaus (Sovacool and Bulan 2011). The project required a diversity of job specifications and involved numerous professionals resulting in a major project management challenge that required experienced and skilled project managers. However, based on current published assessments, we can conclude the MCI is still in an immature state in terms of handling construction projects such as a large dam.

There were some comments from the hired partners. The report by Sovacool and Bulan (2011) revealed that most of the partners did not have the necessary experience in dam-building. For example, IMPSA (Argentina) who was chosen to build half of the turbines required for the project and Sime Darby hired for the civil engineering work, were brought in with no prior experience in damn construction. Delays inevitably occurred, and the authors blamed these inexperienced partners. This evoked loud criticism regarding the contractors’ selection, where the selection of the contractors and partners was believed to have resulted from rather suspect political "negotiations". In the end, the criticism aimed at this practice involving billions of RM put the construction practices of the MCI in a rather unimpressive light.

From the case study above, we can conclude that the MCI is still facing some major challenges in handling construction projects. The long discussed problems of delays, and cost overruns are still occurring today. In spite of advanced technology and management systems being adopted, the status of the MCI does not seem to have improved accordingly. An investigation into MCI's challenges in finding an all-encompassing solution is a field worth looking into.

2.6 Implications of Construction Problems

2.6.1 Delays

A delay can be defined as the late completion of project work compared to the planned schedule completion in the contract. In 2005, about 17.3% of government contract projects in Malaysia were considered 'problematic' with delays of more than three months (Sambasivan and Soon 2007). Abdul-Rahman et al. (2006) found 45.9% of projects had delays in the completion dates during the construction stage. A study conducted by Abdullah, Rahman and Azis (2010) showed that 90% of the Mara management procurement projects ended up being delayed with the main causes of the delays all due to contractors' actions such as financial difficulties, poor site management, and ineffective planning and scheduling.

Delays can result in disruption of work and loss of productivity, late completion of the project, increased time-related costs, third party claims, and abandonment or termination of the contract. Delays are costly and often result in disputes and claims. Six effects of construction delays were identified in a few different studies (Aibinu and Jagboro 2002; Abedi, Fathi and Mohammad 2011): time overrun, cost overrun, dispute, arbitration, litigation, and total abandonment. The most frequent consequences of project delays are the extension of the project duration and cost overrun.

Sambasivan and Soon (2007) interviewed clients, consultants, and contractors on the causes of delays in construction projects and the 10 most common causes identified were; (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) client's inadequate financing and payment for completed work, (5) problems with subcontractors, (6) shortage of material, (7) labour supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

2.6.2 Time Overrun

Another study conducted by Memon, Rahman, and Azis (2011) revealed that 30 large construction projects in Malaysia were identified as encountering time overrun during construction, with the average time overrun of 34.74%. Among the 30 construction projects, 56.67% had encountered between 1- 100 days of time overrun, 16.67% faced between 101 – 200 days, 16.67% had between 201 – 300 days, and 3% encountered overruns of more than 300 days. The findings from the perspective of project management consultants (PMC) again, showed the contractors were responsible for the time-overrun issues and should be required to manage their cash flow and financial resources, improve site management, and conduct efficient planning and scheduling.

One of the major consequences of time overrun in construction projects is the cost overrun. Cost overruns have proven to demonstrate a positive and strong linear relationship with time overrun in a study conducted by (Sambasivan and Soon 2007). The results indicated the higher the percentage of time overrun, the higher the project costs and overestimated costs will likely be unacceptable to the client at the project feasibility stage as it will result in financial losses for the contractor and/or client.

2.6.3 Cost Overrun

Cost overrun is one of the major problems in the construction industry today, including in Malaysia. A study by Shehu et al. (2014) found more than half of Malaysian construction projects (55%) did not complete within the budget originally agreed. The most common factors causing cost overruns in the Malaysian construction industry were; poor design and delays in design, unrealistic contract duration and requirement imposed, lack of experience, late delivery of materials and equipment, relationship between management and labour, delay in preparation and approval of architecture drawings, inadequate planning and scheduling, poor site management and supervision, and mistakes during construction (Memon, Rahman and Azis 2011). As mentioned before, most of the causes were related to project management matters. Lack of management system expertise and lack of the ability to control construction costs could cause the construction companies to fail (Charoenngam and Sriprasert 2001).

Notably, Shehu et al. (2014) showed some interesting contradictions from the majority of the literature. The Malaysian public sector has been long criticized for its low performance, and usually, private projects perform better than public schemes (Sweis et al. 2013). However, (Shehu et al. 2014) indicated the Malaysian public sector projects seemed to perform better than private sector development projects and this is an uncommon phenomenon. Surprisingly, traditional procurement was found to be more likely associated with reduced costs compared with other procurement methods of project management, design and construction. This is in contrast to most project management literature where project management claims to have a better project performance (Bryde 2003; Cooke-Davies 2004; Gita, Kam and Tak 2014). This is a compelling finding worth investigating to determine the current MCI phenomena and the future direction of project management methods.

2.6.4 Dispute

A dispute exists when a claim or assertion made by one party is rejected by the other party, and that rejection is not accepted (Kumaraswamy and Yogeswaran 1998).

When disputes occur in project management, three aspects will be questioned; who, how much, and what. Who caused the overrun, how much of a delay occurred, and in what terms should the monetary awards be made. Disputes can be a result of many reasons but are mainly due to financial losses incurred.

Many researchers have studied construction industry disputes (Sambasivan and Yau 2007; Aibinu and Jagboro 2002; Carmichael 2002; Odeh and Battaineh 2002). They have concluded there are a large number of variables that contribute to construction disputes, which are difficult to summarize. However, it is evident construction disputes inevitably arise from a delay in completion schedule, budget overrun, and the quality of work and these are all contractor-related problems. Carmichael (2002) identified the contractor-related causes of disputes, which include the contractor's inadequate management, supervision and coordination of the work, delay or suspension of work, and failure to plan and execute any necessary changes to the work. Contractors play a prominent role in managing a construction project in terms of time, cost and quality; if all of these were managed well, disputes would be less likely to occur.

2.6.5 Arbitration

Arbitration is a process of settling disputes between parties without litigation in the courts. There is no statutory definition of arbitration. The Concise Oxford Dictionary simply states it is "the settlement of a dispute by an arbitrator".

In construction disputes, arbitration is preferred compared to litigation, the main advantage being the speed with which hearings can commence unlike the delays and uncertainties in the court system, which can take months. The date of a hearing can be set for the convenience of all parties and heard in private, and their peers, who are conversant with their work, will act as surrogate judges for the dispute.

2.6.6 Litigation

Litigation is the use of the court system to resolve disputes. In litigation, the process begins with the issue of a writ for a hearing and then on to judgment. One of the failures of the legal process has been the speed with which solicitors have been prepared to issue writs. After the writ has been issued, the plaintiff cannot simply withdraw his writ, as a counterclaim would be found against him along with any associated costs.

Disputes meeting certain conditions are required to be resolved through litigation. These include disputes involving a substantial legal issue, multiple-parties, allegations of dishonesty, difficulty, and a party who refuses to compromise and requests a court ruling.

2.6.7 Total Abandonment

Table 2-7: Abandoned Housing Projects (Peninsular) Statistics.

Year	Abandoned projects	Affected house units	No. of affected families
2011	235		
2012	177		
2013	204	27,177	19,016
2014	165	32,582	24,018
2015	151	26,934	17,862

The latest report by Ministry of Housing and Local Government (MHLG) indicated that the total number of abandoned projects for 2015 reached 151. These abandoned projects comprise 26,934 units of houses involving 17,862 families. As of July 2016, 20 projects were under the revival process, involving 6,154 units and 4,610 house buyers. Meanwhile, 24 projects were still under review process for revival, involving 5,880 units and 3,615 house buyers. The abandoned projects can be traced back 31 years to 1985. Moreover, 414 developers have been blacklisted by the MHLG due to their incompetence in completing their housing developments.

The abandoned housing projects have resulted in multiple adverse consequences to the economy, society, and environment, especially the house buyers (Razak, Mohammed and Tarique 2015). The homebuyers have to endure the inability to occupy the property, and instead, must continue servicing the bank loan and continue paying rent for other property to live. They also bear the loss of any rental value and property value appreciation. The worst situation is when the buyers are blacklisted due to the inability to repay the bank loan and lose the opportunity to purchase another new house.

One of the initiatives by the government to overcome the abandoned projects is through rehabilitating. In 2008, a new division under the Jabatan Perumahan Negara (JPN), which is the Division of Rehabilitation of Abandoned Projects, was established. From 2009 to 2012, 104 out of 177 abandoned projects have been revived under this program (MHLG 2012). However, there have been nine projects classified as having no chance for revival by the MHLG (2005). These nine projects comprise 2,866 units of houses involving 1,364 house buyers. The total value was estimated to at RM452.29 million.

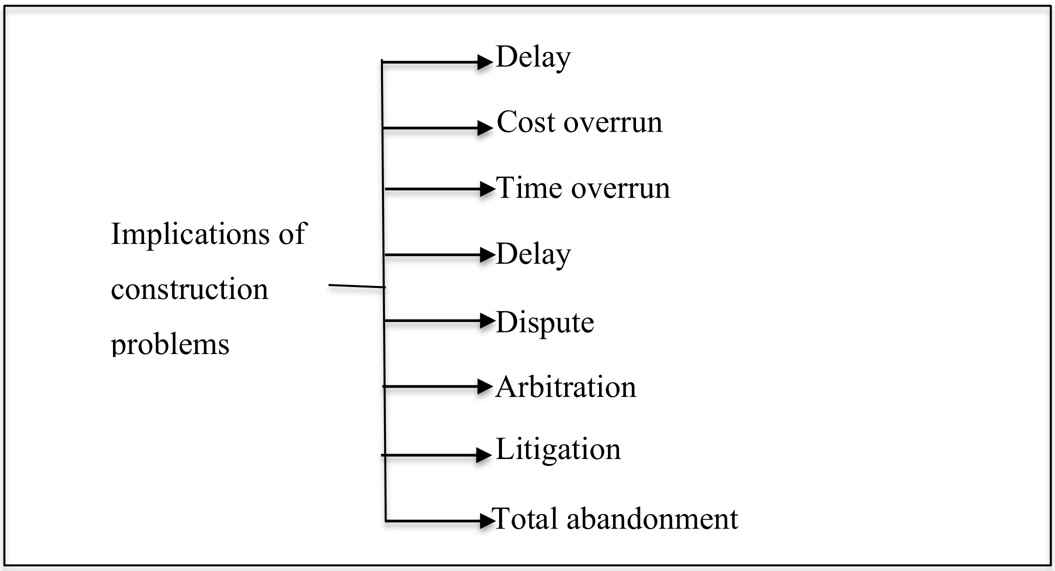


Figure 2-8: Summary of implications of construction problems.

2.7 Summary

This chapter explains how the construction industry is vital to the economy and development of the nation. The construction industry is a complex process characterized by a multitude of stakeholders and professionals. Effectively managing a construction project is a significant challenge for the Malaysian construction industry. The CIDB, a government organization governing the construction industry, requires all building contractors in Malaysia to be registered by grades (G1 to G7). The categorization of grades is determined by the company's experience, capability, and financial status, which mean the higher the grade, the greater the company profile is. Most importantly, the requirement that G7 contractors to be ISO 9001 certified ensures a higher quality of the contractors in the country. A new G8 category was proposed by the CIDB in the CITP (Construction Industry Transformation Program), which would supersede the G7 rating as the highest grade. Earning the G8 status comes with even more stringent rules than the G7 grade. The adoption of quality management and an internationally recognized quality certification will aid the G8 applicants. The CITP has targeted 50 Malaysian companies to obtain G8 status within the five years allowed for this programme. These government programs are a result of the importance of high quality work in the construction industry and the role the MCI plays in developing the nation. The G7 contractors with their certified qualifications fit the profile of this study, and they have been selected as the sample for this study.

The CITP, a programme launched by the Malaysian government, concludes the MCI still subject to low quality work and low productivity due to an over dependence on low-skilled foreign workers, and a little interest in technology and modern practices. The construction industry is declining in the local market share and yet to become a real competitor in the global market. A summary from the literature review of the construction problems and the consequences was discussed, followed by an explanation of the current situation faced by the MCI. Doubts have been raised regarding the current performance quality, and whether the construction industry is able to achieve the strategic objectives set by the CITP, to do high quality work, to meet safety and professionalism standards, achieve high productivity, maintain environmentally sustainable practices, and an internalized industry. Focusing on the construction industry's problems and the remedies to overcome the problems is encouraged in developing a modernized construction industry in Malaysia.

CHAPTER 3

LITERATURE REVIEW

3.0 Introduction

This chapter discusses the concept of quality in the perspective of the construction industry. The literature of TQM follows, including the definition of and evolution of TQM. The TQM practices, adopted originally from the Malcolm Baldridge National Awards (MBNQA) and the Baldridge criteria are discussed in detail. Next, this section discusses the dimensions of project performance. The relationship between each of the TQM practices and project performance are reviewed. This chapter ends with a brief summary.

3.1 Conceptualization of Quality

Quality is defined as the "degree to which a set of inherent characteristics fulfils requirements" according to the ISO 9000: 2008. However, the term is used broadly in various contexts, and different people view quality differently based on their expectations of the product. There is no common definition of quality (Almusharraf 2015). Some of the agreed definitions of quality are; fitness for use, conformance to specifications, paid value, support services, and psychological criteria (Reid and Sanders 2011).

According to the ASCE study in Günaydın (1995), the construction industry defined quality as fulfilling the requirements of the multiple stakeholders namely the owner, design professionals, contractor, and the regulatory agencies. For instance, meeting of customers' requirements of functional adequacy, completed on time and within budget, minimum operation and maintenance costs; fulfilling design requirements of time and budget allowance; meeting contractors' requirements such as provision of detailed contract plans, writing specifications and other related documents related to the construction process; last but not least meeting the regulatory agencies' requirements including conformance with building laws, regulations, codes, and policies.

In the construction industry, there are two types of quality; product quality and process quality (Günaydın 1995). Product quality is directed to the physical product itself such as equipment, technology, and building materials quality that are applied to the building construction. Meanwhile, process quality means the standard of the production process that produce acceptable or faulty product. It refers to the organization and management of a project during the phase in construction where planning and design, construction, and operation and maintenance occur. Both types of quality are equally important in the construction industry; product and process quality will eventually determine the product's performance.

3.2 Total Quality Management (TQM)

Total Quality Management (TQM) is designed to improve quality performance at every level of the organization through an integrated effort. TQM is about meeting quality expectations of customers, sometimes referred to as 'customer-defined quality.' However, a clear definition of quality is difficult as different people have different opinions on the definitions of high quality.

Oakland (2014) has defined TQM as follows:

Total Quality Management (TQM) is an approach to improving the effectiveness and flexibility of business as a whole. It is essentially a way of organizing and involving the whole organization; every department, every activity, every single person at every level.

3.3 Evolution of Total Quality Management (TQM)

The concept of quality has been long existed and has evolved over time. The notion originated in the early twentieth century, where inspections were used to assure conformity to specific requirements in producing products (Dale, Van der Wiele and

Van Iwaarden 1999). However, during the Industrial Revolution, the growing organizations and production require more than just inspection for the quality conformance (Taylor 1911). Therefore, the quality control through more effective operations is needed.

In 1911, Fredrick W. Taylor introduced statistical theory framework in his book of 'The Principles of Scientific Management'. This framework was used to improve productivity of workers in industrial sector. Some of the important concepts introduced by Taylor are control of quality, process analysis, and functional specialization. These concepts are recognized and still in practice until today.

During the 1920s, Dr. Walter Shewhart introduced quality control in a more proactive way. He applied statistical theory to the quality management and developed the first modern control (Shewhart 1926). Shewhart's work is the starting of statistical quality control (SQC) and was published in 1931 as *Economic Control of Quality of Manufactured Product*. He proved that improved quality of the final product can be achieved through elimination of variation in the process. He is the founder of the statistical process control systems, and he is often regarded as "the father of modern quality control" (Shewhart 1931).

During World War II in the 1940's, statistical quality became evident. The quality of weapons production process was monitored using Shewhart's statistical control techniques – the quality control charts. Gen. MacArthur then sought for Shewhart's assistance in rebuilding the Japanese industries after the war. Instead, Shewhart recommended his Western Electric protégés, W. Edwards Deming and Joseph Juran for this task.

Dr. W. Edwards Deming stressed individuals and the company's management are important in delivering quality. According to Deming (1982), 85% of quality problems are due to processes, systems, and poor management, where only worker error only accounted for 15%. He further emphasized that an organization's culture changes with management's commitment to quality as the path to achieving high quality. Deming popularized Shewhart's 'Learning and Improvement Cycle' as the Plan-Do-Study-Act (PDSA) Cycle (Moen and Norman 2006). In addition to

Deming's philosophy of management, Deming's *Fourteen Points of Quality* was developed to help guide organizations, regardless of size and type, in achieving quality improvement.

Deming's *Fourteen Points of Quality* (Deming 1982) consists of (1) creating constancy of purpose towards improvement of product and service, (2) adopting the new philosophy, (3) ceasing dependence on mass inspection, (4) ending the practice of awarding business on the basis of price, (5) finding errors, (6) instituting modern methods of training on the job, (7) instituting modern methods of supervision of production workers, (8) driving out fear, (9) breaking down barriers between departments, (10) eliminating numerical goals, (11) eliminating work standards that prescribe numerical quotas, (12) removing barriers that stand between the hourly worker and their right to pride of workmanship, (13) instituting a vigorous programme of education and retraining, and (14) creating a structure in upper management. Deming's principles have been successfully proven in global companies such as Toyota, Gamble, Ritz-Carlton, Harley-Davidson, as well as other well-known organizations (Daft 2010).

Meanwhile, Dr. Joseph Juran went to Japan in 1951 to work with manufacturers and conducting classes on quality. Juran's notion of quality as 'fitness for use' concerns about customer needs and requirement of the products use instead of emphasizing technical specification conformance. He developed the concept of 'cost of quality', which enables justification of quality regarding money value. He is well known for his quality set: quality planning, quality control, and quality improvement (Juran 1986).

Quality planning is to determine customer, product requirements, and business goals. Then, set up the processes needed to meet the standardized requirements. The second part focuses on the application of statistical control methods to monitor the quality standards through identification of variations. The last part is quality improvement through continuous innovation. Both Deming and Juran stressed workers' continuous improvement through a regular process of skills training.

In the 1960's, the quality concept took on a broader meaning. Quality was seen as a total concept that affected not only the production processes but also the entire organization. All the company functions were responsible for product quality, and all shared the costs of poor quality. The Japanese embraced the teachings of these Western quality "gurus", and adopted, and developed their own quality concepts i.e. *Kaizen*. Kaizen adopted the quality management principles of TQM and 'lean' manufacturing and embedded them in the organization's values.

During the 1970's and 1980's, foreign companies offered the concept of higher quality product with lower price. Japanese products began to overtake American market share especially in the automobile and electronics industry as Toyota, Honda, Sony, and Toshiba led the way. This was when American industries started to become aware of the importance of quality, by observing Japanese successes. U.S corporations started to expand the theories and methods as quality improvement.

Armand V. Feigenbaum (1956) introduced the conceptual foundations and practical applications of quality management through his '40 steps of quality' principles. He stressed a total quality system approach is the commitment of the entire organizations in improving quality. Feigenbaum is therefore considered the founder of Total Quality Management.

