PROJECT MANAGERS' KNOWLEDGE MANAGEMENT AND COMPETENCY MODEL FOR CONSTRUCTION IN MALAYSIA

ELMAHDEE M.A.B.A HASHIM

UNIVERSITI TEKNOLOGI MALAYSIA

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To my beloved mother, my lovely wife Khawla, my daughters (Nadia, Dana), my son (Mohammed), my sister Soad, my cousins Hashim and Mohammadin, and my family

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"Praise be to Allah, the cherisher and the sustainer of the world", "praise be to him he who taught by the pen, taught human, that which he does not know"

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ABSTRACT

The construction industry in Malaysia plays a critical role in its economic development. However, this sector suffers frequent problems, including time and cost overrun, low quality, and poor performance and productivity. One of the critical factors leading to these problems is the incompetent project managers who lead and execute projects. This study investigated the role of the knowledge management approach in improving project managers' competencies through testing the relationship between knowledge management (KM) and project managers' competencies (PMC). Despite the direct linkage between knowledge management and competencies, literature rarely shows a model that presents this direct relationship, particularly in the construction industry. This study applied a quantitative method using an online survey for data collection. The target respondents were project managers in construction companies in Malaysia. The questionnaire was distributed to randomly selected 480 construction companies from the CIDB website. A total number of 227 completed responses were collected from 181 companies. The data was analyzed using descriptive analysis, a reliability test, and exploratory factor analysis using SPSS software. However, the research model and research hypotheses were tested through structural equation modeling (SEM) using AMOS software. The results of the descriptive analysis indicated that the application of knowledge management in Malaysian construction companies is modest. Also, the findings indicated that knowledge management has a positive causal effect on project managers' competencies. The KM-PMC model developed in this study capable for predicting and improving project managers' competencies using the knowledge management approach. As this study is limited to the direct effect of knowledge management on project managers' competencies, future research may explore the mediator factors that affect relationships within the KM-PMC model.

ABSTRAK

Industri pembinaan di Malaysia memainkan peranan yang penting dalam pembangunan ekonomi. Walau bagaimanapun, sektor ini kerap mengalami masalah termasuk masa dan kos berlebihan, berkualiti rendah, dan prestasi dan produktiviti yang lemah. Salah satu faktor penting yang menyebabkan masalah ini berlaku ialah pengurus projek yang memimpin dan melaksanakan projek, tidak cekap. Kajian ini menyelidik peranan pendekatan pengurusan pengetahuan dalam meningkatkan kecekapan pengurus projek dengan menguji hubungan antara pengurusan pengetahuan (KM) dan kecekapan pengurus projek (PMC). Meskipun wujud hubungan langsung antara pengurusan pengetahuan dan kecekapan, kajian jarang menunjukkan model hubungan langsung ini, khususnya dalam industri pembinaan. Kajian ini mengaplikasikan kaedah kuantitatif menggunakan tinjauan dalam talian bagi pengumpulan data. Responden sasaran merupakan pengurus projek di syarikat pembinaan di Malaysia. Soal selidik telah diedarkan kepada sejumlah 480 syarikat pembinaan yang telah dipilih secara rawak dari laman web CIDB. Sebanyak 227 jawapan lengkap dikumpulkan daripada 181 syarikat. Data dianalisis menggunakan analisis deskriptif, ujian kebolehpercayaan, dan analisis faktor penerokaan menggunakan perisian SPSS. Walau bagaimanapun, model dan hipotesis penyelidikan telah diuji melalui pemodelan persamaan struktur (SEM) menggunakan perisian AMOS. Keputusan analisis deskriptif menunjukkan bahawa aplikasi pengurusan pengetahuan dalam syarikat-syarikat pembinaan Malaysia adalah sederhana. Selain itu, hasil kajian menunjukkan bahawa pengurusan pengetahuan mempunyai kesan positif terhadap kecekapan pengurus projek. Sumbangan utama kajian ini merupakan model KM-PMC yang boleh meramal dan memberi petunjuk kepada peningkatan kecekapan pengurus projek dengan menggunakan pendekatan pengurusan pengetahuan. Kajian ini terhad kepada kesan langsung pengurusan pengetahuan terhadap kecekapan pengurus projek. Penyelidikan masa hadapan boleh meneroka faktor pengantara yang memberi kesan kepada perhubungan dalam model KM-PMC.