Later, Philip B. Crosby developed with the "Do it right the first time" concept. In 1979, Crosby was famously coined the phrase "quality is free" and other seminal concepts such as "Zero Defects". He pointed out that many of the quality costs are inclusive of organizational costs and are hard to quantify.

Crosby's four absolutes of quality consists of (1) quality is conformance to requirements, (2) the quality system of prevention, (3) zero defect as the performance standard, and (4) price non-conformance as the quality measurement.

The Yong and Wilkinson (2002) study, marked a touchstone in the TQM evolutionary journey over four phases i.e. inspection, quality control, quality assurance, and finally becoming TQM. The evolution of TQM grew from inspection, identification and correction of errors, quality manuals and controlling process performance. Next, it developed into more comprehensive manuals and systems by third-party certification, expanded to all areas of the organization instead of production process. Finally, it evolved through the use of standardized techniques such SPC with continuous improvement.

The concept of quality has developed over the years. It evolved from a reactive approach where quality problems are only corrected after they occur, into a proactive approach, where quality is built into the product or process design. The initial concept of quality where quality was regarding inspection and variations correcting evolved into statistical control techniques using charts. Total commitment involving the entire organization from management to all levels of staff delivering quality was then introduced. Quality started to have a strategic meaning.

Today, improving quality has become a survival factor for all companies. Successful companies understand quality provides a competitive advantage and maintaining customers is important. The customer-driven quality approach arose when meeting or exceeding customer expectations became the total quality objective.

3.4 Total Quality Management (TQM) Practices

Many researchers have defined TQM in various ways although they are generally complementary to each other. The number and significance of TQM elements vary from one author to another. This leads to dis-agreement regarding the design of TQM from the literature (Dahlgaard-Park 2011). Problems appeared when a diversity of TQM dimensions occurred. Many researchers have preferred to develop their own model instead of using a proven constructed model, which has been tested by preceding authors. As a result, agreement on a set of common TQM practices defining the wide range of TQM frameworks is problematic (Prajogo and McDermott 2005; Psomas, Vouzas and Kafetzopoulos 2014).

Quality awards have been adopted as the TQM framework in many studies conducted in other countries. There are more than a hundred quality awards existing in various countries. All these quality awards have been derived from earlier prestigious awards: the Malcolm Baldridge National Quality Award (MBNQA), the European Quality Award, and the Deming Prize (Jaeger, Adair and Al-Qudah 2013). Taking into consideration the widespread acceptance of the MBNQA quality criteria, these criteria best represent TQM and were chosen for the analysis of construction organizations in Malaysia. The rationale for adopting MBNQA in this study is that it is widely recognized as one of the benchmarks of TQM and many scholars have validated this system of TQM practices (Prajogo and McDermott 2005; Terziovski 2006; Ooi et al. 2011; Sabella, Kashou and Omran 2014). This framework is also relevant and appropriate to both manufacturing (Ooi et al. 2013) and non-manufacturing sectors (Bouranta, Psomas and Pantouvakis 2017). In this study, TQM practices based on the MBNQA model were adopted for the following reasons:

1. It contains both soft and hard elements of TQM (Talib, Rahman and Qureshi 2013; Lee, Ooi and Choong 2013; Lee and Ooi 2015);
2. It has been adopted by many researchers in their empirical research (Talib, Rahman and Qureshi 2013; Lee, Ooi and Choong 2013; Lee and Ooi 2015);
3. It has been implemented in both developing and developed countries (Lee, Ooi and Choong 2013; Lee and Ooi 2015);
4. It has been applied in construction projects (Lam, Lam and Wang 2008; Jaeger, Adair and Al-Qudah 2013).

MBNQA's framework incorporates seven independent quality criteria: leadership, strategic planning, customer/market focus, process management, human resource focus, measurement/analysis, and results. Each of the criteria will be discussed in detail in the following section.

3.4.1 Quality Awards: Malcolm Baldridge National Awards (MBNQA)

The Malcolm Baldridge National Quality Award (MBNQA) was developed by the U.S. Congress in 1987 to raise the quality awareness and stimulate quality initiatives to increase competitiveness in the business community. It is also an award and recognition given annually to companies that demonstrate quality excellence and establish best-practice standards in the industry.

The award is given to no more than two companies in each category. There are three categories namely manufacturing, services, and small business. The companies are selected based on the Baldridge Criteria for Performance Excellence as illustrated in in Table 3-1.

Table 3-1: Categories and Items of MBNQA

Categories and Items	
1	**Leadership**
	1.1 Senior Leadership
	1.2 Governance and Societal Responsibilities
2	**Strategic Planning**
	2.1 Strategic Development
	2.2 Strategy Implementation
3	**Customer Focus**
	3.1 Voice of Customer
	3.2 Customer Engagement
4	**Workforce Focus**
	4.1 Workforce Environment
	4.2 Workforce Engagement
5	**Operation Focus**
	5.1 Work Processes
	5.2 Operational Effectiveness
6	**Measurement, Analysis, and Knowledge Management**
	6.1 Measurement, Analysis and Improvement of Organizational Performance
	6.2 Knowledge Management, Information, and Information Technology
7	**Results**
	7.1 Product and Process Results
	7.2 Customer-Focused Results
	7.3 Workforce-Focused Results
	7.4 Leadership and Governance Results
	7.5 Financial, and Market Results

3.4.2 Baldridge Criteria

This model comprises seven criteria for performance excellence categories namely: (1) leadership, (2) strategic planning, (3) customer focus, (4) measurement, analysis, and knowledge management, (5) workforce focus, (6) operation focus, and (7) results. However, this research will exclude the last criteria i.e. results, as the criteria of results for project performance will be developed by the author and be discussed later in this chapter. The following sections will look into each of the categories and the issues raised.

3.4.2.1 Leadership

According to the National Institute of Standards and Technology (NIST), leadership is subdivided into two types: senior leadership, and governance and societal responsibilities (Lee and Ooi 2015). This section focuses on senior leader's guidance in leading and sustaining an organization, the organization's governance system and its legal, ethical, and societal responsibilities in supporting the key stakeholders (Lam, Lam and Wang 2008; Lam et al. 2012; Ooi 2014).

Senior leadership examines an organization's upper management leadership. The focus is on the actions of senior managers in creating and sustaining a high-performance organization, such as setting an organization's vision, values, and mission, promoting legal and ethical behaviour, and creating a sustainable organization. It also includes the communication between a leader and the entire workforce and key customers in order to improve organizational performance and focus on actions to achieve the organization's objectives.

Governance and societal responsibilities review an organization's approach to achieve the key aspects of the organization's governance system, including the senior leaders' performance evaluation. It also includes following appropriate legal and ethical behaviour, societal responsibilities, and supporting the key stakeholders.

3.4.2.2 Strategic Planning

Strategic planning is sub-divided into two sub-sections: strategy development and strategy deployment (Lam, Lam and Wang 2008; Jaeger, Adair and Al-Qudah 2013; Lee and Ooi 2015). The primary focus here is on an organization's development and deployment of strategic objectives and action plans, any changes of circumstances required, and measuring progress (National Institute of Standards and Technology 2013).

Strategy development examines an organization's strategy development process in setting strategic goals and develops strategic objectives, leading and enhancing the organizations overall performance. Activities include the strategic planning process to address strategic challenges and leverage its strategic advantages and strategic opportunities, key work system decision-making, key strategic objectives, and goals.

Strategy implementation will be evaluated regarding the allocation of resources and the workforce to support and deploy the strategic objectives into action plans. In addition, the indicators and key measurements would be developed by the organization to track the effectiveness of the action plans and include benchmarking with other comparable organizations and finally a modified action plan if circumstances suddenly challenged the organization.

3.4.2.3 Customer Focus

This category is subdivided into two sections: (1) voice of the customer and (2) customer engagement (Lam, Lam and Wang 2008; Jaeger, Adair and Al-Qudah 2013; Lee and Ooi 2015). This section addresses an organization's engagement with its customers for long-term marketplace success. By determining requirements, expectations, and preferences of customers through active listening to customers this will established an improved relationship with customers. This criteria also focuses on how an organization determines key concerns using information from customers to improve and identify opportunities for innovation that leads to customer satisfaction and loyalty (National Institute of Standards and Technology 2013).

Understanding customers' needs and requirements are one of an organization's key processes for obtaining information about current and potential customers and markets and leads to greater understanding of emerging customer requirements and expectations. This criteria also allows for tracking markets changes to provide opportunities to offer more relevant products and services. This practice includes listening actively to customers and collecting information on their satisfaction, dissatisfaction, and engagement.

Customer engagement includes an organization's processes in serving customers' needs and building a relationship with them. The activities include determining customer and market requirements for product offerings, developing key communication mechanisms to support customers, and identifying current and future customer groups and market segments for business growth. Moreover, building customer relationships is also a major aspect of customer engagement. It includes activities involved in relationship management and complaint management to acquire new customers and build new markets, retain customers, and enhance customer engagement and develop a relationship with the organization.

3.4.2.4 Workforce Focus

This category is sub-divided into two sections: (a) workforce environment and (b) workforce engagement (Sabella, Kashou and Omran 2014; Lee and Ooi 2015). According to the National Institute of Standards and Technology (2013), workforce focus emphasizes an organization's efforts in building a conducive working environment, through engagement, management, and development of the workforce to maximize its full potential driving the organization's overall mission, strategy, and action plans.

Workforce environment focuses on workforce ability and capacity management such as competencies, skills, certifications, and staffing levels in accomplishing an organization's work, new workforce recruitment requirements, work accomplishment management, and workforce change management. It also examines the development of a supportive and secure work climate of an organization such as a healthy and secure workplace, staff benefits, and policies.

Workforce engagement focuses on an organization's development of workforce members, managers, and leaders to achieve a high performance through improvement and innovation. This criterion involves workforce performance management such as determining key elements that affect workforce engagement, assessment of workforce engagement, and workforce and leader development.

3.4.2.5 Operation Focus

This category is sub-divided into two sections: (a) work processes and (b) operational effectiveness (Jaeger, Adair and Al-Qudah 2013; Lee and Ooi 2015). The first section focuses on an organization's design, management, and the improvement of its product and work processes, while operational effectiveness attempts to improve customer value and achieve organizational success and sustainability (National Institute of Standards and Technology 2013).

Work processes examine an organization's key work processes such as product and process design based on key product and process requirements, process management such as implementation, measurement, and improvement of key products and lastly, processes to deliver products that achieve customer value and organizational success and sustainability.

Operational effectiveness analyzes the effectiveness of an organization's operation on an ongoing basis and into the future. The activities include overall operations costs control, innovation management, safety and emergency preparedness, and supply chain management.

3.4.2.6 Measurement, Analysis and Knowledge Management

This category is subdivided into two sub-sections: (a) measurement, analysis, and improvement of organizational performance, and (b) knowledge management, information, and information technology (Lam, Lam and Wang 2008; Lee and Ooi 2015). This section focuses on an organization's selection, management, and use of data and information for performance measurement and analysis in support of organizational planning and performance improvement (National Institute of Standards and Technology 2013).

Measurement, analysis, and improvement of organizational performance in this category focuses on an organization's process of measuring, analysing, reviewing, and improving organizational performance by using data and information at all levels and in all parts of the organization. It also examines the organization’s decision-making process using comparative and customer data.

Knowledge management, information, and information technology evaluates an organization’s process of managing and building its knowledge assets. It examines how an organization ensures the availability of high-quality data and information, and the software and hardware needed by the workforce, suppliers, partners, collaborations, and customers.

3.5 Project Performance

The Project Management Institute (1996) defines a project as “a temporary endeavour undertaken to create a unique product or service”. Projects are unique, novel, specifically aimed at a certain goal, and have a clear finishing date. The nature of projects, which are complex and unpredictable, causes serious challenges to project-based organizations. Moreover, project-based organizations are fundamentally different from standard organizations. Therefore, defining project success is a difficult task (Alzahrani and Emsley 2013).

Within the context of a construction project, the success of a project may be judged differently by the construction organizations depending on their objectives (Neyestani 2016). What is viewed as a measure of success for one project may be perceived as an indication of abject failure for another. In fact, it is hardly to determine whether a project is a success or a failure because the concept of success remains imprecise among project participants (Alzahrani and Emsley 2013).

Also, there is no commonly agreed framework for performance measurements regarding projects (Toor and Ogunlana 2010). It is impossible to develop a universal checklist for project success criteria due to the unique characteristics of the project where each of the project is differ in terms of size, location, complexity, and uniqueness(Westerveld 2003). Time, cost, and quality referred to as the ‘iron triangle’ are the commonly accepted performance indicators to measure the success of construction projects (Meredith and Mantel Jr 2011; Mane and Patil 2015). Over the years, the “iron triangle” criteria (time, cost, and quality) have been criticized because they seemed to be inadequate measurements. Toor and Ogunlana (2010) have reported the earlier performance criteria are no longer the determinant of project success due to the evolution of project environments. Customer satisfaction and the overall satisfaction of stakeholders should also be taken into consideration in project performance evaluation criteria (Proust 2011; Neyestani 2016)

The conventional dimensions of the iron triangle, albeit often criticized, are still considered vital in measuring the project success (Papke-Shields, Beise and Quan 2010; Neyestani 2016). This research uses the basic criteria, project efficiency as discussed by Shenhar et al. (2001). Project performance was evaluated according to the estimated budget, timeline, technical specifications (product/service requirements), and the ability to fulfil customer service needs and requirements. Therefore, in this research, the project performance was measured by applying project efficiency standards (time, cost, and quality).

Table 3-2: Studies of TQM and elements of performance (2010 onwards).

Author	Elements of performance	Analysis procedure	TQM framework adopted	Sample Size	Region	Industry specific
Kuo and Kuo (2010)	Project performance	Structural equation modelling	TQM	N=371	Taiwan	Construction
Ali and Rahmat (2010)	Project performance	Mean	TQM	N=30	Malaysia	Construction
Din, Abd-Hamid, and Bryde (2011)	Project management practices Financial management practices	MANOVA	ISO 9000	N=336	Malaysia	Construction
Agus (2011)	Product performance & customer-related performance	Pearson's correlation & Structural equation modelling	TQM	Not mentioned	Malaysia	Manufacturing
Teh, Tritos, and Dotun (2012)	Technology management	Structural equation modelling	TQM	N=115	ASEAN (Thailand, Malaysia, Philippines, Indonesia, and	Automotive manufacturing
Talib, Rahman, and Qureshi (2013)	Quality performance	Pearson's correlation & Multiple regression	TQM	N= 172	India	Service
Irfan and Kee (2013)	Service quality	Structural equation modelling	TQM	N-255	Pakistan	Service
Ooi et al. (2013)	Innovation performance	Multiple regression	MBNQA	N=206	Malaysia	Manufacturing
Mir and Pinnington (2014)	Project success	Bi-variate correlation & Multiple Regression	PMPA	N=154	United Arab Emirates	Construction
Sadikoglu and Olcay (2014)	Firm performance	Multiple regression	TQM	N= 242	Turkey	Not mentioned
Leong et al. (2014)	Project performance	Correlation & regression analysis	TQM	N=1030	Malaysia	Construction
Banna, Ahmad, and Koh (2016)	Bank loan quality	FAMA-MacBeth regression	TQM	N=581	United State	Bank
Shafiq, Lasrado, and Hafeez (2017)	Organizational performance	Structural equation modelling	EFQM	N=210	Pakistan	Textile
Mehralian et al. (2017)	Organizational performance	Structural equation modelling	TQM	N=933	Iran	Pharmaceutical

Table 3-3: TQM practices and elements of performance adopted.

Author	TQM adopted		Dimensions of performance	
Kuo and Kuo (2010)	1. Leadership ability 2. Human research management 3. Process management	4. Continuous quality improvement & information 5. Cooperation firms' management	*Project performance* 1. Technology innovation 2. Successful ratio 3. Product quality	4. Cost/benefit analysis 5. Process improvement
Ali and Rahmat (2010)	*ISO 9000 certification*		*Project performance* 1. Cost performance 2. Time performance 3. Quality performance	4. Client's satisfaction 5. Health and safety 6. Functionality
Din, Abd-Hamid, and Bryde (2011)	*ISO 9000 certification*		1. Project management practices 2. Financial management practices	3. Project success
Agus (2011)	1. Supplier relations 2. Benchmarking	3. Quality measurement 4. Continuous process improvement	1. Product performance 2. Customer-related performance	
Teh, Tritos, and Dotun (2012)	*Hard TQM elements* 1. Customer focus 2. Information & analysis	3. Process management	*Technology management*	
Talib, Rahman, and Qureshi (2013)	1. Top management commitment 2. Customer focus 3. Training and education	9. Quality system 10. Benchmarking 11. Quality culture 12. Human resource	*Quality performance* 1. Product quality 2. Service quality 3. Process quality	5. Employee satisfaction 6. Customer satisfaction 7. Supplier performance

	4. Continuous improvement and innovation 5. Supplier management 6. Employee involvement 7. Information & analysis 8. Process management	management 13. Strategic planning 14. Employee encouragement 15. Teamwork 16. Communication 17. Product & service design	4. Employee service quality	
Irfan and Kee (2013)	1. Top management commitment & visionary leadership 2. Customer focused 3. Information, analysis & system	4. Service culture 5. Human resource management 6. Social responsibility	*Service quality* 1. Customer satisfaction 2. Employee satisfaction	
Ooi et al. (2012)	1. Leadership 2. Strategic planning 3. Customer focus	4. Information analysis 5. People management 6. Process management	*Innovation performance*	
Mir and Pinnington (2014)	*PMPA (Bryde 2003)* 1. PM leadership 2. PM staff 3. PM policy & strategy	4. PM partnership & resources 5. PM KPI's	*Project success* 1. Project efficiency 2. Impact on customer	3. Impact on the team 4. Business success 5. Preparing for the future
Sadikoglu and Olcay (2014)	1. Leadership 2. Knowledge and process management 3. Training	4. Supplier quality management 5. Customer focus 6. Strategic quality planning	*Firm performance* 1. Operational performance 2. Inventory management performance 3. Employee performance	4. Innovation performance 5. Social responsibility 6. Customer results 7. Market and financial performance
Leong et al. (2014)	*ISO 9000 certification*		*Project performance* 1. Cost performance 2. Time performance 3. Time performance	4. Quality performance 5. Safety and health 6. Clients' satisfaction

Banna, Ahmad, and Koh (2016)	1. Bank efficiency 2. Income-to-cost ratio		*Bank loan quality* 1. Non-performing loans	
Shafiq, Lasrado, and Hafeez (2017)	*EFQM* 1. Leadership 2. Strategy	3. Partnership & resources 4. Process 5. People	*Organizational performance* 1. Financial results 2. Non-financial results	
Mehralian et al. (2017)	1. Top management commitment 2. Strategic planning process 3. Quality information and usage 4. Employee training	5. Process design 6. Supplier quality 7. Benchmarking 8. Customer focus	*Organizational performance* (Balanced Scorecard Approach) 1. Financial perspective 2. Customer perspective	3. Internal process perspective 4. Learning and growth perspective

3.6 The Relationship between TQM and Project Performance

Table 3-2 illustrates a summary of studies on the link between TQM and the elements of performance. These studies were identified through the Scopus search engine from 2010 onwards with the main key words of TQM and performance. From the table, it is clear the TQM studies from the literature were not from one single area but were conducted all across the world, from Taiwan, Malaysia, India, and Pakistan, to the United Arab Emirates, Turkey, the United States, and Iran. The industries involved also varied, such as construction, manufacturing, and services. The TQM framework adopted in each study was diverse as well as the measurements of performance being investigated. TQM framework and dimensions of performance in each study are summarized Table 3-3.