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LIST OF ABBREVIATIONS

AEC	-	Architecture, Engineering and Construction
AGFI	-	Adjusted Goodness-of-Fit Index
AHP	-	Analytical Hierarchy Process
APM	-	Association for Project Management
CFA	-	Confirmatory Factor Analysis
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
CHAOS	-	Refers to Standish Group Reports
CIDB	-	Construction Industry Development Board
COMs	-	Comfort, Competence, Communication, and Commitment
CSF	-	Critical Success Factors
EFA	-	Exploratory Factor Analysis
EFA	-	Exploratory Factor Analysis
GDP	-	Gross domestic product
GFI	-	Goodness-of-Fit Index
ICB	-	IPMA Competence Baseline
IPMA	-	International Project Management Association
KM	-	Knowledge Management
KMO	-	Kaiser-Meyer-Olkin
KM-PMC	-	Knowledge Management and Project Managers' Competencies
KMS	-	Knowledge Management Systems
NFI	-	Normed Fit Index
NNFI	-	Non-Normed Fit Index
PC	-	Personal Competencies
PCA	-	Principal Components Analysis

PGFI	-	Parsimonious Goodness-of-Fit Index
PM	-	Project Management
PMBOK	-	Project Management Body of Knowledge
PMC	-	Project Management Competencies
PMCD	-	Project Manager Competency Development
PMI	-	Project Management Institute
PMO	-	Project Management Office
PMP	-	Project Management Professional
PNFI	-	Parsimonious Normed Fit Index
RMR	-	Root Mean Square Residual
RMSEA	-	Root Mean Square Effort of Approximation
SEM	-	Structural Equations Modeling
SME	-	Small and Medium Enterprises
SRMR	-	Standardized root mean square residual
SSM	-	Soft System Methodology
STV	-	Subject-to-Variable ratio
TLI	-	Tucker-Lewis Index

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CHAPTER 1

INTRODUCTION

1.1 Background of Research

Nowadays, in highly technological and high level of competitive environment, project managers play a critical role in a project success. Their selection, assignment, and on-going development are the critical key to a project ultimate success. Pinto and Kharbanda (1995) argued that project management is a leader-intensive endeavour, and competent project managers can help a project to be succeeded even in the face of substantial challenges. Additionally, Crawford (2000) pointed out that a competent project manager is a strong factor that affects a project success or failure. Bedingfield and Thal (2008) pointed out that by selecting the most appropriate and competent project manager, project success would be enhanced. Also, Cheng, Dainty, and Moore (2005) indicated that there is a growing awareness of the relationship between construction project managers' competencies and achieving project success. Therefore, a competent project manager can contribute to a project success and prevent project failure.

Despite the promising role of the competent project managers in the project success, construction projects suffer a high ratio of project failure in terms of cost, time, and quality (Rahman *et al*., 2012). Frame (1997) conducted a study on 8,000 construction projects and found that only 16% of them satisfied the three criteria of time, cost, and quality. Flyvbjerg, Holm, and Buhl (2003) conducted a study on 258 construction projects in 20 countries and concluded that 9 out of 10 projects were cost overrun. Omoregie and Radford (2006) and Apolot, Alinaitwe, and Tindiwensi (2011) stated that time and cost overrun are the major problems in the construction project globally. Whereas, Malaysian construction industry is not an exception, Ahmad *et al*. (2009) stated that 87% of Malaysian construction projects encountered time overrun of 10-40%. Memon *et al.* (2011) studied MARA large projects and found that the projects encountered an overrun with the average of 23.74% of contract duration. Rahman *et al*. (2012) found that 92% of Malaysian construction projects were overrun with an amount between 5-10% in terms of time and cost. Endut, Akintoye, and Kelly (2009) stated that only 20.5% of Malaysian public projects and 33.35 % of private projects were completed within the estimated time, and 46.8% of public projects and 37.2% of private projects were completed within the estimated budget. Furthermore, the Malaysian Auditor General Reports illustrated many examples of project failure in Malaysia, for example, the Electrified Double Track Project between Rawang and Ipoh that has been completed with a cost overrun of RM 1.43 billion (National Audit Department Malaysia, 2011). Another example is the Construction and Upgrading of Rural Road Projects in Sarawak with 175 projects, 38 projects (37.6%) out of 101 projects were delayed from 15 to 242 days; and 13 projects (17.4%) out of 74 projects under construction were behind schedule by more than 20% (National Audit Department Malaysia, 2011). The high ratio of project failure attracted the researchers to study the factors that cause project failure in the construction projects.

In order to reduce the high ratio of project failure, project managers must possess the core competencies that make them able to confront project problems (Dainty, Cheng, and Moore, 2004; Crowford, 2000; Stevenson and Starkweather, 2010; Turner and Muller, 2005). However, previous studies indicated that lack of knowledge and skills among the project managers is a critical factor that causes

project failure (Zimmerer and Yasin, 1998; Kivrak *et al*., 2008; Nguyen and Chileshe, 2013; Rahman, Memon, and Abd Karim, 2013; Sambasivan and Soon, 2007; Hamzah *et al*., 2011). Construction companies usually use training to improve their project managers' competencies. However, training is very costly and must be conducted off-site (Wang and Dunston, 2007; Hill, 2010). In addition, despite the high expenditure on the traditional methods such as training, the construction project failure ratio still high. This makes the senior managers feel unsure of what is the best way to develop and provide competent project managers for the future (Pinto and Kharbanda, 1995). Therefore, construction companies need a new strategy that enables their project managers to improve their competencies and lead their projects to success.

1.2 Area of Research

Construction industry is a critical sector that contributes positively to the economics of any country. It plays an important role in establishing the infrastructure required for the socioeconomic development and contributing directly to the country economic growth (Fadhlin *et al*., 2004). The construction products provide the necessary public infrastructure and private physical structures for many productive activities such as services, commerce, utilities and other industries. This industry is not only important for its finished products, but also employs a large number of people (directly and indirectly), e.g. the employment in the Malaysian construction industry represents 8% of the total Malaysian labour (CIDB, 2012). However, any construction project has a high level of risk and is susceptible to loss if its completion is delayed, exceeded its budget, or did not meet the quality expectations (Khamidi, Khan, and Idrus, 2011).

The construction industry in Malaysia can be described as the economic driver due to its role in linking many industries to it such as metal products and

electrical machinery (MGCC, 2010; 2011; 2012). It is separated into two areas. The first area is general construction which includes residential construction, non-residential construction and civil engineering construction. However, the second area is the special trade works which includes metal works, electrical works, refrigeration and air-conditioning works, plumbing, sewerage and sanitary works, painting works, carpentry, tiling and flooring works and glass works (MGCC, 2010). In order to support the need of learning, information, and development for the construction industry, the Malaysian government has established the Construction Industry Development Board (CIDB) that represents a statutory board under the Ministry of Works. This board also aims to make the construction industry more dynamic to enable it to be globally competitive (MGCC, 2010).

Although the Malaysian government's attention is to the construction sector and the efforts of CIDB in developing the sector by providing training and development, Malaysian construction sector suffers high ratio in project failure in terms of cost, time, and quality (Rahman *et al*., 2012; Endut, Akintoye, and Kelly, 2009). Previous studies in the construction project failure in Malaysia found that lack of knowledge and skills of the project managers is a critical factor that causes project failure in Malaysia (Abdullah, Mukmin and Samad, 2011; Tan, 2013; Esa and Samad, 2011; Malaysia Productivity Corporation, 2011; Rahman *et al*., 2012). Therefore, Malaysian construction companies need to focus on and assess the core competencies of their project managers to increase the probability of project success.