A few studies have conducted TQM research in the construction industry, such as Kuo and Kuo (2010); Ali and Rahmat (2010), Din, Abd-Hamid, and Bryde (2011), Mir and Pinnington (2014) and Leong et al. (2014). Kuo and Kuo (2010) considered the link between TQM and project performance in Taiwan using structural equation modelling (SEM). The study confirmed that TQM had a positive and direct influence on project performance. A study conducted by Ali and Rahmat (2010) investigated the performance measurements of construction projects managed by ISO-certified contractors in Malaysia. The study concluded that functionality and clients' satisfaction are the most important criteria for measuring construction project performance whereas time and cost were the least important. In this study, mean statistics were used to rank the importance of project performance measurements as perceived by the contractors in the ISO-certified companies. There was no analysis conducted of an association between TQM and project performance.

Din, Abd-Hamid, and Bryde (2011) measured the difference between Malaysian ISO 9000 certified companies and non-certified companies in project management practices, financial management practices, and project success. The study indicated that certified companies outperformed non-certified companies in project management practices and financial management practices and ISO 9000 certification showed a positive moderating effect on the casual relationship between TQM practices and project success. The casual relationship between project management practices and project success were explained by comparing the project management practices between certified and non-certified companies. Furthermore, any links between project management practices and project success were not identified.

Mir and Pinnington (2014) investigated the relationship between TQM and project success in the United Arab Emirates. A Project Management Performance Assessment (PMPA) framework of TQM was adopted and tested against project success. The outcome of this study showed that PMPA and its contributing variables were found to have positively influenced project success. The association between each of the individual PMPA variables was tested and cross-checked using two methods, linear regression and Pearson's correlation. Both analyses come to the same conclusion KPIs, staff, leadership, and lifecycle management processes were the most contributing variables to project success. Partnership and resources, and PM policy and strategy were ranked the lowest in association with project success. A multiple regression analysis concluded the best-fit model which would explain the greatest variance in project success were life-cycle management processes, policy, and strategy.

Lastly, Leong et al. (2014) measured the effectiveness of ISO 9000 certification in Malaysia companies using project performance indicators. The results showed customer satisfaction and time variance were positively significant with ISO 9000 certification. However, in this study, there were no standards of ISO 9000 certification investigated as project performance indicators. The study merely investigated which project performance indicators had an impact on ISO 9000 certification. All the TQM studies conducted for the construction industry discussed above differed in the region, analysis procedure, TQM framework adopted, and in performance measurements. The TQM framework adopted in each of the studies is illustrated in Table 3-3 with their performance measurements. The MBNQA framework of TQM has not been explored in the construction industry and its relationship with project performance.

From the literature review conducted it becomes evident that no research studies have exclusively focused on the relationship between project performance and TQM in Malaysia. Therefore, this study focuses on analyzing empirical evidence for any relationship between TQM and project performance in the Malaysian construction industry. Coupled with the current pressure to improve the level of quality in the construction industry in Malaysia, there is indeed a need and urgency for a research study on whether the implementation of TQM can improve project performance. This research will not only focus on investigating whether a link exists, but also examine whether there may be any practical contributions for the construction organizations in improving their project performance through the implementation of TQM.

3.6.1 The Relationship between Leadership and Project Performance

Leadership is about guiding others toward the attainment of project objectives, “motivating and guiding others to realize their potential and together achieving challenging organizational goals”. Successful leadership is able to convince people of the need for change, stimulates new ways of thinking and problem solving, and then encourages them to work together to accomplish project objectives in difficult work environments. Meanwhile, leadership in total quality management is regarded as a commitment by top management, to create an organization devoted to quality,

The importance of leadership has been noted throughout the project management literature, as a requirement of project excellence (Kerzner 2013), a determinant of overall project culture (Shore 2008), and as a vehicle for mobilizing people for change (Patterson 2010). Today, there are many leadership style theories that have emerged such as emotional intelligence, contingency, competency, traits, and behaviour (Dulewicz and Higgs 2004) and all of them claim that an appropriate leadership style can benefit project success and enhance project performance.

A study by Turner (2014) revealed that effective leadership is viewed as a critical factor for success in the management of organizations and it has also been shown an appropriate leadership style can lead to better performance. However, there is some contradiction in the literature where the leadership of a project manager is not regarded as a success factor of projects. In agreement with Anantatmula (2010) and Fung and Ramasamy (2015), this current study argues that though leadership style and competence are not directly related to project success, the leadership role is crucial to facilitate various project success factors that contribute to project performance. A project manager's leadership roles and responsibilities towards the project team and stakeholders influence the project outcomes (Fung and Ramasamy (2015).

Jiang (2014), also made similar claims as he suggested leadership could directly benefit project success with corresponding competencies or indirectly through improving teamwork to help achieve a successful project. A model was developed where Jiang (2014) proposed an appropriate leadership style can reduce the negative effect of the project type on teamwork and project success. However, this is just a conceptual model with further empirical testing needed. The findings of the above literature review provide an opportunity to explore further project manager leadership in promoting project performance.

H1: There is a positive and significant relationship between leadership and project performance.

3.6.2 The Relationship between Strategic Planning and Project Performance

Planning has been considered one of the critical factors for project success in the strategic management literature (Meredith and Mantel Jr 2011) and project management literature (Turner 2014). Zwikael and Globerson (2004) recognized the importance of project planning and in their opinion, high quality planning increases the chances the project will be properly executed and completed. Adding to their previous study, Zwikael and Globerson (2006) asserted high-quality project planning in construction and engineering organizations has resulted in projects completed at half the cost and schedule overruns, compared to organizations in other industries such as information technology and communications, services, and manufacturing.

In another recent study (Zwikael et al. 2014), found increasing the quality of planning improves project efficiency in high-risk projects and improves project effectiveness in low-risk projects. However, one of their hypotheses results showed that project planning was not significantly correlated with project efficiency or effectiveness. Evidence was found showing the results of Zwikael and Globerson (2006) contradicted the findings of Zwikael et al. (2014) . The earlier study indicated high-quality project planning would reduce cost and schedule overruns, however, in the study by Zwikael et al. (2014) they mentioned project planning was found not to be correlated with either project efficiency or effectiveness.

Some results from the literature have challenged the importance of planning. For example, one of the very first milestones of Mintzberg (1994) book *The Rise and Fall of Strategic Planning*. Additional doubts are expressed in project management literature by Bart (1993) regarding the importance of formal planning. He indicated the traditional planning approach contains excessive formal control restrictions, which curtails opportunities for creativity and thus may eventually lead to project failure.

Although some claim that too much planning curtails the creativity of the project team, there is no argument stating at least a minimum level of planning is required. The rationale behind project planning is planning reduces uncertainty and increases the likelihood of project success. Planning does not guarantee project success, but a lack of planning will probably lead to failure according to the Project Management Body of Knowledge (PMBOK). Based on the assumptions presented above, there appears to be a relationship between strategic planning and project performance.

H2: There is a positive and significant relationship between strategic planning and project performance.

3.6.3 The Relationship between Customer Focus and Project Performance

A customer-centred approach has long been recognized as an important strategy for improving business performance. The concepts of knowing customer requirements and being responsive to customer demands, and measuring customer satisfaction have led to an increase in cash flow, revenue growth, profitability, market share, and stock price (Anderson, Fornell and Mazvancheryl 2004; Gruca and Rego 2005; Homburg, Koschate and Hoyer 2005; Williams and Naumann 2011).

This customer focus concept is also supported in a study by Zou et al. (2014) where they found an active customer relationship management strategy leads to better project performance as the relationship changed across project phases. Psomas, Vouzas, and Kafetzopoulos (2014) in their study revealed customer focus policy was the key TQM factor, which positively affected Spain's service sector. This suggests a customer focus approach leads to a better understanding of customers' needs, which in turn translates into internal actions being taken and eventually results in satisfied customers and thus an organization's performance improves. However, some previous studies have showed contrasting results. Talib, Rahman, and Qureshi (2013) investigating quality performance observed customer – oriented activities did not contribute positively to the Indian service sector.

It has often been suggested " it is from two to twenty times as expensive to get a new customer as to retain an existing one" (Goodman, O'Brien and Segal 2000). Developing customer loyalty through customer satisfaction seems to generate a steady stream of sales in the long-term. Having reviewed the logic of a customer focus strategy, there is strong support for the statement increasing customer focus, will enhance the organization's performance in the project environment.

H3: There is a positive and significant relationship between customer focus and project performance.

3.6.4 The Relationship between Workforce Focus and Project Performance

The workforce is the most dynamic resource in an organization. It dominates the operation process to ensure that an organization performs its daily operations effectively and efficiently (Sabella, Kashou and Omran 2014) to maintaining a high level of quality can be achieved by bringing out the best talents and capabilities of a workforce (Lee and Ooi 2014). These capacities can be further enhanced through a variety of organizational development practices such as employee training, involvement, empowerment, recognition, teamwork, etc. Where an organization has a high level of workforce focus, the requirements of employees are noticed (i.e. comfortable working environment, self-improvement opportunities, etc.), which in turn will generate greater work performance and increase morale and satisfaction. In the long run, this approach will enhance the organization's productivity and ultimately its performance (Valmohammadi and Roshanzamir 2015).

Most of the studies reviewed indicate workforce focus has a significant relationship with performance. A study conducted in Spain showed an emphasis on workforce was one of the elements significantly affecting the service industry (Psomas, Vouzas and Kafetzopoulos 2014). This has been supported by Valmohammadi and Roshanzamir (2015), where implementation of workforce-oriented activities increased organizational performance. However, the workforce-related activities did not show significance in the quality and innovation in performance at ASEAN manufacturing plants (Zeng, Phan and Matsui 2015). One of the ASEAN countries in the study was Malaysia.

This present study based on the literature reviewed, strongly suggests encouragement of workforce focus practices such as empowerment, involvement, training, and information sharing are the key factors of quality programmes. An organization needs to focus in this area if they want to succeed in improving performance. Hence, it is hypothesized that:

H4: There is a positive and significant relationship between workforce focus and project performance.

3.6.5 The Relationship between Operation Focus and Project Performance

Operation management is a systematic approach in which all the resources of an organization are used in the most efficient and effective manner to achieve the desired performance (Ooi 2014). Operation focus emphasizes activities which includes preventive and proactive approaches to quality management (Lee and Ooi 2014). The activities include designing fool-proof and stable production schedules and work distribution to reduce variation and improve the quality of the product during the production stage (Bouranta, Psomas and Pantouvakis 2017).

Empirical studies such as Mehralian et al. (2017), have investigated the relationship between process management and performance which have showed a positive correlation between them. Valmohammadi and Roshanzamir (2015), Zeng, Phan, and Matsui (2015); Irfan and Kee (2013) and Zehir et al. (2012) also showed similar results where all of the studies claimed that a positive significant relationship does exist between process management and performance.

However, there are some studies that showed contradictory findings. Shieh and Wu (2002) demonstrated process management did not have an association with project performance. A recent study (Talib, Rahman and Qureshi 2013) conducted on Indian service companies revealed similar findings. The results collected from 172 service companies showed process management had no significant effect on quality performance.

Following Deming's belief, where improving the process can improve productivity and quality (Shieh and Wu 2002), this current study suggests that to achieve better performance, the key processes must be identified, evaluated, and continually improved. Based on the concept above, it is hypothesized that:

H5: There is a positive and significant positive relationship between operation focus and project performance.

3.6.6 The Relationship between Measurement, Analysis, and Knowledge Management and Project Performance

It is important for managers to make quality decisions for an organization based on the analysis of real and relevant data as emphasized by (Lee and Ooi 2015). It is the duty of an organization to ensure the availability of reliable, adequate, high quality, and timely data and information for all key users to improve performance (Ooi 2014). This concern about the reliability and validity of data and information using appropriate tools of measurement and/or analysis to support quality-based decision-making is necessary for the organization to improve its performance (Bouranta, Psomas and Pantouvakis 2017).

Mehralian et al. (2017) and Valmohammadi and Roshanzamir (2015) suggest the implementation of data collection and an analysis system will increase the performances of a firm. Zeng, Phan, and Matsui (2015) in their study investigating 283 manufacturing plants observed quality information had a direct impact on quality performance in ASEAN countries. Other studies also showed quality information and analysis have had significant effects on performance such as Irfan and Kee (2013) and Agus (2011).

Based on the previous literature discussed, the process of obtaining adequate data and information to support quality-based decision-making seems to be an important part of every organization regardless of type of industry. Key decisions are then made by organizations on the information and analysis resulting from this process. Thus, the following hypothesis is proposed:

H6: There is a positive and significant relationship between measurement, analysis and knowledge management, and project performance.

3.7 Summary

This chapter has explained the dimensions and relationships between TQM practices and project performance. From the literature review, it is hypothesized TQM practices result in improved project performance in construction organizations. However, there were also some contradictory findings as well, some that may affect TQM practices towards project performance. To test these hypotheses, a research methodology was used to confirm the predictions and is presented in the next chapter.

CHAPTER 4

RESEARCH METHODOLOGY

4.0 Introduction

This chapter describes the methodology used to ensure that this study conforms to the objectives that have been outlined. The topics covered in this chapter are research design, sample and population, descriptions of research instruments and data collection procedures, and the techniques employed for statistical analysis in this study.

4.1 Research Design

The research design is defined as how the study is designed to achieve its objectives. Research design starts with a topic selection and is then followed by data collection methods, measurement procedures, questionnaire design, sampling, and data analysis hair (Hair Jr et al. 2013). This study adopted questionnaire, the most common qualitative data collection method, to measure the adoption of TQM practices and the correlation to project performance in the Malaysian construction organizations.

4.1.1 Cross-sectional Study

The cross-sectional study is suitable to demonstrate an association or prevalence (Sedgwick 2014), with the information derived from the sample of the population at one point in a time (Hair Jr et al. 2013). The longitudinal study, in contrast, associate with the same sample units a number of time over certain period (Babin and Zikmund 2015). For this research, a cross-sectional study seems to suit the aim of this study, firstly, as this study does not require examining trends. Secondly, this study requires data collection from large number organizations to have a representative sampling (Malhotra and Birks 2007) and lastly, due to time and resources constraints. In this study, cross sectional study is used to observe and find an association between TQM practices and project performance.

4.1.2 Limitations of Cross-sectional Study

A cross-sectional study may be prone to non-response bias resulting in a non-representative sample of the population (Sedgwick 2014). The distribution of questionnaire survey forms was carried out using three different methods, e-mail, fax, and postal to reduce the possibility of the non-response bias. No causal relationship is determined between the variables as the data is recorded only once for each participant. A further study is suggested for greater in-depth research. Lastly, there is the presence of common method variance. Common method variance is a measurement error (Podsakoff, MacKenzie and Podsakoff 2012) that happens when " responses systematically vary with a common scaling approach on measures from a single data source" (Fuller et al. 2016). Harman's single factor test was used as the statistical test against the common method variance because it is the simplest measure and widely used in the literature for this type of survey (Podsakoff, MacKenzie and Podsakoff 2012).

4.2 The Sampling Process

The sampling process for this study involves a number of elements. The sampling process involved steps of (1) defining the population, (2) developing sampling frame, (3) selecting the appropriate sampling method, (4) determining the sample size, and (5) selecting the sample (Malhotra and Birks 2007).

4.2.1 Defining the Population

The population is defined as the entire group of subjects under study as specified by the objectives of the research (Burns and Bush 2003). The target population of this study was all the construction organizations in Malaysia. The sample size was derived from the listed members of the CIDB (Construction Industry Development Board), a statutory body representing the construction companies in Malaysia. The CIDB was established in 1994 and currently represents 73,069 construction companies from every range of the CIDB categories (CIDB, 2016), which is the actual population size (N) for this study.

4.2.2 Establishment of the Sample Frame

The sample frame is a list of the targeted population members from which the sample will be drawn (Saunders 2011). This study used the sample frame as the sample of the population. The sampling frame for this study included all of the construction organizations that have adopted the ISO 9001 quality management system. Since 2000, all members in Category Grade 7 are required to follow ISO 9001 certification, and therefore, this group were selected as the sample frame for this study. The total number of CIDB members qualified as Category Grade 7 is 6,331 organizations.

4.2.3 Sampling Method

There are two major sampling approaches, probability and non-probability. Non-probability sampling does not involve random selection, whereas probability does (Tochrim 2002). In probability sampling, every individual has an equal opportunity to be selected, however, in non-probability sampling, a respondent is carefully selected based on stipulated criteria (Hair Jr et al. 2013).

In this research, a generalize results are ought to obtain as much as possible, a simple random sampling was used. 20% of the total population was deemed sufficient for the study purpose (Salkind 2014).. The organizations in the sampling frame were first entered into a spreadsheet with serial numbers and randomly selected using the RAND function.

The rationale for adopting the simple random sampling process was it gave each unit an equal chance of being selected (Malhotra and Birks 2007) and it is best used when an accurate and easily accessible sampling frame that lists the entire population is available (Saunders 2009). Simple random sampling was chosen because it is inexpensive and efficient and able to produce a more representative sample (Hayes 1998; Luck and Rubin 1987; Wong 1999).

Table 4-1: Construction organizations registered under CIDB Malaysia.

Grade / State	G1	G2	G3	G4	G5	G6	G7
Johor	2,897	1,566	1,210	358	426	131	450
Kedah	2,077	691	339	122	133	55	201
Kelantan	2,047	826	231	98	110	57	142
Labuan	138	30	17	4	1	0	1
Melaka	1,053	444	328	129	120	47	147
Negeri Sembilan	1,827	741	358	125	151	47	110
Pahang	2,258	846	410	211	168	65	145
Perak	2,580	873	547	204	245	85	189
Perlis	887	173	56	16	29	5	32
Pulau Pinang	1,326	577	714	215	257	110	410
Sabah	7,132	1,751	779	183	216	89	510
Sarawak	2,358	1,005	479	176	206	98	514
Selangor	3,889	1,851	2,219	819	1,293	366	1,567
Terengganu	2,331	822	321	177	202	93	206
Wilayah Persekutuam	1,509	767	1,533	660	1,271	352	1,707
TOTAL				73,069			

4.2.4 Sample Size

An adequate sample size is essential in order to provide a scientifically sound contribution to the research. It is one of the criteria for multiple regression analysis. Stevens (2012) has recommended, "For social science research, about 15 participants per predictor are needed for a reliable equation". While Tabachnick and Fidell (2013) gave a formula for calculating sample size requirements by taking into account the number of independent variables: $N \geq 50 + 8m$ (where m is the number of independent variables). As a general rule of thumb, at least 300 respondents are deemed comfortable, 500 will be very good, and 1000 as excellent (Tabachnick and Fidell 2013). The Krejcie and Morgan's (1970) formula was adopted to calculate the minimum required sample size from the population of 6,331 construction organizations.

$$S = \frac{X^2 \, NP\,(1-P)}{d^2\,(N-1) + X^2\,P(1-P)}$$

Where

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05).

$$S = \frac{(3.841)(6331)(0.5)(1-0.5)}{0.05^2\,(6330) + 3.841\,(0.5)(1-0.5)}$$

= 362

Based on the Krejcie and Morgan's formula, the minimum sample size for a population of 6,331 is 362 respondents.