Ruuska and Vartiainen (2003) revealed that the project manager's competencies are the key aspect of a project's success. Therefore, researchers emphasized that project managers must possess the core competencies needed to complete their projects on time and cost, and according to estimated specifications (Dainty, Cheng, Moore, 2004; Crowford, 2000; Stevenson and Starkweather, 2010; Turner and Muller, 2005). However, there is a wide range of project managers' competencies in different calcifications, e.g. Omidvar *et al*. (2011b) categorized these competencies into three groups which are Person-related competencies, Job-related competencies, and Contextual competencies. The person-related

competencies include project management competencies, technical competencies, and personal competencies (Omidvar *et al*., 2011b). However, recent research findings in Malaysia stated that the lack of project management and personal competencies significantly affect the project success in Malaysia (Abdullah, Rahman, and Awang, 2011; Tan, 2013; Esa and Samad, 2011; Malaysia Productivity Corporation, 2011; Rahman *et al*., 2012).

The Project Management Institute (PMI) in 2002 identified nine project management competencies in its Project Management Competency Development (PMCD) Framework. These nine competencies are: Project Integration Management competency; Project Scope Management competency; Project Time Management competency; Project Cost Management competency; Project Quality Management competency; Project Human Resource Management competency; Project Communication Management competency; Project Risk Management competency; and Project Procurement Management competency. Brill, Bishop, and Walker (2006) and Crawford (2004) stated that PMCD competencies are very useful for project managers to ensure high performance and project success. Therefore, these nine competencies of PMI (2002) may be appropriate in representing the project management competencies for the project managers.

Personal competencies include the personal characteristics of the project manager such as Leadership, Interpersonal Communication, Problem Solving, Human Skills, and Conceptual Skills. Gido and Clements (2007) described the effective project manager who has strong leadership ability, high interpersonal skills, and problem solving skills. Also, Leadership; Personal Communication, and Problem Solving competencies were identified by many researchers as the most important personal competencies needed for the project managers (Brill, Bishop, and Walker, 2006; Pinto and Kharbanda, 1995; Gushgari, Francis and Saklou, 1997; Brugger, Gerrits and Pruitt, 2000; Hauschildt, Keim and Medeof, 2000; Crawford and Nahmias, 2010).

Despite the high importance of the project managers' competencies such as project management and personal competencies, the development of these competencies is not an easy task. Construction companies often use traditional methods such as training for developing their project managers' competencies, as well as the project managers' competencies standards such as PMCD framework by PMI and IPMA Competence Baseline (ICB) by IPMA. Despite the important role of training and competencies standards, projects still have high ratio of project failure. Therefore, there is a need to find a new strategy and model that able to provide a continuous development for the project managers' competencies. By looking for this new strategy, it is found that knowledge management may help because of the direct linkage with competencies (Prahalad and Hamel, 1990; Owira and Ogollah, 2014).

Landaeta (2008) figured out that projects generate serious challenges for project managers due to the complex and unpredictable nature of them and suggested that knowledge represents one of the key project capabilities that enable project managers and their teams to cope with these challenges. Additionally, Prahalad and Hamel (1990) described knowledge as the only asset that can offer competitive advantage to the organizations due to the strong linkage between knowledge and the core competencies. However, knowledge is not easily transformable; Ismail, Nor and Marjani (2009) pointed out that inability to share new knowledge quickly and effectively amongst project teams is one of the critical limitations of project managers. They emphasized the encouragement of sharing knowledge among project teams to increase the probability of project success. Therefore, knowledge creation and sharing should be a part of the daily practice of a project (Koskinen, 2000; Ruuska, 2005). This was further strengthen when Yu, Liu, and Fu (2009), concluded that it is very important to execute knowledge management systematically to create, accumulate, and refine the experiences of every project manager in order to promote the diffusion and sharing of the tacit knowledge. Therefore, managing the knowledge resources effectively may help an organization to sustain its competitive position in a changing business environment (Hadikusumo and Rowlinson, 2004).