4.2.5 Sample Selection

For this study, the ISO 9001 certified construction organizations were randomly selected from the CIDB (Category Grade 7) listed companies. The CIDB directory is frequently used to represent Malaysian construction organizations such as Din, Abd-Hamid, and Bryde (2011), Mir and Pinnington (2014), and Ali and Rahmat (2010).

The organizations selected as the sample were all in the construction industry. Organizations listed in the CIDB directory with ISO 9001 certification were targeted. This sample group was chosen as there is no certification for TQM in Malaysia (Sila 2007) and no database available listing Malaysian organizations that had adopted TQM practices. Given that the ISO 9001 standard is based on quality management principles, which are in line with TQM philosophy, the criterion for selecting which organizations would participate in the study was their certification to ISO 9001. It was assumed that the ISO certified companies are TQM-oriented and compatible with the total quality philosophy (Goetsch and Davis 2006; Wu and Liu 2010).

A total of 1,810 questionnaires were sent out to achieve the targeted sample size with the assumed response rate of 20%. To ensure distribution equality in representing the whole of Malaysia, the 1,810 questionnaires were distributed among the 13

Malaysian states according to the ratio calculated in Table 4-2 below. Based on the density of the population, 488 questionnaires were sent to Wilayah Persekutuan, 448 to Selangor, 147 to Sarawak, 146 to Sabah, 129 to Johor, 117 to Pulau Pinang, 59 to Terengganu, 57 to Kedah, 54 to Perak, 42 to Melaka, 41 to Pahang and Kelantan, 31 to Pahang, 9 to Perlis and 1 to Labuan.

Table 4-2: Targeted respondents for each state.

States	G7 organizations	Percentage	Number of targeted respondents
Johor	450	7.11	129
Kedah	201	3.17	57
Kelantan	142	2.24	41
Labuan	1	0.02	1
Melaka	147	2.32	42
Negeri Sembilan	110	1.74	31
Pahang	145	2.29	41
Perak	189	2.99	54
Perlis	32	0.51	9
Pulau Pinang	410	6.48	117
Sabah	510	8.06	146
Sarawak	514	8.12	147
Selangor	1,567	24.75	448
Terengganu	206	3.25	59
Wilayah Persekutuan	1,707	26.96	488
Total	**6,331**	**100%**	**1,810**

4.3 Research Instrument

A structured survey questionnaire was employed to measure the perceptions of quality, practitioners in the construction organizations had, on six variables associated with project performance. The variables consisted of leadership, strategic planning, customer focus, and measurement, analysis, and knowledge management, workforce focus, operation focus, and project performance. The survey was considered the most efficient means of collecting data compared to other methods, such as conducting interviews or a case study.

Based on an extensive literature review of TQM practices that influence the performance of projects conducted by the construction organizations, a questionnaire was developed. All of the variables identified were ensured to be ambiguous and captured the major theoretical construct of interests (Fischer 2010). The questionnaire consisted of 42 items, measuring six theoretical constructs: (1) leadership, (2) strategic planning, (3) customer focus, (4) measurement, analysis, and knowledge management, (5) workforce focus, (6) operation focus, and (7) project performance.

Likert scales were adopted because it highly represents the likelihood and the accuracy of the respondents' responses (Burns, Bush and Sinha 2014; Babin and Zikmund 2015) and it yields higher reliability coefficients with fewer items (Hayes 1998). Likert scales are also widely used in social science (Garland 1991). In the study of Likert (1932), the reliability of the entire scale is maximized when the respondent answer by the means of a 5-point scale. Hence, this study adopted the 5-point Likert rating scale. Each of the questionnaire items was assessed on a 5-point Likert rating scale. Responses to TQM practices were assessed with a level of frequency value of (1) *very low*, (2) *low*, (3) *medium*, (4) *high*, and (5) *very high*. Responses for scales measuring the project performance of construction organizations that had adopted TQM practices were also recorded using the 5-point Likert rating scale with a level of agreement of, (1) *strongly disagree*, (2) *agree*, (3) *neutral*, (4) *agree*, and (5) *strongly agree*.

Table 4-3: The number of questionnaire items.

Section	Constructs	Dimensions	Sources	No. of Items	Rating Scale
1	Respondent and organization profile			6	
2	Leadership	The commitment to quality practices by top management	Flynn, Schroeder, and Sakakibara (1995); Ahire, Golhar, and Waller (1996); Anderson, Jerman, and Crum (1998); Lau, Zhao, and Xiao (2004); Saraph, Benson, and Schroeder (1989)	6	1 = very low, 5 = very high
3	Strategic planning	The propensity to develop and implement organizational strategic actions	Lau, Zhao, and Xiao (2004); Lee et al. (2012)	5	1 = very low, 5 = very high
4	Customer focus	The ability to assess and meet customer expectations	Flynn, Schroeder, and Sakakibara (1995); Ahire, Golhar, and Waller (1996); Lau, Zhao, and Xiao (2004); Fotopoulos and Psomas (2010); Lee et al. (2012)	6	1 = very low, 5 = very high
5	Measurement, analysis and knowledge management	The efforts to gather, measure, analyze work performance and improvements	Saraph, Benson, and Schroeder (1989); Anderson, Jerman, and Crum (1998); Lau, Zhao, and Xiao (2004); Lee et al. (2012)	7	1 = very low, 5 = very high
6	Workforce focus	The assessment of employee capability and capacity needs	Saraph, Benson, and Schroeder (1989); Flynn, Schroeder, and Sakakibara (1995); Lau, Zhao, and Xiao (2004); Lee et al. (2012)	7	1 = very low, 5 = very high

(Continued)

Section	Constructs	Dimensions	Sources	No. of Items	Rating Scale
7	Operation focus	The efforts to improve product and work processes and achieve organizational success	Saraph, Benson, and Schroeder (1989); Flynn, Schroeder, and Sakakibara (1995); Lau, Zhao, and Xiao (2004); Lee et al. (2012)	7	1 = very low, 5 = very high
8	Project performance	The objectives of a construction project	Shenhar et al. (2001); Ling et al. (2008); Yeung, Chan, and Chan (2009)	4	1 = strongly disagree, 5 = strongly agree
Total number of measurement scale items				**48**	

4.4 Method of Data Collection

The survey questionnaire was sent to the top management of the organisation such as managers, project managers, and quality managers, as they would have been involved in the strategic decision-making and management of the organizations.

Emails, postal mail, and faxes were the tools applied in this study to distribute the research instrument. Emails have been shown to achieve a higher response rate compared to postal mail (Griffis, Goldsby and Cooper 2003; Wright and Ogbuehi 2014). Postal mail and fax were used as secondary options to cover those organizations that had no email address to ensure a high response rate. A cover letter explaining the objectives, significance, and details of the study, attached with a consent form and survey questionnaire were sent to the respondents. The consent form was to seek participation approval, and at the same time, the confidentiality of every individual response was assured.

The reasons for the email distribution include cost and time saving, and ease of distribution and responding. However, due to the other challenges such as no Internet access and undelivered postal address, secondary options using postal mail and fax were adopted to ensure a higher response rate.

4.5 Statistical Analysis

This section describes the data analysis employed in this study. The collected dataset went through a data screening process for accuracy of data, missing data, and outliers. Next, factor analysis and a reliability test were conducted. Finally, the Pearson's correlation and multiple regression analysis were applied to examine the hypothesized relationships among the variables. All the statistical analyses were conducted using the Statistical Package for Social Science (SPSS) 21.0 software.

4.5.1 Data Screening

170 questionnaires were returned, and were checked for completeness. 9 sets showed incompleteness and were subsequently discarded, leaving 161 useable surveys. The data were then entered for data screening.

Data screening is essential to make sure that the data sets are accurate with zero-error before the main analysis is run as it may affect the precision of the analysis. The purpose of data screening is to ensure data accuracy, check for missing data, the fitness of the data set and assumptions, the transformation of variables, identified outliers, and linearity.

4.5.1.1 Accuracy of Data File

One of the best ways to ensure the accuracy of the data file is to proofread the original data against the computed data file. However, this process may not be efficient or possible when involving a large set of data. In this case, examination of the descriptive statistics of the variables can be used to check for data accuracy. For continuous variables, it is important to make sure all of the values are within range, where means and standard deviations are plausible. If there is an out-of –range value, this will distort the mean value. For categorical variables in this study by age: (1) 20

-30, (2) 30 -40, (3) 40 -50, and (4) ≥ 50, there should be no out-of-range values besides 1, 2, 3, and 4. Continuous variables can be checked using Descriptives while categorical variables can be checked using Frequencies, both of the statistics use the SPSS 21.0 software.

4.5.1.2 Missing Data

Missing data is the bane of every researcher and one of the inevitable problems in analysis. The missing data case(s) can be identified through case labelling. Researchers may, based on their own discretion, decide what solution is necessary for the missing data. The missing data can either be deleted or estimated. There are other options available on SPSS statistical procedures such as, (1) **Exclude cases listwise**, (2) **Exclude cases pairwise** and (3) **Replace with mean**. It is important to choose the solution carefully as it can cause serious effects on the results.

In this study, the missing values were replaced with mean values using Missing Values Analysis (MVA). The Expected Maximization (EM) technique was employed. EM is an iterative procedure of producing variances, co-variances, and means in an initial step, and then repeating the process until the changes in the parameters are so small the final solution is said to have converged (Graham, 2012). After the missing values have been treated, the dataset was checked for outliers.

4.5.1.3 Outliers

Outliers are cases with extreme values that are unusually high or low, making the cases distinctly different from the norm (Hair Jr et al. 2013). Extreme cases impact the regression solution and affect the precision of the regression weights (Fox, 1991). Therefore, it is important to check the data sets for outliers. There are two types of outliers: univariate outliers and multivariate outliers. Univariate outliers are cases with an extreme value of one variable while multivariate outliers are cases with an unusual combination of scores on two or more variables (Tabachnick and Fidell 2013).

A univariate outlier can be identified through computed standardized values (i.e. Z scores). Cases with standardized scores more than 3.29 ($p < 0.01$, two-tailed test) are potential outliers. Alternative solutions to detect outliers are through graphical methods such as histograms, boxplots, normal probability plots, or de trended normal probability plots.

Multivariate outliers can be identified through the Mahalanobis distance and leverage value (Tabachnick and Fidell 2013). Mahalanobis distance is computed with a $p < 0.01$ criterions using the X^2 distribution. The critical Chi- square value (determined by using the number of independent variables like the degree of freedom) is used to identify cases of outliers. There were six independent variables in this study, and the critical value was 22.46 (refer Tabachnick and Fidell (2013), Table C.4). Any cases with Mahalanobis distance more than the critical value of 22.46 are identified as outliers.

Lunneborg (1994) suggested that outliers can be defined as cases with high leverage value. The calculation for leverage value is shown in the equation below. Mahalanobis distance and leverage value are related (Tabachnick and Fidell 2013). Therefore, any cases exceeding the Mahalanobis distance and leverage value are identified as multivariate outliers. Both the Mahalanobis distance and leverage value can be assessed through the Regression program using the SPSS 21.0 software. The detected multivariate outliers can either be deleted, transformed to reduce its impact, or the scores can be changed on the variables based on the researcher's decision (Tabachnick and Fidell 2013).

$$hii = \frac{Mahalanobis'distance}{N-1} + \frac{1}{N}$$

Table 4-4: Critical values for evaluating Mahalanobis distance value.

Number of independent variables	Critical value	Number of independent variables	Critical value
3	16.27	5	20.52
4	18.47	6	22.46

Source: extracted from a table in Tabachnick and Fidell (2013)

4.5.2 Descriptive Analysis

The background information of respondent and organization were presented through descriptive analyses such as mean, standard deviations, frequencies, and percentages. These important statistics were organized, summarized, simplified, and conclusions made from the dataset.

4.5.3 Factor Analysis

Factor analysis is a data reduction technique. Factor analysis summarized a large set of variables into a smaller set of factor or components in any possible way. Factor analysis comprises of principal component analysis (PCA) and factor analysis (FA). They are both similar in many ways in they both attempt to produce a smaller number of variables with linear combinations of coherent subsets yet relatively independent of each other.

In this study, PCA was employed as the original variables were transformed into a smaller set of linear combinations, with all the variances being used. Preference was given to PCA as opposed to FA (Steven, 1996) as it is mathematically simpler and avoids some of the potential problems that may be associated with FA. Tabachnick and Fidell (2013)suggested that PCA would be a better choice if it were only an empirical summary of the dataset. In Regards to other related studies of TQM, PCA is commonly adopted in summarizing TQM practices (Lee et al. 2010; Lee et al. 2012; Ooi et al. 2013). Hence, PCA was adopted in this study.

There are a few assumptions in PCA that need to be considered. The first assumption is, (a) there are multiple variables that are measured at the continuous level. The second assumption is, (b) there must be linearity between all variables. All variables must have at least one correlation above r = 0.3 with other variables. This can be checked through the Correlation Matrix. The third assumption, (3) there must be an adequate sampling. There are a few methods to detect sampling adequacy, (1) the Kaiser-Meyer-Olkin (KMO) measures the overall data set, (2) KMO measures for each individual variable, and (3) Bartlett's test of sphericity. The KMO measures need to be as close to 1 as possible, with a value above 0.6 an absolute minimum. The Bartlett's test of sphericity has to be statistically significant (i.e. $p < 0.5$) to be suitable for PCA. The fourth assumption is, (4) there should be no outliers. The assumptions are summarized in the Table 4-5 below.

Table 4-5: PCA's four assumptions.

Assumptions	Details	Criteria
1	Multiple variables that are measured at the continuous level	
2	Linearity between all variables	At least one correlation $r > 0.3$
3	Sampling adequacy	KMO > 0.6 Bartlett's test ($p < 0.5$)
4	No outliers	*Z* scores, Casewise diagnostic, Mahalanobis distance & leverage value

The dataset is suitable for PCA when all of the four assumptions have passed. When running a PCA, there are steps that need to be highlighted. They are, (1) initial extraction of the components, (2) determining the number of components to retain, (3) rotation to a final solution, (4) interpreting the rotated solution, (5) computing component scores, and lastly (6) reporting the results.

The major decision in a PCA is the number of components to retain. There are four major criteria to consider in the decision of retaining the number of components. They are the eigen-value-one criterion, the proportion of total variance accounted for, the scree plot test, and the interpretability criterion. The details of the criterion for determining how many components should be retained are summarized in Table 4-6 below. Lastly, the decision on the number of components to retain is very subjective and based on the researcher's interpretation of the data (Tabachnick and Fidell 2013). All of the procedures in a PCA used the SPSS 21.0 software.

Table 4-6: Criterion to retain components in PCA.

Criteria	Details
Eigen-value-one	Retain components with eigenvalue more than 1
Proportion of total variance explained	Retain components that explain at least 5% to 10% and/or Retain all components that can explain at least 60% - 70% of the total variance
Scree plot test	Retain all those components before the inflection point
Interpretability	"Simple structure " – explainable division of variables onto separate components

4.5.4 Reliability Analysis

Reliability measures how well the indicator variables serve as a measurement instrument for latent variables. Reliability can be assessed through internal consistency, which is the degree to which the items that make up the scale are all measuring the same underlying attribute. The most common way to measure internal consistency is by using the Cronbach's coefficient alpha. This statistics tool provides an indication of the average correlation among all the items that make up the scale. The values range from 0 to 1, where higher values indicate a greater reliability. Nunnally (1978) suggested a cut-off point of 0.7 as a reasonable indicator of "fit".

4.5.5 Pearson's Correlation

Pearson's correlation is used to describe the strength and direction of the relationship between two variables. The relationship is measured by the Pearson correlation coefficient, denoted as r. Its value can range from -1 for a perfect negative linear relationship to +1 for a perfect positive linear relationship. A value of zero (0) indicates no relationship between two variables.

There are a few assumptions to be considered in Pearson's correlation. The first assumption is, (a) there needs to be a linear relationship between the two variables. The second assumption is, (b) there should be no significant outliers. The third assumption is, (c) there should be bivariate normality.

Table 4-7: Pearson's correlation assumptions.

Assumptions	Details	Criteria
1	Linearity between two variables	A straight line in scatterplot
2	Outliers	Outskirt data points in scatterplot
3	Bivariate normality	Shapiro-Wilk's test (p>0.5)

4.5.6 Multiple Regression Analysis (MRA)

Multiple regression analysis (MRA) is used to explore the relationship between one continuous dependent variable and other independent variables. MRA is an extension of a bivariate regression, a more sophisticated tool to assess the interrelationship among a set of variables (Tabachnick and Fidell 2013).

During a MRA all the independent variables are entered into the equation simultaneously. Then, each of the independent variables is evaluated regarding its predictive power to explain how much variance the independent variables contributed to the dependent variable. MRA provides information on the model as a whole (all subscales) and the relative contribution of each variable that makes up the model (individual subscales) (Pallant 2011).

Regression techniques are applied to a data set to test the correlation between the independent variables and the dependent variables in varying degree. For instance in this study, regression techniques were used to assess the relationship between a set of independent variables (i.e. TQM practices) leadership, strategic planning, customer and market focus, workforce focus, process management, and measurement, analysis, and knowledge management with a dependent variable project performance. As a result, the MRA will explain how well TQM practices predict project performance and which TQM practice is the best predictor of project performance.

There are six assumptions that need to be considered in MRA. The first assumption is, (a) there should be independence of observations. A Durbin-Watson statistic with a value of approximately 2 indicates that there is no correlation between residuals. The second assumption is, (b) there needs to be a linear relationship between the dependent variables and each of the independent variables, and between the dependent variable and the independent variables collectively. This can be checked through scatterplot and partial regression plots with residuals forming a horizontal band to prove linearity. The third assumption is, (c) there should be homoscedasticity of residuals (equal error variances). Homoscedasticity can be confirmed with a consistent spread of data points in the scatterplot. The fourth assumption is, (d) there should not be multicollinearity. Multicollinearity can be checked through the inspection of Tolerance and/or VIF values. The fifth assumption is, (e) there should be no significant outliers, high leverage points, or highly influential points. Outliers can be identified through Casewise Diagnostic with a value of greater than ± as cut-off criteria. Meanwhile, leverage values should be less than 0.2 to be considered safe, any high leverage values of more than 0.2 are of concern. Influential points can be measured by Cook's distance, any values greater than (>1) should be investigated. The sixth assumption is, (f) there should be a normal distribution of residuals. The normality can be checked through the inspection of the histogram, P-Plot, and Q-Q Plot. Points aligned along the diagonal line represent normality. The MRA's assumptions and their criteria are summarized Table 4-8 below. All of the MRA procedures are adopting the SPSS 21.0 software.

Table 4-8: MRA's assumptions

Assumptions	Details	Criteria
1	Independence of observations	Durbin-Watson statistics – approximately 2
2	Linearity	Scatterplot & partial regression plots – horizontal band
3	Homoscedasticity	Scatterplot – constant distribution of data points
4	Multicollinearity	Tolerance <0.1 VIF >10
5	Outliers High leverage points High influential points	Casewise diagnostics Leverage value <0.2 Cook's distance >1
6	Normality	Histogram – bell-shaped P-P Plot – along the line Q-Q Plot – along the line

4.6 Summary

This chapter discussed the step-by-step guide to the research methods used in this study. The research design first identified the population, sample frame, sampling method and sample size, and the sample selection needed for this study. Then, the research instrument, a survey questionnaire used to collect the necessary information from the respondents, was also discussed. Next, the process of data collection using email, fax, and postal mail was presented. Finally, statistical analysis and procedures applied to examine the objective of this study such as data screening, descriptive analysis, factor analysis, reliability testing, Pearson's correlation analysis, and multiple regression analysis were discussed in detail. The findings, as well as the results of the methodology discussed in this chapter, will be presented in the next chapter.