In order to overcome the lack of project managers' competencies, and provide continues improvement, knowledge management (KM) approach can be examined as a solution. Knowledge management (KM) is the process of creating value from the organization's knowledge assets (Davenport and Prusak, 1998) by generating, sharing, adapting, applying, and modifying knowledge (Gupta, 2008). It deals with creating, capturing, securing, combining, coordinating, retrieving, and distributing knowledge (Tserng and Lin 2005; Fong and Chu, 2006). Also, knowledge management can create and establish a knowledge sharing environment to increase the organization's capabilities (Liebowitz and Beckman, 1998). Moreover, knowledge management is directly correlated with competencies, and considered to be the most important source for improving competencies (Grant, 1996; Sanchez, 2001; Lara, 2008; Zollo and Winter, 2002; Liebowitz and Beckam, 1998; Ranft and Lord, 2002). Therefore, knowledge management would be an appropriate strategy that can provide continuous improvement for not only project managers, but also all staff.

The idea of using knowledge management in overcoming the lack of project managers' competencies is that knowledge management can gather existed and new knowledge and experiences from experts and professionals, store them, and make them available for future use. It facilitates knowledge and experience sharing among the organization's staff to acquire new knowledge, skills, attitudes, and experiences while projects are executed. Also, knowledge management prevent the losing of knowledge that inherent in people mind to increase the organizations' intellectual assets and competitive advantage. Another reason is that as construction projects are temporary, project teams also are temporary and consist of multidisciplinary teams. After the completion of a project, parties involved move on to new projects, resign, or retire. However, project managers accumulate new knowledge, skills, and experience from each project (Yu, Liu and Fu, 2009). Generally, much knowledge gained is lost and the lessons learned are dispersed at the end of the projects if not recorded or shared properly (Hills *et al*., 2008; Ismail, Nor and Marjani, 2009). Therefore, knowledge management can be an appropriate method for the construction companies in saving their knowledge asset and reuse it in increasing their project managers' competencies with low cost, effort, and time.

Therefore, knowledge management may provide a new paradigm to increase the project managers' competencies in terms of project management competencies and personal competencies. To achieve this objective, Malaysian construction companies need to well understand how they manage their knowledge and to what level it affects the project managers' competencies. Also, they need to understand what particular competencies can be increased by using the knowledge management approach. Finally, they need a model that combines knowledge management and project managers' competencies to guide them in increasing their project managers' competencies by using knowledge management.

1.3 Problem Statement

Despite the critical role played by construction industry in the Malaysian economic development, it faces problems such as time and cost overrun, low quality, and poor performance and productivity (Abdullah, Rahman and Awang, 2011; Abdullah, Mukmin and Samad, 2011; National Audit Department Malaysia, 2011; Malaysia Productivity Corporation, 2011; Endut, Akintoye, and Kelly, 2009; Flanagan, 2013; Hai *et al*., 2012; Hamid, 2013; Khamidi, Khan and Idrus, 2011; Rahman, *et al*., 2012; Tan, 2013). These problems affect all parties involved in the construction industry such as contractors, government, clients, and users. Time delay and cost overrun resulted huge financial loss and in most cases cause dramatic disputes between parties due to the extra cost (Khamidi, Khan and Idrus, 2011; National Audit Department Malaysia, 2011), and decrease benefits to each party (Flanagan, 2013; Tan, 2013). The low quality and poor performance and productivity make clients dissatisfied and frequently making complaints. Therefore, clients including government and users enforce contractors to fix the defects in the projects that may need extra huge cost (Flanagan, 2013; Tan, 2013). Without an effective solution for these problems, contractors will lose their money or profit, competitive advantage, and reputation; the projects will lose their viability; clients, government, and users will be dissatisfied and not stop complaining.