CHAPTER 5

FINDINGS AND DISCUSSIONS

5.0 Introduction

This chapter presents an interpretation of the quantitative results with the purpose of highlighting the relationship between each of the TQM practices and project performance by Malaysian construction organizations. The section commences with a discussion on the response rate, the respondents, and organization profiles. There is then a discussion of the data cleaning to remove univariate and multivariate outliers, exploratory factor analysis, and reliability analysis. A Pearson's correlation analysis to determine the bivariate relationship between the variables is subsequently presented. A discussion of the statistical tests and their results, used to examine the relationship and variables between leadership, strategic planning, workforce focus, customer focus, analysis, management and knowledge management, operation focus, and project performance in the construction industry, followed. Also presented in this section is a discussion on the results achieved. An interpretation of the quantitative results obtained in the last chapter, with the purpose of highlighting TQM practices, is supported in the project performance of the Malaysian construction organizations. More importantly, this chapter will relate these TQM practices with project performance to illustrate the relationship between these two concepts.

5.1 Response Rate

Table 5-1: Summary of the response rate.

Description	Number / percentage
Number of questionnaire sent	1,801
Number of questionnaire returned	170
Number of discarded questionnaires	9
Rate of response	8.94%

1,801 questionnaires were sent to the construction organizations in Malaysia through emails, post, and fax. Overall, 170 returned questionnaires were received; 9 questionnaires were subsequently discarded due to the incompleteness of the questionnaires. There were 161 useable questionnaires and the response rate for this study was 8.94%. The summary of the response rate is presented in Table 5-1 above.

The data collection did not meet the minimum required response rate of 200 questionnaires due to various factors. One of the major obstacles when dealing with data collection is the unwillingness of the respondents to collaborate. With the financial and time constraints of this study, 170 questionnaires were collected.

Out of the 1,801 questionnaires sent, 170 organizations responded yielding a 9.4% response rate. During the data collection phase of this study, a number of reasons for non-responding were discovered. The main reason was the lack of willingness to participate from the respondents. Furthermore, some of the mailing and postal addresses, fax numbers, and contact numbers in the directories were incorrect, so the questionnaires were not delivered to the targeted respondents. In addition, most of the survey questionnaires were sent to a main office, while the intended respondents i.e. project managers were often located at the project site. Hence, they were unable to respond.

The response rate has met the requirements of Tabachnick and Fidell (2013) for multiple regression analysis. Many of the other studies which looked at the construction industry analysed approximately 100-200 respondents, such as Shieh and Wu (2002): 157 responses, Mir and Pinnington (2014): 154 responses, Din, Abd-Hamid, and Bryde (2011): 151 responses, Shrivastava, Mohanty, and Lakhe (2006): 147 responses, and Ali and Rahmat (2010): 112 responses. Compared to these studies the final response of 145 in this study is considered sufficient.

5.2 Respondent profile

The 170 questionnaires returned came from construction organizations listed in the CIDB Grade 7 category. Table 5-2 illustrates the number and percentage of the respondents for each section according to their age, position, organization size, ownership of the organization, were category (specialty). The following Table 5-2 shows the majority of the respondents are within 31-40 years of age (36.5%), followed by 20-30 years (25.9%), 41-50 years (21.8%), and above 50 years (15.3%). Regarding position in the organization, there were managers (15.3%), project managers (14.7%), CEOs (11.2%), quality managers (10.6%), and ‘others’ (48.2%) that held a project related position such as director, quantity surveyor, engineers, and so on. The majority of the organizations have a number of employees below 50 (53.5%), followed by 51 – 100 employees (20%), 101 – 500 employees (17.6%), 501 – 1000 employees (6.5%), and above 1000 employees (2.4%). Most of the organizations were owned by Malaysian nationals (96.5%), 2.4% were joint ventures, and only 1.2% were foreign based. As for the category, a majority were related to building construction (57.6%), followed by civil engineering (17.1%), mechanical and electrical engineering (7.1%), and “other activities” related to the construction industry (18.2%) such as foundation, plumbing, concrete, and so on.

Table 5-2: The respondent sample's variables.

Particulars	Category	Frequency	Percentage
Age	20 – 30 years	44	25.9
	31 – 40 years	62	36.5
	41 – 50 years	37	21.8
	Above 50 years	26	15.3
Position	CEO	19	11.2
	Quality manager	18	10.6
	Project manager	25	14.7
	Manager	26	15.3
	Others	82	48.2
Organization size	Below 50 employees	91	53.5
	51 – 100 employees	34	20
	101 – 500 employees	30	17.6
	501 – 1000 employees	11	6.5
	Above 1000 employees	4	2.4

(Continued)

Particulars	Category	Frequency	Percentage
Ownership	Malaysian	164	96.5
	Foreign	2	1.2
	Joint venture	4	2.4
Category	Mechanical & electrical	12	7.1
	Civil engineering	29	17.1
	Building construction	98	57.6
	Others	31	18.2
TOTAL	N= 170		

5.3 Data Cleaning

From the 170 returned questionnaires, 9 responses were found not qualified due to the incompleteness of the content and thus excluded from the data set. The dataset with the remaining 161 data surveys was checked for univariate and multivariate outliers. Checking for univariate and multivariate outliers is crucial as the subsequent analysis, Principal Component Analysis (PCA) and Multiple Regression Analysis (MRA) are extremely sensitive to outliers (Tabachnick and Fidell 2013).

Z-score calculation using SPSS was employed to detect any univariate outliers. Z-score is the number of standard deviations from the mean for a data point. It is a measure of how many standard deviations below or above the population mean a raw score is. Any values that were more than 3.29 were identified as potential univariate outliers (Tabachnick and Fidell 2013). 8 cases (case id#: 115, 143, 120, 160, 114, 098, 097 and 056) were identified as univariate outliers (>3.29) and deleted from the dataset.

The remaining data were checked for multivariate outliers using the Mahalanobis' distance and leverage value (Tabachnick and Fidell 2013). The Mahalanobis' distance is a statistical measure that detects multivariate outliers, based on a chi-square distribution, assessed using $p < .001$. Using a criterion of $\alpha = .001$ with 42 df, critical $x^2 = 76.08$. Lunneborg (1994) suggested that outliers can be defined as cases with a high leverage value. The calculation for leverage value is as below.

$$hii = \frac{Mahalanobis' distance}{N-1} + \frac{1}{N}$$

$$= \frac{76.08}{152} + \frac{1}{152}$$

$$= 0.5071$$

Any cases that exceeded the Mahalanobis's distance of 76.08 and a leverage value of 0.5071 were identified as multivariate outliers. For this reason, 8 cases were identified as multivariate outliers (case id#: 153, 087, 063, 003, 037, 028, 158, and 166). Three more outliers were identified (case id#: 061, 001 and 103) and excluded from the dataset. Finally, the dataset was cleaned of outliers and now prepared for further analysis.

5.4 Factor Analysis

A factor analysis was undertaken with the aim of revealing the underlying structure of the data and constructing summated scales that represent the antecedents and outcomes of project performance. The survey questionnaire was comprised of 38 items measuring six constructs of TQM. There were five items calculating the construct of strategic planning and six items each for measuring the construct of leadership (citation) and customer focus. Seven items each measured three constructs of measurement, analysis, and knowledge management, workforce focus, and operation focuses.

A principal component analysis (PCA) was run on a 38-question survey that measured TQM practices of 145 respondents. The suitability of a PCA was assessed before analysis. Inspection of the correlation matrix showed all of the variables had at least one correlation greater than 0.3. The overall Kaiser-Meyer-Olkin (KMO) measure was 0.928 with individual KMO measures all greater than 0.8, classification of *meritorious* to *marvelous* according to Kaiser (1974). Bartlett's test of sphericity was statistically significant ($p < .0005$), indicating that the data was likely factorizable.

The KMO results and Bartlett's test results for TQM practices can be found in Appendix E.

A PCA with forced factor 6 was applied with the rationale to retain as many of the components established as TQM factors. Five components had eigen-values greater than 1, and the 6th component had an eigen-value (0.98) of close to one as well. Thus, the decision was made to retain the six components. The 6-component solution explained 72.67% of the total variance. The PCA of the effect of TQM practices can be found in Total Variance Explained in Appendix E.

The results of the PCA revealed all of the items loadings were above 0.4. A Promax oblique rotation was employed to aid interpretability. The rotated solution exhibited *simple structure* (Thurstone 1947). The interpretation of the data was consistent with the TQM attributes, which the questionnaire was designed to measure. Measurement, analysis and knowledge management items were loaded on component 1, workforce focus items on component 2, leadership items on component 3, customer focus items on component 4, strategic planning items on component 5, and finally, operation focus items on component 6. The rotation output retained all six constructs of TQM according to the literature with one slight difference, which will be discussed later in the chapter. Component loadings and communalities of the rotated solution are presented in Table 5-3 and structure matrix showing the correlations between variables and factors are shown in Table 5-4.

Table 5-3: Rotated Pattern Matrix for PCA with Promax Rotation.

Items	Component						
	1	2	3	4	5	6	Communalities
Eigenvalues	20.17	2.46	1.54	1.38	1.08	0.99	-
Var %	53.07	59.55	63.61	67.23	70.08	72.67	-
Factor 1: Measurement, analysis & knowledge management							
mm3	.903						.788
mm4	.888						.830
mm5	.875						.811
mm2	.830						.767
mm1	.756						.809
mm6	.593						.796
mm7	.570				.408		.687
of7	.570						.707
of2	.515						.643
of1	.465						.651
Factor 2: Workforce management							
wf2		.941					.744
wf5		.863					.732
wf6	.386	.847					.668
wf3		.752					.758
wf1		.726					.706
wf7		.640					.707
wf4		.539					.679
of6	.475	.508					.695
Factor 3: Leadership							
ls4			.856				.782
ls5			.813				.699
ls2			.794				.712
ls3			.770				.632
ls6			.726				.624
ls1			.585				.643
Factor 4: Customer focus							
cf2				.804			.793
cf5		-3.00		.790			.714
cf3		.380		.777			.765
cf4		.414		.535	.302		.728
cf1				.486			.541
Factor 5 : Strategic planning							
cf6	.439	-.442			.711		.596
sp4					.559		.704
sp3	.346				.439		.654
sp2					.411		.695
sp5			.346		.376		.714
sp1					.359		.643
Factor 6: Operation focus							
of3						.993	.440
of4						.611	.674
of5	.343					.511	.698
Rotation converged in 8 iterations.							

Table 5-4: Structure matrix.

Items	Rotated Component Coefficients					
	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
mm3	**.898**	.576	.524	.438	.486	.521
mm4	**.900**	.620	.466	.438	.550	.534
mm5	**.892**	.564	.502	.467	.541	.537
mm2	**.879**	.597	.495	.584	.485	.494
mm1	**.878**	.620	.550	.627	.550	.531
mm6	**.829**	.701	.556	.607	.643	.556
mm7	**.740**	.594	.383	.398	.631	.566
of7	**.798**	.662	.471	.468	.418	.655
of2	**.723**	.510	.407	.520	.219	.634
of1	**.741**	.640	.496	.538	.323	.618
wf2	.497	**.853**	.542	.501	.426	.491
wf5	.527	**.854**	.608	.484	.485	.463
wf6	.645	**.802**	.525	.370	.416	.412
wf3	.558	**.865**	.604	.530	.592	.525
wf1	.626	**.804**	.613	.539	.357	.521
wf7	.538	**.823**	.583	.526	.638	.508
wf4	.635	**.751**	.472	.333	.604	.558
of6	.751	**.754**	.506	.471	.484	.572
ls4	.362	.565	**.860**	.443	.544	.338
ls5	.559	.526	**.840**	.480	.395	.343
ls2	.442	.568	**.830**	.460	.381	.486
ls3	.459	.490	**.783**	.402	.400	.466
ls6	.358	.564	**.768**	.378	.478	.275
ls1	.473	.658	**.773**	.506	.488	.403
cf2	.520	.496	.568	**.875**	.450	.328
cf5	.553	.358	.426	**.800**	.306	.407
cf3	.402	.625	.428	**.835**	.472	.354
cf4	.430	.714	.432	**.743**	.657	.498
cf1	.451	.551	.490	**.681**	.557	.380
cf6	.538	.323	.361	.396	**.682**	.330
sp4	.529	.692	.640	.441	**.790**	.506
sp3	.667	.618	.577	.523	**.698**	.508
sp2	.631	.693	.622	.594	**.728**	.505
sp5	.506	.707	.717	.603	**.720**	.499
sp1	.616	.683	.580	.563	**.685**	.442
of3	.485	.425	.315	.333	.359	**.883**
of4	.654	.668	.587	.398	.490	**.829**
of5	.722	.604	.566	.413	.374	**.783**

Rotation converged in 8 iterations

There were ten items loaded on Factor 1, all seven items from measurement, analysis, and knowledge management (mm1, mm2, mm3, mm4, mm5, mm6, and mm7) and three items from operation focus were added (of1, of2, and of7) with factor loadings ranging from 0.465 to 0.903. The factor was deemed as valid as all items were loaded on a single factor as expected. A composite score for the factor was created using the sum scores of all of the ten items and the factor remained as *measurement, analysis and knowledge management*.

Factor 2 was comprised of eight items with seven items from workforce focus (wf1, wf2, wf3, wf4, wf5, wf6, and wf7) and 1 item from operation focus (of7). The factor loadings of the items ranged from 0.508 to 0.941. Consistent with the theoretical foundations of the items, a composite score for the factor was created and operationalized as *workforce focus*.

Six items were loaded on Factor 3 with strong factor loadings ranging from 0.585 to 0.856. All of the items loaded on this factor came from the same construct, which was leadership (ls1, ls2, ls3, ls4, ls5, and ls6). Therefore, a composite score was calculated and operationalized as the original construct, *leadership*.

Factor 4 was comprised of five items measuring customer satisfaction. All of the five items came from the customer focus (cf1, cf2, cf3, cf4, and cf5), with factor loadings ranging from 0.486 to 0.804. A composite score for the factor was determined and named against the original construct, which was *customer focus*.

Factor 5 was a composition of six items, which mainly measured the strategic planning of the company. Five items were derived from the construct of strategic planning (sp1, sp2, sp3, sp4, and sp5) and one item from operation focus (cf6). All of the items were loaded on the factor with factor loadings ranging from 0.359 to 0.711. In accordance with the content of the loadings, which were mainly comprised of strategic planning, a composite score was created and operationalized as *strategic planning*.

The last component consisted of three items, which measured the operation practices of a company. All of the items were derived from the same construct of operation focus (of3, of4, and of5). The factor loadings ranged from 0.511 to 0.993. Hence, a total score was calculated based on these three items and transformed into a new variable, *operation focus*.

Similarly, an additional factor analysis was undertaken to assess the dimensionality of the dependent variable, project performance. A single factor solution emerged with an eigen value of 3.08 explaining 77.03% of the variance in the data. The KMO measure of sampling adequacy was 0.82 indicating sufficient intercorrelations, while Bartlett's

Test of Sphericity was statistically significant ($p < .0005$). The result of the factor analysis for project performance is summarized in Table 5-5. A composite score was generated based on the four items and operationalized as *project performance.*

Table 5-5: Factor loadings for project performance.

Items	Component 1
Meet project time objectives	.85
Good at delivering project within budget	.90
Project specifications are usually met by the time of handover	.91
Key stakeholders and users are usually happy with the results from the project	.861
Eigenvalue	3.08
Percentage of variance	77.03
Significance	p < .0005

Based on the components or factors from the factor analysis, composite scores were created. Each of the composite scores was based on the mean scores of the items that were loaded onto the factor. The mean method was chosen because it gives researchers more control over the calculations (Hair Jr et al. 2013) and facilitates the interpretation of descriptive analysis results. Descriptive statistics of the composite variables are presented in Table 5-6.

Table 5-6: Descriptive statistics of composite variables.

Variable	Mean	Std. Dev	Variance
Leadership	4.110	0.580	0.337
Strategic planning	3.920	0.624	0.390
Customer focus	4.070	0.635	0.403
Workforce focus	4.040	0.641	0.411
Operation focus	3.770	0.677	0.459
Measurment, analysis & knowledge management	3.780	0.748	5.560

5.5 Reliability Analysis

The Cronbach's coefficient alpha was tested on both independent and dependent variables after factor analysis. Values range from 0 to 1, with higher values indicating greater reliability. The minimum acceptable level for the reliability coefficient is 0.7 (Nunnally 1978) , Table 5-7 shows that each of the variable constructs exceeded the minimum alpha value of 0.7, which indicates good internal consistency and reliability, which is necessary for further analysis. The reliability statistics for all of the variables can be found in Appendix E.

Table 5-7: Cronbach's alpha of the various constructs.

Variables	Number of items	Number of deleted items	Cronbach's alpha
Leadership	6	-	.901
Strategic planning	6	-	.897
Customer focus	5	-	.869
Workforce focus	8	-	.935
Operation focus	3	-	.845
Measurement, analysis & knowledge management	10	-	.957
Project performance	4	-	.900

5.6 Correlation Analysis: Relationships between the Variables

The Pearson's correlation analysis was carried out to examine the bivariate relationships among the main variables. The results of the correlation analysis are presented in Table 5-8. As depicted in the table, the correlation coefficients for the variables were relatively high, ranging from 0.458 to 0.798. Workforce focus was highly related to project performance ($r = 0.619$, $p < 0.01$). This was followed by the variables of strategic planning ($r = 0.558$, $p < 0.01$), leadership ($r = 0.533$, $p < 0.01$), operation focus ($r = 0.513$, $p < 0.01$), and analysis, management, and knowledge management ($r = 0.458$, $p < 0.01$).

All of the TQM practices had significant positive correlations ($p < 0.01$) with project performance. All 21 correlations were larger than 0.15. The highest coefficient correlation in this research was 0.798, which is below the cut-off point of 0.90 for the collinearity problem. Hence, collinearity and multicollinearity do not present problems in this research (Hair Jr et al. 2013).

Table 5-8: Pearson's correlation analysis of the main variables.

Variables	1	2	3	4	5	6	7
Project Performance	1.000						
Measurement, analysis & knowledge management	0.458**	1.000					
Workforce focus	0.619**	0.785**	1.000				
Leadership	0.533**	0.594**	0.706**	1.000			
Customer focus	0.452**	0.673**	0.669**	0.611**	1.000		
Strategic planning	0.558**	0.798**	0.775**	0.728**	0.730**	1.000	
Operation focus	0.513**	0.738**	0.681**	0.560**	0.527**	0.648**	1.000

Notes: Correlation is significant at the **0.01 level (two-tailed)

5.7 Statistical Test of Hypotheses

This study seeks to describe the association between TQM practices and project performance in Malaysian construction organizations by analyzing the 6 TQM constructs, specifically leadership, strategic planning, customer focus, measurement, analysis and knowledge management, workforce focus and operation focus.

The research hypotheses were structured according to the two specific research questions from this study, which were to identify the relationship between TQM and project performance and to determine which TQM practices have a greater association with project performance. This study used the regression analysis technique to test the regression model. Table 5-9 summarizes the hypotheses of the study.

Table 5-9: Summary of hypotheses.