Researchers and reports addressed these problems as the main indicator of construction project failure in Malaysia. In general, lack of competent project manager is one of the factors that cause project failure (CHAOS, 2003; Zimmerer and Yasin, 1998). It is found that lack of knowledge and skills of the construction workforce in particular project managers is one of the critical factors that cause these problems (Abdullah, Mukmin and Samad, 2011; Tan, 2013; Esa and Samad, 2011; Malaysia Productivity Corporation, 2011; Rahman, *et al*., 2012). A competent project manager is a critical factor that affects project success or failure (Smith, Carson, and Alexander, 1984; Karpin, 1995; Pinto and Kharbanda, 1995; Crawford, 2000; Bedingfield and Thal, 2008). In order to settle this problem, construction companies often use training as a method to improve their project managers' competencies, however, training is very costly and difficult to be conducted on-site while projects are executed (Wang and Dunston, 2007; Hill, 2010). Also, the high cost of training makes companies to be late in the payment of the training fees, or postpone the current training (Hasmori, Ismail, and Said 2012). Despite the high expenditure on training by contractors, new research findings still state that the problem of lack of project managers' competencies is not totally solved and remains as a barrier to project success. Therefore, construction companies need an alternative method to solve this problem besides training.

1.4 Research Questions

The main research questions of this study are:

i. What is the current implementation of Knowledge Management in Malaysian construction companies?

ii. What is the current level of Project Managers' Competencies in Malaysian construction companies?

iii. What is the relationship between Knowledge Management and project managers' project management competencies in Malaysian construction companies?

iv. What is the relationship between Knowledge Management and project managers' personal competencies in Malaysian construction companies?

v. Which competencies are the most affected by the implementation of Knowledge Management in Malaysian construction companies?

vi. What is the model that can help Malaysian construction companies in increasing their project managers' project management and personal competencies by using Knowledge Management approach?

1.5 Aim and Objectives of the Research

The aim of this study is to provide a model of Knowledge Management and Project Managers' Competencies (KM-PMC) that is able to predict the changes of project managers' competencies by the changes of knowledge management. In order to achieve this aim, the main objectives of this study are:

i. To assess the current practice of Knowledge Management in Malaysian construction companies.

ii. To assess the current level of Project Managers' Competencies in Malaysian construction companies.

iii. To identify the causal relationship between Knowledge Management and project managers' Project Management Competencies in Malaysian construction companies.

iv. To identify the causal relationship between Knowledge Management and project managers' Personal Competencies in Malaysian construction companies.

v. To identify the most affected Project Managers' Competencies by the implementation of Knowledge Management.

1.6 Scope of Research Study

Through reviewing the literature, it is found that previous studies on knowledge management in construction industry are very limited, and focused only on the importance of knowledge management, assessment, and barriers and factors identification. Also few studies on knowledge management models in construction context have been found; however, most of them focused on knowledge management systems perspective. This is in line with Kivark *et al*. (2008) who stated that knowledge management is a new topic and still limited in the construction industry. Furthermore, there is lack of previous studies that explains the relationship between knowledge management and project managers' competencies in construction industry context. Also, there is lack of the models that explains this relationship and provides continuous development for construction project managers. This is in line with Hills *et al*. (2008) when they stated that despite the role of knowledge management, its application in improving project management performance and competencies is not widely discussed. This study attempts to fill this gap of knowledge by explaining the causal relationships between knowledge management and project manager's competencies by formulating a model that ensure continuous improvement for project managers in the construction industry.

Because of the wide range of project managers' competencies in construction, this study focused on two groups of competencies. The first group is project management competencies and includes nine competencies as adopted from PMI's PMCD (2002) Framework by Project management institution. PMI's PMCD (2002) framework identified three dimensions of project managers' competencies. These three dimensions are: Project Management Knowledge Competencies; Project Management Performance Competencies; and Personal Competencies. This study focused on Project Management Knowledge Competencies that reflect what the project manager knows about project management. Project Management Knowledge Competencies included nine competencies. These nine competencies are project Integration Management Competency, Project Scope Management Competency, Project Time Management Competency, Project Cost Management Competency, Project Quality Management Competency, Project Human Resource Management Competency, Project Risk Management Competency, Project Communication Management Competency, and Project Procurement Management Competency.