Hypotheses	
H_1	There is a significant positive relationship between leadership and project performance.
H_2	There is a significant positive relationship between strategic planning and project performance.
H_3	There is a significant positive relationship between customer focus and project performance.
H_4	There is a significant positive relationship between workforce focus and project performance.

(Continued)

Hypotheses	
H_5	There is a significant positive relationship between operation focus and project performance.
H_6	There is a significant positive relationship between measurement, analysis and knowledge management and project performance.

A multiple regression analysis was run to test the hypotheses. MRA is a useful technique that can be used to analyze the relationship between a dependent variable and several independent variables (Hair Jr et al. 2013). Five independents variables (total quality management constructs) and one dependent variable (project performance) were entered in the multiple regression models using the Enter method.

The SPSS statistics showed that there was independence of residuals, as assessed by the Durbin-Watson statistic of 1.853 (Appendix E). The inspection of (i) scatterplot (Appendix E) of the studentized residuals against the (unstandardized) predicted values and (ii) partial regression plots (Appendix E) showed that the independent variables were collectively and individually in a linear relationship with the dependent variable. Assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values (Appendix E), the residuals were randomly scattered indicating that there was homoscedasticity (i.e. the variances along the line of best fit remain similar along the line). There was no evidence of multicollinearity, as assessed by tolerance values (all greater than 0.1). Casewise diagnostics showed that there were no studentized deleted residuals (outliers) greater than ±3 standard deviations. The ordered leverage values showed no leverage values greater than 0.2. There was no Cook's distance value above 1 indicating no influential points available. The bell-shaped histogram (Appendix E) and residuals aligned along the diagonal line as shown in both P-P Plot (Appendix E) and Q-Q Plot (Appendix E) indicate the assumption of normality was met. From these analyses, it can be concluded that multiple regression models of this study meets the assumptions required to ensure the validity of its significance test (Ooi et al. 2013).

The multiple regression model was statistically significant, $F(6, 135) = 17.702$, $p < .0005$. Table 5-10, the coefficient of determination (R^2) for the overall model was

44% with an adjusted R^2 of 41.5%, a large size effect according to (Cohen et al. 2013). The individual model variables revealed that workforce focus (**β** = 0.463, $p < 0.01$) and operation focus **(β** = 0.225, $p < 0.05$) were found to have a significant and positive effect on project performance. While, measurement, analysis, and knowledge management (**β** = -0.321, $p < 0.05$) was found to have a significant negative effect on project performance. Therefore, hypotheses H4 and H5 were supported. Meanwhile, leadership, customer focus, and strategic planning had no significant effect on project performance. Hence, H1, H2, H3, and H6 were not supported.

Table 5-10: Regressions predicting project performance.

	B	**S.E.**	**β**	**p**
(Constant)	1.016	0.326		0.002
Leadership	0.104	0.113	0.094	0.357
Strategic planning	0.238	0.138	0.231	0.085
Customer focus	0.013	0.100	0.013	0.894
Workforce focus	0.465	0.124	0.463	0.000
Operation focus	0.214	0.094	0.225	0.025
Measurement, analysis & knowledge management	-0.276	0.113	-0.321	0.016
R^2	0.440			
R^2 Change	0.440			
F Change	17.702			
	$p < 0.001$			
Adj. R^2	0.415			
N	142			

This chapter has so far presented the results of multiple regression analysis conducted to test the direct relationship between TQM constructs and project performance. The results of the hypotheses testing are presented and discussed below.

> H_1 There is a significant positive relationship between leadership and project performance.

Hypothesis H_1 argues that leadership is positively related to project performance in the construction industry. However, the results of multiple regression analysis revealed that its relationship with project performance (**β** = .094, p = .357) is not significant. Therefore, hypothesis H_1 is rejected.

> H_2 There is a significant positive relationship between strategic planning and project performance.

Hypothesis H_2 proposes that strategic planning is significantly related to project performance in the construction industry. However, the results of the multiple regression analysis showed the opposite. Strategic planning (**β** = .231, p = .085) had no significant relationship with project performance. Hence, hypothesis H_2 is rejected.

> H_3 There is a significant positive relationship between customer focus and project performance.

Hypothesis H_3 contends customer focus is significantly related to project performance in the construction industry. The multiple regression analysis showed that customer focus (**β** = .013, p = .894) had no significant relationship with project performance. Hence, hypothesis H_3 is rejected.

> H_4 There is a significant positive relationship between workforce focus and project performance.

Hypothesis H_4 maintains workforce focus is significantly related to project performance. The results of multiple regression analysis showed that workforce focus (**β** = .463, p = .000) had a significant and positive relationship with project performance. Therefore, hypothesis H_4 is supported.

> H_5 There is a significant positive relationship between operation focus and project performance.

Hypothesis H_5 argues that operation focus is significantly related to project performance in the construction industry. The results of multiple regression analysis indicated that operation focus (**β** = .225, p = .025) had a significant and positive relationship with project performance. Therefore, hypothesis H_5 is supported.

H_6 There is a significant positive relationship between measurement, analysis, and knowledge management and project performance.

Hypothesis H_6 claims that measurement, analysis, and knowledge management are significantly related to project performance in the construction industry. The results of multiple regression analysis indicated that measurement, analysis, and knowledge management (**β** = -.321, p = .016) had a significant but negative relationship with project performance. Therefore, hypothesis H_6 is not supported. Overall, the results showed that TQM practices were partially correlated with project performance in Malaysian construction organizations. The summarized results of the hypotheses testing are presented in Table 5-11 below.

Table 5-11: Summary of the hypotheses and test results.

	Hypothesis	**Results**
H_1	There is a significant positive relationship between leadership and project performance.	Not supported
H_2	There is a significant positive relationship between strategic planning and project performance.	Not supported
H_3	There is a significant positive relationship between customer focus and project performance.	Not supported
H_4	There is a significant positive relationship between workforce focus and project performance.	Supported
H_5	There is a significant positive relationship between operation focus and project performance.	Supported
H_6	There is a significant positive relationship between measurement, analysis and knowledge management and project performance.	Not supported

5.9 Discussion of the Findings

The sections below will discuss the findings on the two research questions and the six research hypotheses based on the analysis in Chapter Five.

5.9.1 Discussions of Findings – Research Question One

To highlight the relationship between TQM practices and project performance, a correlational analysis was presented in Chapter Five. The six TQM practices included leadership, strategic planning, customer focus, workforce focus, operation focus, and measurement, analysis, and knowledge management. Table 5-12 presents the analysis of the responses given by the respondents on the TQM practices for their respective construction organizations.

Table 5-12: Descriptive analysis of the various TQM constructs.

Variables	Mean	Std. Dev	Variance
Leadership	4.110	0.580	0.337
Strategic planning	3.920	0.624	0.390
Customer focus	4.070	0.635	0.403
Workforce focus	4.040	0.641	0.411
Operation focus	3.770	0.677	0.459
Measurement, analysis & knowledge management	3.780	0.748	0.560

Although there were different levels of responses given by the respondents, it was determined that every construction organization, which participated in this study, had applied all six practices of TQM.

The overall objective of this study was to investigate the nature of TQM practices and their relationship towards project performance. Based on the analytical results in the previous sections, TQM does have a significant relationship with project performance. The results confirm the findings from previous studies (Mir and Pinnington 2014; Din, Abd-Hamid and Bryde 2011; Arumugam, Ooi and Fong 2008). In summary, the TQM practices based on the MBNQA framework have displayed a positive association with project performance. Each of the TQM practices and their links to project performance will be discussed in the following section.

5.9.2 Discussions of Findings – Research Question Two

Six hypotheses were developed to examine whether the dimensions of TQM, i.e. leadership, strategic planning, customer focus, measurement, analysis, and knowledge management, workforce focus, and operation focus were significantly related to project performance within the construction organizations in Malaysia. The overall hypotheses testing results obtained from a multiple regression analysis have shown that 2 of the 6 dimensions, workforce focus and operation focus, have a significant and positive impact on project performance. The others do not have a significant impact on project performance. The findings of each hypothesis are discussed in the following subsections.

5.9.2.1 Hypothesis 1 – Relationship of Leadership and Project Performance

The initial conclusion that can be derived from this research is that leadership, one of the TQM practices, has demonstrated an insignificant impact on project performance. This indicates that the level of management leadership in the construction industry is still not intensive enough to influence project performance. The outcome of this study is consistent with but also contradicts other recent studies. A recent study by Shafiq, Lasrado, and Hafeez (2017) found leadership had a significant relationship with organizational performance both in financial and non-financial measurements. The study was conducted in the textile sector in Pakistan using a structural equation model (SEM), which is different in context of region, industry and analysis method from this study. This may explain the contradictory results derived from the study. A study by Talib, Rahman, and Qureshi (2013) found top management commitment had no significant effect on quality performance. In their study, Sadikoglu and Olcay (2014) also concluded, leadership was not significant to all of the firm's performance measurements which included operational performance, inventory performance, employee performance, innovation performance, social responsibility, customer satisfaction, and market and financial performance. The insignificant relationship of leadership in project performance is explained in some of the literature. In project success literature, leadership is not regarded as one of the success factors in project management (Turner 2014). In Yang, Huang, and Wu (2011) the researchers explained leadership is indirectly related to project performance through the relationship between team members. This is a similar conclusion to one of the studies conducted in Malaysia (Fung and Ramasamy 2015), who also claimed, while the execution of leadership does not directly influence project performance, the team effectiveness resulting from leadership enhancement is likely to lead to better performance. This theory explains why leadership is not significant to project performance as the relationship is amplified by the factor of teamwork. One of the findings in Yang, Huang, and Wu (2011), stated that the higher the complexity level of the projects the more likely the projects are to be successful compared to those with lower complexity. The complexity of the project plays a moderating role in enhancing project performance and if applied to this study, project complexity could be an influencing factor that explains the relationship between leadership and project performance. In other words, the project conducted by the contractors in this study may consist of residential or shop lots with a lower level of complexity and where the role of leadership has not improved project performance. Fung and Ramasamy (2015) explained that project performance is not directly dependent on leadership but on other factors. There are other factors that a play a mediating role in the relationship between leadership and project performance (Lo, Ramayah and De Run 2010). It is understandable not all TQM practices have a significant relationship with project performance. It may be the case some TQM practices affect performance rather indirectly through the application of other, additional TQM practices or factors. In this study, it can be concluded leadership does not have a direct significant effect on project performance. There is a possibility the role of leadership on project performance is mediating through other factors and this may explain why leadership does not play a significant role in enhancing project performance as claimed in the general management literature.

5.9.2 .2 Hypothesis 2 – Relationship of Strategic Planning and Project Performance

The results from this study demonstrate strategic planning does not have a significant relationship in improving project performance in the Malaysian companies. The assertion that planning is one of the critical success factors for project success, found in almost all strategic management and project management literature (Johnson et al. 2001; Meredith and Mantel Jr 2011; Pinto and Slevin 1988; Turner 2014) does not apply in this study. Talib, Rahman, and Qureshi (2013) in their study investigating TQM in Indian service companies found strategic planning was not significant to quality performance. A study conducted by Zwikael et al. (2014) in Fiji tried to determine the moderating effect of risk on the relationship between planning and success in project environment. The results of their regression analysis revealed project planning was not significantly correlated with project efficiency and effectiveness. Another study by Sadikoglu and Olcay (2014) also discovered that strategic planning was only partially correlated with organizational performance in Turkish firms. Out of seven measurements of organizational performance, strategic planning only positively related to employee performance and social responsibility. Despite the different regions, the results of these three studies show the same outcomes, where strategic planning is not significantly or only partially correlated with performances. This means that efforts in enhancing planning do not improve project performance. Zwikael et al. (2014) discovered risk factors play a moderating role in correlating project planning with success. They found the existence of a high-risk increases the quality of planning and improves project efficiency while a low-risk improves project effectiveness. This explains why strategic planning is found to have no significant association with project performance in this study, where the presence of risk factors plays a mediating role. In addition, construction practices such as engagement of multiple professionals, reliance on subcontractors, and constant changes to project descriptions and goals make planning even more challenging. Laird (2016) observed the increasing size and complexity of the project enhanced the correlation between project planning and project success. When size and complexity increases, more effective planning is necessary to coordinate the interrelated efforts of team members to success. This finding is parallel to the finding for leadership (see 5.9.2.1) where the factor of size, complexity, and risk of a project impacts the performance indirectly. The outcome of this hypothesis implies strategic planning is still not intensive enough to improve project performance. The implication of strategic planning may exist through the existence of other factors, which need to be further explored.

5.9.2.3 Hypothesis 3 – Relationship of Customer Focus and Project Performance

The findings of this study show customer focus is not a vital determinant of project performance. This signifies understanding customer needs and the efforts of fulfilling customer satisfaction are not a priority in the construction industry and they do not affect project performance. Talib, Rahman, and Qureshi (2013) discovered customer focus was one of the TQM factors not significant to quality performance for Indian service companies. In their study, customer focus had an indirect relationship with quality performance through continuous improvement. Another study by Sadikoglu and Olcay (2014) also revealed customer focus was partially correlated with organizational performance in Turkish manufacturing and service industries. In their study, customer focus only significantly related to two out of seven organizational measurements (i.e. operational performance and social responsibility). Although both Talib, Rahman, and Qureshi (2013) and Sadikoglu and Olcay (2014) conducted studies in different countries and industries, they both showed similar outcomes to this study. According to Talib, Rahman, and Qureshi (2013) customer focus related indirectly to quality performance through other factors. This is supported by a previous study by Tari, Molina, and Castejon (2007) which demonstrated customer focus did not show a significant relationship with performance. However, the relationship is indirectly linked to performance through process management. Nair (2006) once again showed the impact of customer focus on performance measurements is influenced by moderating factors. The customer-oriented activities are designed to improve products and services with the goal of satisfying customers. The outcomes of customer-focused activities will then be transferred to process management to be implemented and eventually be reflected in the overall project performance. The relationship between customer focus and performance with the moderating effect of process management is applicable in the construction industry. As in this current study, customer focus is not being prioritised in the construction industry. The effect of customer focus on project performance could be a presence through process management, which requires further study.

5.9.2.4 Hypothesis 4 – Relationship of Workforce Focus and Project Performance

The outcome of this research illustrates workforce focus is significantly linked to project performance in the Malaysian construction organizations. Workforce related practices include employee involvement, human resource management, and employee encouragement. In the studies of Naqvi, Bokhari, and Aziz (2011) and Zwikael and Unger-Aviram (2010), human resource management has been regarded as one of the core elements of project management. Other than that, one of the elements of workforce focus, which is the performance management of employees, also has gained significance in project performance (Naqvi, Bokhari and Aziz 2011). In Sadikoglu and Olcay (2014) study, employee training was the only significant effect on operational management. Other organization measurements such as inventory performance, innovation performance, social responsibility, and market and financial performance were not related to employee training in the Turkish manufacturing and service industry (Sadikoglu and Olcay 2014). Furthermore, a study in the automotive industry of Thailand by Popaitoon and Siengthai (2014) demonstrated human resource management practices had a positive association with project-related performance in the long term. However, Talib, Rahman, and Qureshi (2013) in their study investigating TQM practices at Indian service companies showed workforce related practices have no significant effect on quality performance. This can be explained in which the repetitive work process in manufacturing and service industries disregards the needs of workforce focus, as shown in both Talib, Rahman, and Qureshi (2013) and Sadikoglu and Olcay (2014) . However, the construction industry, which depends greatly on its workforce in the building process, says that workforce focus is related to project performance. Overall, providing more intensive workforce focus practices could trigger a greater contribution by employees to achieving the desired project performance.

5.9.2.5 Hypothesis 5 – Relationship of Operation Focus and Project Performance

Clear objectives and goals set by the organization with well-defined processes will lead workers towards a better performance. The finding in this study has confirmed this statement. ISO status certifies that Malaysian construction organizations under G7 have a standardized process management system for their business. Similarly, in other studies, process management has been confirmed as having a statistically significant relationship with performance (Sadikoglu and Zehir 2010; Zehir et al. 2012). Mir and Pinnington (2014) studied United Arab Emirates (UAE) project based organizations and observed one of the process management practices, KPIs (Key performance indicators) was significantly correlated with project success. Similarly, in Sadikoglu and Olcay (2014), their study revealed that process management partially contributed to firm performance in the Turkish manufacturing and service industry, through inventory performance, innovation performance, and customer service. Zeng, Phan, and Matsui (2015), looked at management practices and their impact on manufacturing performance in eight countries and discovered that process management was as one of the quality management practices that had a direct effect on quality performance. Process management has been shown to have a significant correlation in enhancing project performance not only in Malaysia but in other countries as well (Mir and Pinnington 2014). Process performance has also shown significant contributions in the manufacturing and service industry (Sadikoglu and Olcay 2014; Zeng, Phan and Matsui 2015). Regardless of country or industry, process management has proven its importance in improving performance. The results of these findings have highlighted the importance of implementing the appropriate procedure throughout the project life cycle. A study by Tari, Molina, and Castejon (2007) asserted quality outcomes are achieved through the continuous improvement from process management activities. Process management activities such as developing key work processes at every project level, establishing Key Performance Indicators (KPIs), monitoring performance, approaches and tools to improve process performance, reducing variability, and preparing emergency plans will lead the organization to continuous improvement and ultimately have a positive impact on project performance. Their findings have also indicated process management activities must derive from suppliers and customers. Appropriate and effective work process activities can only be defined and implemented through the understanding of customer needs and a good relationship with suppliers. Particularly in a construction project, the uncertain nature of the industry requires work processes to be defined, managed, monitored, and controlled properly.

5.9.2.6 Relationship of Measurement, Analysis and Knowledge Management and Project Performance

The current study's results show measurement, analysis, and knowledge management has a negative influence in improving the performance of the Malaysian construction organizations. This result is surprising as the more time and effort focused on measurement, analysis, and knowledge management, the less it will be in resulting the project performance. This result is also contradictory to the findings of other studies. In Mehralian et al. (2017) , quality information availability and usage were found to be one of the TQM practices significantly affecting the performance of the pharmaceutical industry in Iran. Valmohammadi and Roshanzamir (2015) in their study investigating pharmaceutical manufacturing in Tehran showed measurement, analysis and knowledge management was one of the TQM practices associated with organizational performance. Zeng, Phan, and Matsui (2015) in their study discovered quality information had a direct effect on the manufacturing industry's quality performance. In those studies, the importance of decision-making by managers based on real data analysis had been emphasized. Reliable and timely data information through appropriate tools or measurements is vital for upper management to decide the organization's direction and to drive excellence. On the other hand, some of the studies revealed contradictory outcomes. Ooi et al. (2012) in their study investigating Malaysian manufacturing revealed information analysis had a negative association with innovation performance. Likewise in Teh, Tritos, and Dotun (2012), information analysis had a negative relationship with the ASEAN (Thailand, Malaysia, Philippines, Indonesia and Vietnam) automotive industry. It is not surprising that measurement, analysis and knowledge management is not significant in improving project performance as there are other studies showing a similar relationship in their respective sector and country. The result of this hypothesis indicates the Malaysian construction industry still does not recognize the importance of using quality measurements and data in decision-making. Project managers in Malaysian construction organizations should look into reallocating their resources wisely to take advantage of adopting measurement, analysis, and knowledge management practices to improve their project performance. To accomplish this, the management of the organizations, especially the upper management decision-makers should rely more on statistical measurements, and reliable analyzed data and encourage an information sharing culture in the organization to gain competitive advantage and maintain a leadership position in the industry.