The second group is personal competencies and contains three competencies that collected from the literature and considered as the most important for the project manager. These three competencies are Leadership Competency, Personal Communication Competency, and Problem Solving Competency. The choice of these two groups of competencies is because they complement each other and only one group of competencies will be useless without the other group (Dainty, Cheng, and Moore, 2004). Therefore, the combination of project management competencies and personal competencies will give more strengthen to the research model because of the variety of competencies included. Furthermore, as this study aims to examine knowledge management as a solution in improving project managers' competencies beside or as alternate of training, these groups of competencies may be considered as the mostly frequented training programs that occurred by construction companies (Dainty, Cheng, and Moore, 2004).

In order to assess the practice level of knowledge management, the researcher compared 12 KM models and concluded that Lawson's (2003) KM model covers the most needed processes for knowledge management. Also, Lawson's (2003) KM model is a combination of the processes identified by Wiig (1993); Horwitch and Armacost (2002); and Parikh (2001) who contributed to knowledge management. Lawson's (2003) KM model includes six processes of knowledge management. Therefore, this study focused on these six processes which are: Creating Knowledge; Capturing Knowledge; Organizing Knowledge; Storing Knowledge; Disseminating Knowledge; and Applying Knowledge.

Finally, this study focused on the construction companies located in Malaysia. The focus is on the project managers who are working at companies under Grade 6 (G6) and Grade seven (G7). The focusing on G6 and G7 is because only these two grades are awarded for big contracts, however, companies under G1 to G5 are considered as small and medium enterprise, and their awarded projects are very limited (CIDB, 2012). Also, because of the companies' size under G1 to G5 are very small, they may have no attention to knowledge management.

1.7 Significance of the Study

This study contributes to knowledge theory by developing a new model that integrates knowledge management and project managers' competencies in the field of construction industry. This model aims to explain the causal relationship between knowledge management and project managers' competencies to provide a solution of the problem of lack of project managers' competencies in the way that will ensure continuous improvement for such competencies. Also, it provides a constructive contribution to the knowledge base of the project management discipline and knowledge management as well, not only in the construction industry but also to all project-based industries. By exploring the causal relationship between knowledge

management and project managers' competencies, the expected results of the study may generate a new insight that offers a basis to improve project managers' competencies not only through training but also through a good sharing of knowledge and experiences. The expected results of the study also may help senior leadership with more insight to the project management and personal competencies that can be enhanced by using appropriate knowledge management systems. This study may be useful for creating a new paradigm for:

i. Construction companies to review and encourage knowledge sharing culture and encourage project managers and other project teams to share their knowledge and experience.

ii. Project Management Institute (PMI) and other standard parties to include a new area of the body of knowledge that describes the importance of knowledge sharing and how to share knowledge among project managers in the way that enhance their competencies and experience.

iii. Information system companies that develop project management systems to include an effective and appropriate knowledge management system within their packages.

Finally, this study aims to be as a new strategy to overcome the deficiencies of project managers through enhancing their project management and personal competencies by sharing knowledge and experiences internally and externally.

1.8 Operational Definitions

Competency: Is knowledge, skills, abilities, experience, and behaviour needed to lead and perform the project.

Construction Industry: Is the industry that includes construction projects such as infrastructure projects and residential and non-residential construction projects.

Personal Competencies: Is knowledge, skills, and abilities that formulate the personal characteristics of the project manager such as leadership, interpersonal communication, conceptual thinking, and problem solving.

Project Failure: Is the failure in completing the project within the contract budget, schedule, and quality.

Project Management Competencies: Are knowledge, skills, and abilities of the project manager according to project management approach by Project Management Institute (PMI).

Project Management: Is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder's needs and expectations from a project.

Project Manager: Is a person who is responsible for delivering all the components of the project and works based on the project management approach.

Project Success: Is completing the project scope within the contract budget, schedule, and quality to satisfy all project parties.

Project: Is a complex and temporally endeavor to produce a unique product or service by using the organization's resources in order to achieve its objectives under the constraints of scope, time, cost, and quality.