5.10 Summary

This chapter presents the results of the various statistical analyses carried out to test the hypotheses. Principle component analysis, the Pearson's correlation analysis, and multiple regression analysis were conducted according to formally recognized procedures, and the results were presented in table format. The major findings with regards to the hypotheses have been highlighted in this chapter together with discussions. The next chapter focuses on the conclusions, implications, limitations, and possible future studies.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

6.0 Introduction

This chapter aims to draw some conclusions based on the discussion of the data presented in Chapter 5 regarding the links between TQM and project performance. This section also presents the implications of this research from the managerial and theoretical perspectives. Finally, the limitations of this study and some suggestions for further research in the future are provided.

6.1 Conclusions

The Malaysian construction industry has recognized the importance of continuous quality improvement of TQM in its practices. One TQM recommendation in the construction industry is the application for ISO 9000 certification. The ISO 9000 certification is only compulsory for those in the construction industry in Grade 7, according to the CIDB. Other smaller scale construction organizations are still lacking in TQM awareness and implementation. The continuous effort of promoting and implementing quality management practices in Malaysia, especially in the construction sector, need to be encouraged.

The current management practices show the recognition of the importance of the workforce is essential to the Malaysian construction industry. The workforce is the core factor that sustains the overall operation of a construction project, where every stage of the project depends greatly on the workforce. This study suggests that by providing training, a good working environment, by encouraging teamwork, problem solving, a culture of ‘quality’, recognition, a rewards system, and fair compensation will increase workforce satisfaction. In addition, continuous monitoring and measuring of employee performance and job satisfaction are also essential to keep the workforce motivated and hence perform their jobs to their ability. They are the valuable assets that need great attention to improve the performance outcomes in the construction industry.

Operation related functions are important in this unique, dynamic, and unpredictable industry. Developing key work processes, Key Performance Indicators (KPIs), a report system, new approaches and tools, improved communication with suppliers, and emergency plans are important to develop the operation process of the Malaysian construction organizations. Well-prepared operation functions enhance productivity. Project performance in the Malaysian construction industry depends directly on process management.

Another significance of this study is measurement, analysis and knowledge management has a negative influence in improving the performance of the Malaysian construction organizations. Similar implications are found in other sectors such as the manufacturing sector in Malaysia (Ooi et al. 2012) and the automotive industry of ASEAN (Teh, Tritos and Dotun 2012). Measurements of performance, data collection and analysis, and knowledge management are the process of minimizing and reducing variability and changes; hence, a negative relationship exists between measurement, analysis and knowledge management and project performance. One other significance arising from this finding, there is a lack of knowledge in the use of measurement and analysis tools and a lack of support from management to instil a culture of information sharing in the construction organizations. The organizations have to reallocate their resources in this respect, as this is how reliable decision-making should be based.

Other TQM practices such as leadership, strategic planning and customer focus do not have a direct impact on project performance. However, other studies showed the possibility of other mediating factors influencing these features and ultimately performance (Lo, Ramayah and De Run 2010; Yang, Huang and Wu 2011; Zwikael et al. 2014; Fung and Ramasamy 2015; Laird 2016). Overall TQM has a significant impact on Malaysian construction project performance. The implication is that TQM is a holistic approach, which should be implemented collectively because each practice is interdependent with the other practices (Zwain, Lim and Othman 2017).

6.2 Research Implications

This research further enriches the TQM literature and brought some implications from both theoretical and managerial perspectives, which will be discussed as follows:

6.2.1 Managerial Implications

TQM is a recent development towards organizational success, which has been followed by organizations around the world. It has been widely recognized as one of the key elements for improving the performance of companies (Ooi et al. 2011). Companies have started to adopt the quality-conscious management features of TQM as it is one the most effective methods to improve the competitiveness of their firm holistically. Moreover, the practices of TQM have been found to be useful mechanisms to improve the management and performance either as a complete package or individually. The findings and discussions in the previous sections revealed valuable insights for practitioners and researchers in both quality and project performance fields. The understanding of the significance of TQM practices in the construction industry will indeed improve project performance.

This study has established some practical approaches for organizations, especially Malaysian construction companies on how TQM practices can enhance project performance. It is essential that a TQM framework be developed, tested, and studied in the relevant context so that it can contribute effectively to the firms in the industry. This research clearly demonstrates that 2 out of the 6 TQM practices, specifically workforce focus and operation focus, have positive impacts on project performance in the construction organizations of Malaysia. More explicitly, workforce focus and operation focus stand out as two of the most effective TQM practices linked to project performance. Hence, management should focus on these two constructs in their organization.

This study provides a useful tool for practitioners in construction management. Increasing the awareness of managers of all levels in the construction sector on the multidimensionality of TQM and drawing their attention to how these 6 TQM practices are devoted to project performance are the practical contributions of this research. This research acknowledges the importance of TQM practices by contributing to a successful project performance culture in the industry. The continuous implementation, monitoring, and assessment of TQM practices in these organizations should be emphasized to produce the best results within the construction industry in Malaysia.

The findings of this study provide observations and insights to enable policy makers and regulators, such as the CIDB, to assess and consider any relevant revisions and amendments to current policies in Malaysia to improve quality performance in the Malaysian construction industry. For instance, one suggestion is for workforce focus and operation focus which have shown significant impact on project performance, be incorporated into current Malaysian construction industry policy. The workforce and operation focus related activities can be included as a source of reference to improve project performance and upgrade the status of the Malaysian construction industry globally. It is also suggested to expand the mandatory requirement of adopting ISO 9001 certification to the other groups of contractors, not just the G7 in Malaysia.

6.2.2 Theoretical Implications

In the project management literature, many studies have attempted to find a more efficient way to achieve project success or improve project performance. However, there is still insufficient research conducted in the area of TQM and project performance relationships, especially in the context of the Malaysian construction industry. In this research, a TQM model based on the MBNQA framework that incorporated six measurements was developed to investigate whether such practices would influence project performance in the construction organizations. This study is believed to contribute knowledge of TQM to the literature, particularly in the context of Malaysia. This research offers a foundation for future research to be carried out, to examine the link between TQM and project performance, so additional insights can be discovered and transformed into new concepts. Moreover, this study also contributes to the literature by highlighting the effects of individual TQM practices on project performance. The management team, through the findings of this research, can develop a more encouraging TQM culture by modifying TQM practices so they can be adapted for a specific organization.

6.3 Research Limitations and Future Research Directions

The results of this research had to address some data weaknesses due to resource and time constraints. The first limitation was the study only focused on Malaysian organizations. It is suggested this study could be broadened to other countries including developed, developing, and underdeveloped countries. A comparison study between Malaysia, a developing country, and another group of countries in the world is encouraged. This may further investigate the differences in the relationship between TQM and project performance across various nations. These investigations are believed to bring significant contributions and valuable insights to the industry.

Secondly, due to time constraints, a cross-sectional study was conducted in this research. In the future, a longitudinal study studying the link between TQM and project performance in the industry based on time sequence is suggested. The causality between variables can be tested through different points of time data for a clearer and more significant contribution.

The questionnaire survey was targeted at middle to upper level project-related personnel such as directors, CEOs, managers, project managers, quality managers, and quantity surveyors. A different perspective covering the entire workforce will provide greater insights on TQM applications in the organizations with a more holistic outcome. The perspective on the adoption and application of TQM practices from ordinary workers may differ from management and should be taken into consideration as well. Therefore, it is suggested to conduct a study that covers the different levels of the workforce.

The TQM practices discussed in this research are based on the MBNQA criteria and consist of 6 constructs. The quality practices are limited in this study whereas in the literature other factors may influence the performance outcome in the context of construction. Other national quality award frameworks such as the Deming Prize and the European Quality Award can also be adopted as the predictors in the future. Furthermore, other external factors should be taken into consideration in the future such as organizational culture, continuous improvement, corporate governance, and corporate strategy. These factors may play essential roles in defining or moderating quality practices and project performance.

It is suggested that this study could be expanded where the role of a mediating influence would be investigated. The findings of this study showed many of the TQM practices were not directly linked to project performance but the literature has shown there is a history of mediating factors effecting variables and outcomes. Another topic for research, which takes into consideration the mediating factor, is using other alternative methodologies than the types used in this study.

Finally, the sample size of this study does not meet the minimum requirement to represent the population of G7 contractors in Malaysia. A comparison of sample sizes in the construction industry studies such as Shieh and Wu (2002); Shrivastava, Mohanty, and Lakhe (2006), Ali and Rahmat (2010), Din, Abd-Hamid, and Bryde (2011) and Mir and Pinnington (2014) suggest the sample size in this study is acceptable. However, a future study is suggested to increase the sample size for a better representation of the population and a better understanding of their organizations practices affecting Malaysian project performance. A comparison between a study with a larger sample size and the current study would be interesting in validating these results.

6.5 Summary

This chapter summarized the discussion of all the findings in the previous chapter. Each of the six hypotheses was examined and explained based on the empirical results. Next, there was a discussion on the managerial and theoretical implications of this research. There were some limitations to this research as well as suggestions to expand on this research even further. The conclusion in this chapter completes this research.

Malaysian Construction Quality Management Survey

PARTICIPANT INFORMATION STATEMENT

HREC Project Number:	*The Ethics Office will advise you of this number after you have submitted your project*
Project Title:	*The influence of total quality management on project performance: The case of construction organizations in Malaysia.*
Principal Investigator:	*Dr. Adriel Sim Khoon Seng*
Student researcher:	*Jong Cherng Yee*
Version Number:	*1*
Version Date:	*01/Apr/2015*

What is the Project About?

Quality management system has been widely implemented and adopted in the construction industry. One of the representatives of quality management system is the well-known Total Quality Management (TQM). In fact, TQM has been accepted as the stimulator for performance improvement in the construction industry. However, there is lack of relevant studies that exclusively focus on the relationship between TQM and project performance. Hence, the objective of this study is to explore the relationship between TQM and project performance in the construction organizations in Malaysia. Data will be collected from organizations listed in the Construction Industry Development Board (CIDB) Sarawak, Malaysia. Two elements will be explored: TQM and project performance. The outcomes of this study can provide useful insights on the implications of TQM on project performance in construction organizations. It also helps industry practitioners to determine their area of improvements in TQM for better project performance to gain and to sustain competitive advantage in construction industry.

Who is doing the Research?

The project is being conducted by Jong Cherng Yee. The results of this research project will be used by Jong Cherng Yee to obtain a Master of Philosophy at Curtin University and is funded by the University. There will be no costs to you and you will not be paid for participating in this project.

Why am I being asked to take part and what will I have to do?

You have been asked to take part because you have the condition we are researching. Your participation will give empirical results of on the current quality practices on project performance in Malaysian construction industry. You are required to complete the questionnaire. We will ask you questions regarding you and your organization, total quality management (TQM) practices implemented in your organization, and project performance of your organization. It is most welcome if you can complete the questionnaire in two (2) weeks time from the date of delivered. Please kindly return the completed questionnaire in an attached return envelope. There will be no cost to you for taking part in this research and you will not be paid for taking part.

Curtin University

Malaysian Construction Quality Management Survey

CONSENT FORM

HREC Project Number:	*RDBS-60-15*
Project Title:	*The influence of total quality management on project performance: The case of construction organizations in Malaysia.*
Principal Investigator:	*Dr. Adriel Sim Khoon Seng*
Student researcher:	*Jong Cherng Yee*
Version Number:	*1*
Version Date:	*01/Apr/2015*

- I have read *{or had read to me in my first language}*, the information statement version listed above and I understand its contents.
- I believe I understand the purpose, extent and possible risks of my involvement in this project.
- I voluntarily consent to take part in this research project.
- I have had an opportunity to ask questions and I am satisfied with the answers I have received.
- I understand that this project has been approved by Curtin University Human Research Ethics Committee and will be carried out in line with the National Statement on Ethical Conduct in Human Research (2007) – updated March 2014.
- I understand I will receive a copy of this Information Statement and Consent Form.

Participant Name	
Participant Signature	
Date	

Declaration by researcher: I have supplied an Information Letter and Consent Form to the participant who has signed above, and believe that they understand the purpose, extent and possible risks of their involvement in this project.

Researcher Name	
Researcher Signature	
Date	

Note: All parties signing the Consent Form must date their own signature.

QUESTIONNAIRE

Please tick at the box below.	
☐	I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.
Section A: Respondent & organization profile	
Please tick at the relevant box for the questions below.	
Age	☐ 20 – 30 ☐ 30 – 40 ☐ 40 – 50 ☐ ≥ 50
Position	☐ CEO ☐ Quality Manager ☐ Project Manager ☐ Manager ☐ Other Please specify: ________________
Organization Size (No. of employees)	☐ ≤ 50 ☐ 51 – 100 ☐ 101 – 500 ☐ 501 – 1000 ☐ ≥ 1000
Ownership	☐ Malaysian ☐ Foreign ☐ Joint Venture
Category	☐ Mechanical & Electrical ☐ Civil Engineering ☐ Building Construction ☐ Other Please specify: ________________
What type of quality management do your organization practice? (You may tick more than one answer)	☐ None ☐ Total Quality Management (TQM) ☐ ISO 9001 ☐ Lean ☐ Six Sigma ☐ Other Please specify: ________________

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Section B: Total Quality Management (TQM) practices						
Please circle one number per line to indicate the extent to which the frequency of practice in your organization based on your assessment, perception or opinion, where (1) = very low, (2) = low, (3) = medium, (4) = high; and (5) = very high.						
Leadership						
LS1	Top management establishes and sustains clear and visible customer-focused quality vision, values and mission.	1	2	3	4	5
LS2	Top management participates in quality management and improvement process	1	2	3	4	5
LS3	Top management hold meetings discusses and reviews quality-related issues	1	2	3	4	5
LS4	Top management encourages quality-related concepts and skills	1	2	3	4	5
LS5	Top management allocates adequate resources for quality improvement	1	2	3	4	5
LS6	Top management pursues long-term quality improvement process	1	2	3	4	5
Strategic Planning						
SP1	A mission statement which has been communicated throughout the company and is supported by employees	1	2	3	4	5
SP2	A comprehensive structured planning process which regularly sets and reviews short and long-term goals	1	2	3	4	5
SP3	Incorporate supplier capabilities and needs of other stakeholders including the community when develops organization's plans, policies, and objectives	1	2	3	4	5
SP4	Organization's strategic plans and tactical plan are linked to quality values	1	2	3	4	5
SP5	Integrate continuous quality improvements into planning process	1	2	3	4	5
Customer Focus						
CF1	Customer focused practice and culture	1	2	3	4	5
CF2	Provide mechanism for customer feedback	1	2	3	4	5
CF3	Take customer complaints as continuous improvement process	1	2	3	4	5
CF4	Review customer complaints and take into consideration for product innovation	1	2	3	4	5
CF5	Conduct a customer satisfaction survey	1	2	3	4	5
CF6	Conduct market study to collect suggestions for improving product	1	2	3	4	5
Measurement, Analysis and Knowledge Management						
MM1	Implement organizational performance measurement system	1	2	3	4	5
MM2	Conduct organizational performance measure at a constant time interval period	1	2	3	4	5
MM3	Data and information collection at all levels and in all parts of organization	1	2	3	4	5
MM4	Analyse and review the data and information collected	1	2	3	4	5
MM5	Availability of key performance figures for analysis and decision making	1	2	3	4	5
MM6	Performance review findings for continuous improvement and innovation	1	2	3	4	5
MM7	Benchmarking of other firms' product quality and procedures	1	2	3	4	5

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Workforce Focus						
WF1	Provide training and development process for all employees	1	2	3	4	5
WF2	Encourage teamwork and problem solving among employees	1	2	3	4	5
WF3	Employee performance are monitored and measured	1	2	3	4	5
WF4	Measure employee satisfaction	1	2	3	4	5
WF5	Maintain a working environment that contributes to the health, safety and well-being of all employees	1	2	3	4	5
WF6	Promote compensation, recognition, and reward system among employees	1	2	3	4	5
WF7	Instil quality culture on continuous improvement among employees	1	2	3	4	5
Operation Focus						
OF1	Develop a set of key work processes	1	2	3	4	5
OF2	Establish Key Performance Indicators (KPIs) for monitoring purpose	1	2	3	4	5
OF3	Practice daily operation work processes report system	1	2	3	4	5
OF4	Monitor and reviews on work processes performance	1	2	3	4	5
OF5	Use of approaches or tools to improve process performance and reduce variability	1	2	3	4	5
OF6	Exercise two-way communication with suppliers	1	2	3	4	5
OF7	A well-prepared disaster and emergency preparedness system to ensure the continuity organization's operations	1	2	3	4	5
Section 3: Project performance						
Please circle one number per line to indicate the extent to which you agree or disagree with the following statement, where (1) = strongly disagree, (2) = disagree, (3) = neutral, (4) = agree; and (5) = strongly agree.						
PP1	Meet project time objectives	1	2	3	4	5
PP2	Good at delivering project within budget	1	2	3	4	5
PP3	Project specifications are usually met by the time of handover	1	2	3	4	5
PP4	Key stakeholders and end users are usually happy with the results from the project	1	2	3	4	5

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MEMORANDUM

Curtin University

To:	Dr. Adriel Sim Khoon Seng Faculty of Business and Humanities Sarawak
CC:	
From:	Dr Catherine Gangell, Manager Research Integrity
Subject	Ethics approval Approval number: RDBS-60-15
Date:	03-Sep-15

Office of Research and Development
Human Research Ethics Office

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Office for the project: 5064

The influence of Total Quality Management on project performance: The case of construction organizations in Malaysia.

Your application has been approved through the low risk ethics approvals process at Curtin University.

Please note the following conditions of approval:

1. Approval is granted for a period of four years from **03-Sep-15** to **03-Sep-19**
2. Research must be conducted as stated in the approved protocol.
3. Any amendments to the approved protocol must be approved by the Ethics Office.
4. An annual progress report must be submitted to the Ethics Office annually, on the anniversary of approval.
5. All adverse events must be reported to the Ethics Office.
6. A completion report must be submitted to the Ethics Office on completion of the project.
7. Data must be stored in accordance with WAUSDA and Curtin University policy.
8. The Ethics Office may conduct a randomly identified audit of a proportion of research projects approved by the HREC.

Should you have any queries about the consideration of your project please contact the Ethics Support Officer for your faculty, or the Ethics Office at hrec@curtin.edu.au or on 9266 2784. All human research ethics forms and guidelines are available on the ethics website.