1.9 Thesis Organization

As shown in the research roadmap in Figure.1.1, the research is driven by the problem statement which generated the research questions and developed the research hypotheses. Following is a synopsis of the subsequent chapters in the study:

i. **Introduction**: Chapter 1 presented a brief background for the research followed by the area of research. The problem statement has been identified and supported by some evidences. Then, research questions were generated. Also, the research objectives were identified to be the endeavour of the study followed by research model and hypotheses, research scope, and significance of the study. Finally, key and operational definitions for the most significant terms were defined.

ii. **Project Managers' Competencies**: Chapter 2 presents the literature and related studies related to project managers, and project managers' competencies.

iii. **Knowledge Management**: Chapter 3 presents the literature and related knowledge management, and knowledge management in construction industry.

iv. **Research Methodology**: Chapter 4 describes the most appropriate research methodology followed to answer the research questions and achieve the objectives followed by a description of the survey instrument design; the sample and population, data collection protocol, and data analysis procedures.

v. **Data Analysis**: Chapter 5 of the research study is completed after the survey data is collected. It contains the descriptive analysis of the demographic information, descriptive analysis of knowledge management and project managers' competencies, and testing the research model and the hypotheses using Structural Equation Modeling (SEM).

vi. **Conclusion**: Chapter 6 of the research study presents the findings of the results in Chapter 5, followed by the conclusion and recommendations for future research.

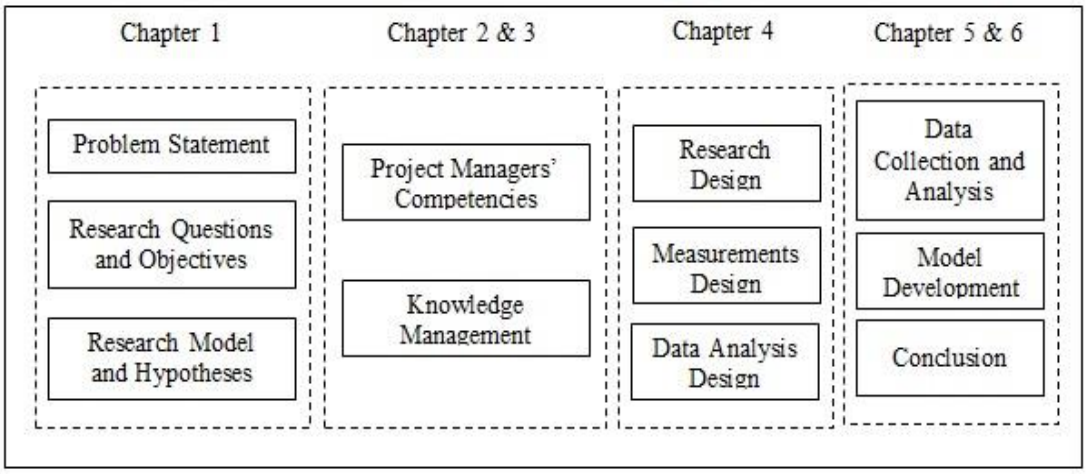

Figure 1.1: Research Roadmap

This limitation is because it is very difficult to validate complex models through SEM unless gathering data from huge sample size (may be at least 1000 feedbacks). However, in the case of this study, the target respondents are the project managers, and it was very hard to collect data from them, and may be impossible to collect huge data.

6.6 Recommendations for Future Research

This study has examined the capability of Knowledge Management in improving 12 competencies of project managers in Malaysian construction context. The findings provide strong evidence about the positive impact of Knowledge Management on the studied competencies. Also, the research model explain the direct causal relationship between Knowledge Management and Project Managers' Competencies, it can serve as a base model for future research. Therefore the recommendations for future research are:

- Further research needed to cover other competencies such as technical competencies.
- Future research may include another factors that affect Knowledge Management practice such as organizational culture and attitude to use Knowledge Management systems, and dependent factors such as project success.
- Further research is needed in other contexts to provide evidence of the generalization of the research model and because of some factors can be varied from country to country such as project complexity, organizational culture, and business environment.

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