Yours sincerely,

Dr Catherine Gangell
Manager, Research Integrity

Appendix E-1 - Principal component analysis (PCA) assumptions

KMO & Bartlett's test and Total Variance Explained

Kaiser-Meyer-Olkin (KMO) of Sampling Adequacy		0.928
Bartlett's Test of Sphericity	Approx. Chi Square	5129.448
	df	703
	Sig.	0.000

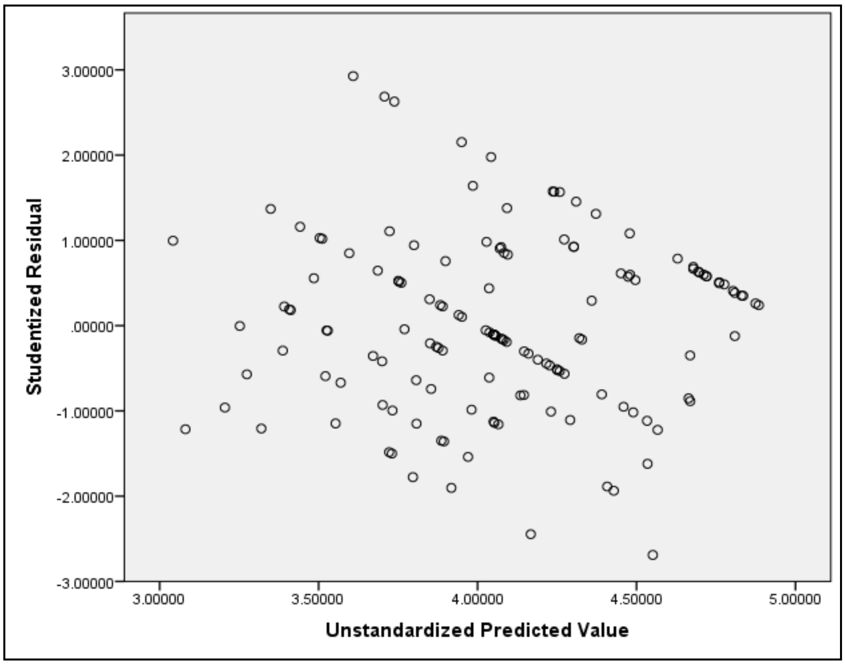
Component	Initial Eigenvalues			Extraction Sum of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total
1	20.168	53.073	53.073	20.168	53.073	53.073	15.357
2	2.463	6.481	59.554	2.463	6.481	59.554	15.924
3	1.541	4.055	63.609	1.541	4.055	63.609	12.802
4	1.375	3.618	67.227	1.375	3.618	67.227	10.859
5	1.083	2.849	70.076	1.083	2.849	70.076	10.669
6	0.987	2.598	72.674	0.987	2.598	72.674	10.401
7	0.818	2.153	74.826				
8	0.786	2.068	76.894				
9	0.712	1.874	78.768				
10	0.593	1.56	82.034				

Appendix E-2 - Multiple regression analysis (MRA) assumptions

Durtbin-Watson, Tolerance and VIF value

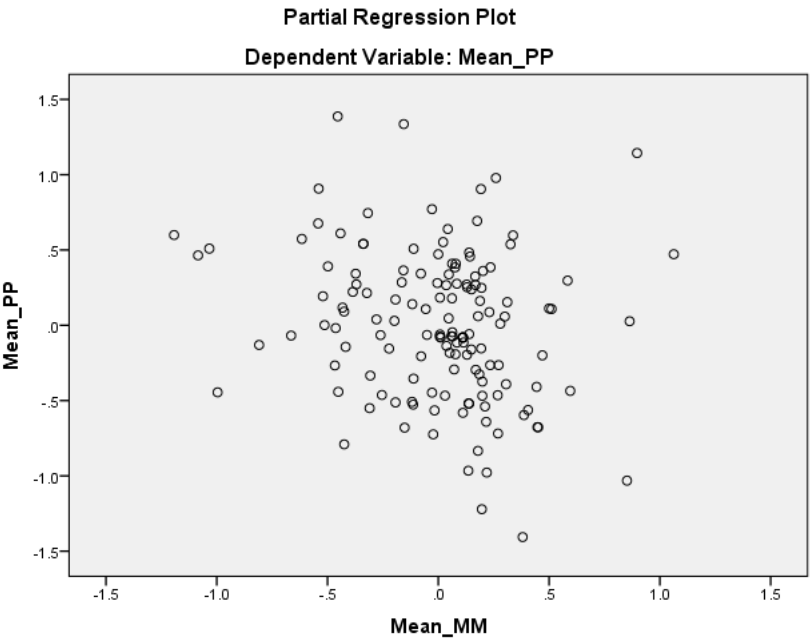
Durbin-Watson	1.853	
	Collinearity Statistcis	
Model	Tolerance	VIF
Measurement, analysis & knowledge management	0.238	4.200
Workforce focus	0.273	3.659
Leadership	0.401	2.494
Customer focus	0.426	2.348
Strategic planning	0.233	4.300
Operation focus	0.420	2.380

Scatterplot

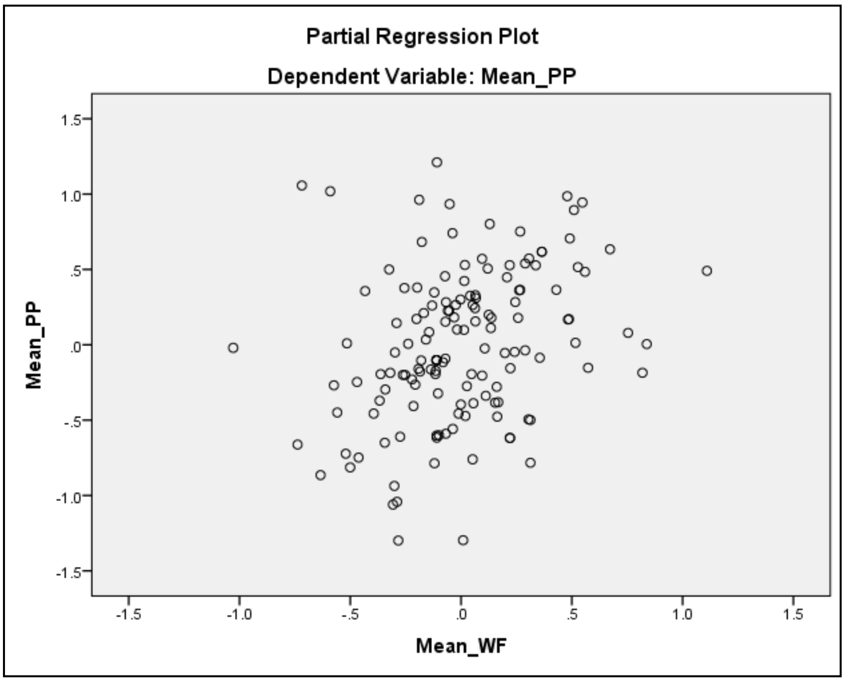


Partial egression plots

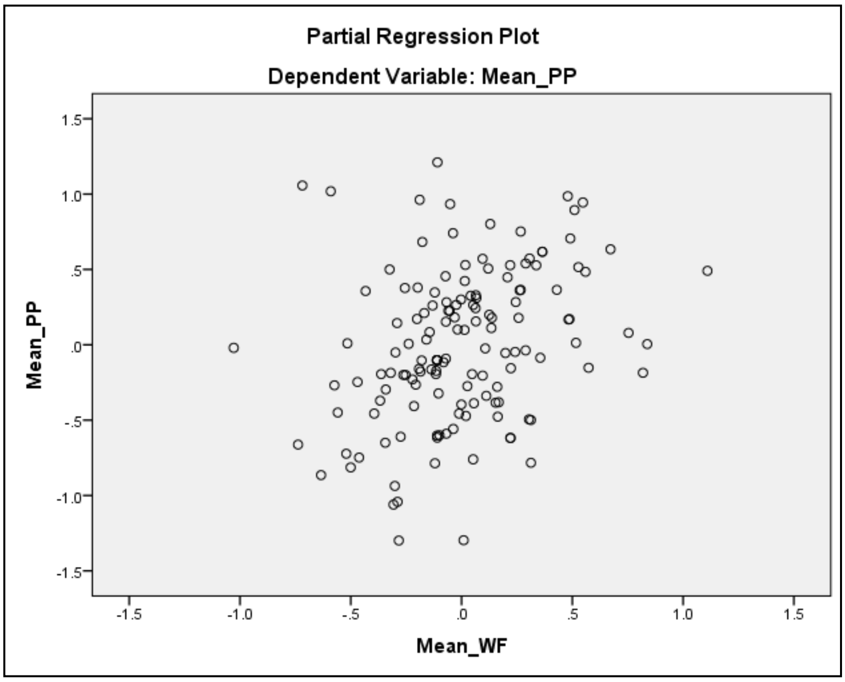
Project performance and measurement, analysis and knowledge management



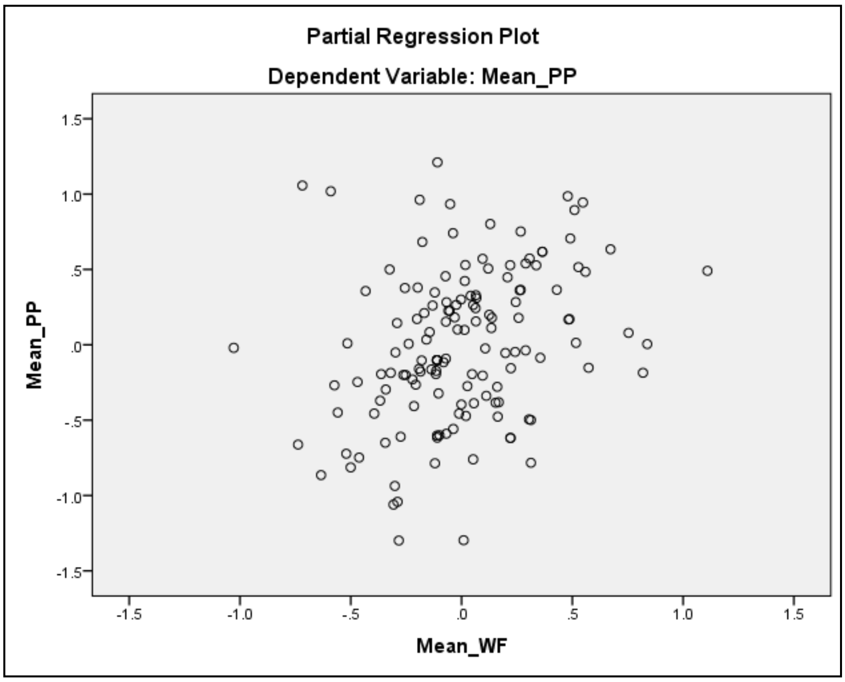
Project performance and workforce focus



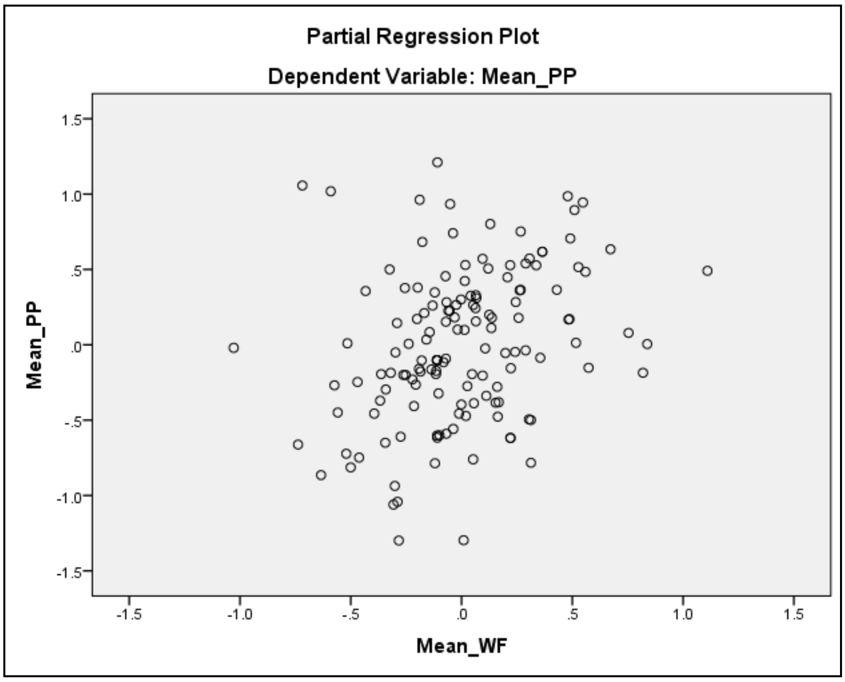
Project performance and leadership



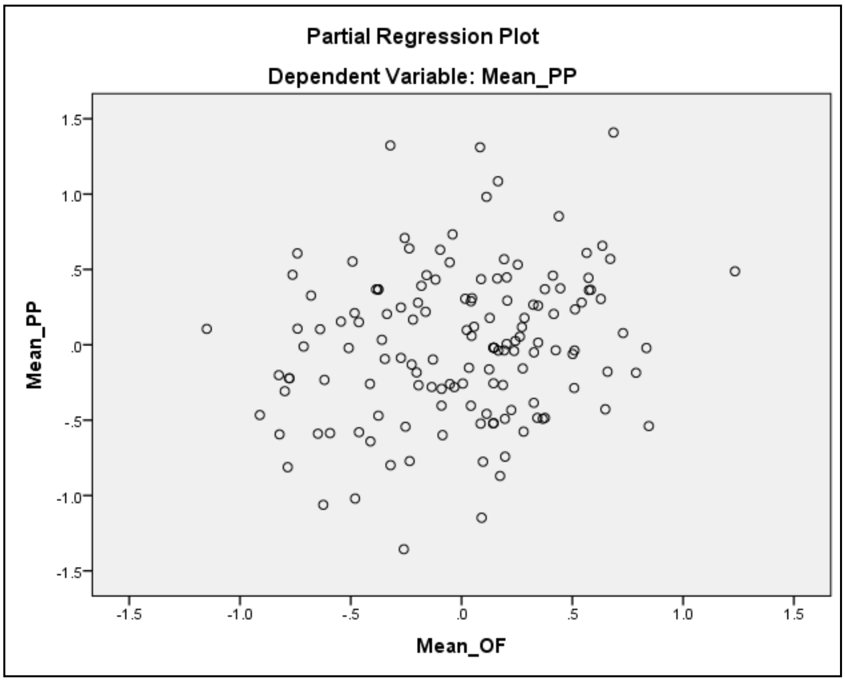
Project performance and customer focus



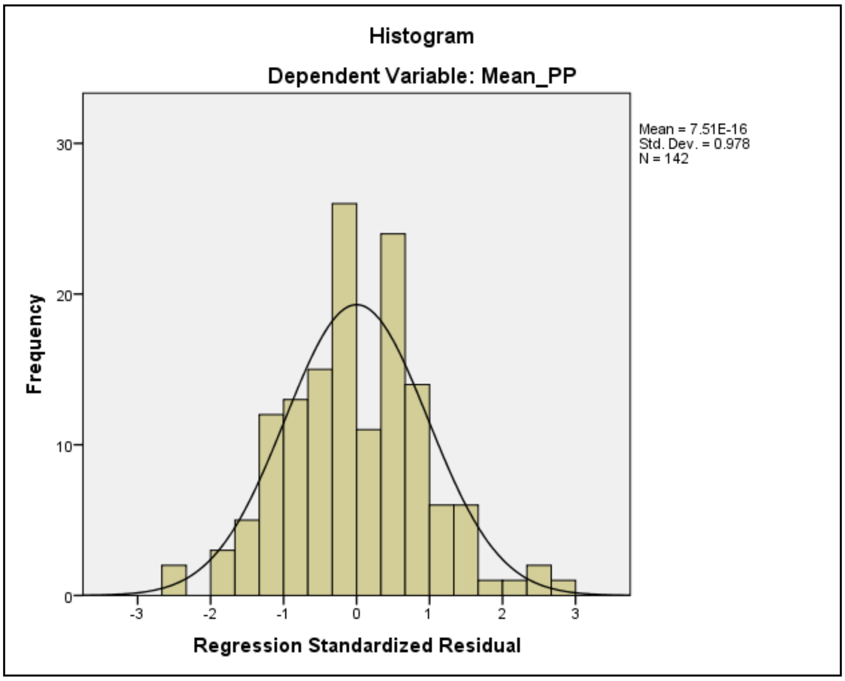
Project performance and strategic planning



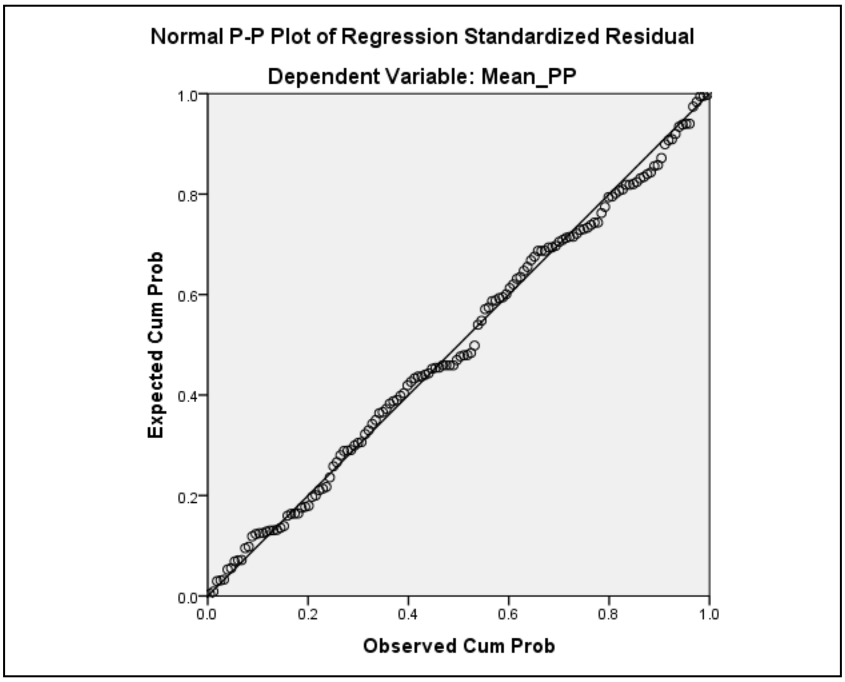
Project performance and operation focus



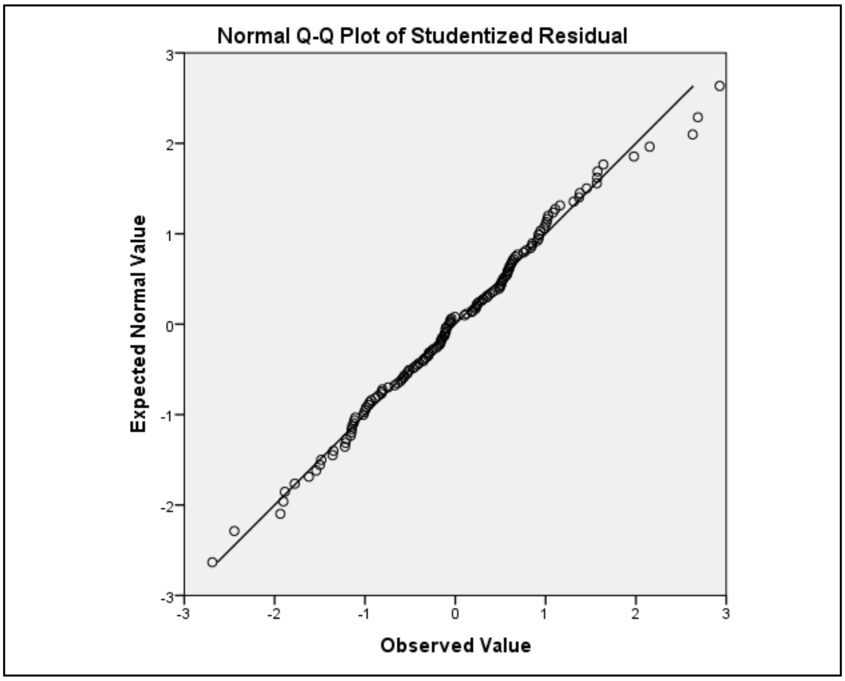
Histogram



P-P Plot



Q-Q Plot



Normal Q-Q Plot of Studentized Residual
Expected Normal Value
Observed Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
3

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