INVESTIGATING KNOWLEDGE COMPETENCE OF CIVIL ENGINEERS IN MALAYSIA

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INVESTIGATING KNOWLEDGE COMPETENCE OF CIVIL ENGINEERS IN MALAYSIA

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LIST OF ABBREVIATIONS

EK:	Engineering Knowledge
EMK:	Engineering Management Knowledge
SDK:	Self-Development Knowledge
MOF:	Ministry of Finance
PMI:	Project Management Institute
CIOB:	Construction Industry Organisation Board
CIDB:	Construction Industry Development Board
ASCE:	American Society of Civil Engineer
MIM:	Malaysia Institute of Management
SPSS:	Statistical Process for Social Science
PMBOK:	Project Management Book of Knowledge
NSPE:	National Society for Professional Engineer
ASME:	American Society of Mechanical Engineer
AASTH:	American Association of State Highway and Transportation
TFCE:	The Future Civil Engineer
EE:	Environment Engineering
GTE:	Geotechnical Engineering
WRE:	Water Resources Engineering

MENGKAJI KETERAMPILAN PENGETAHUAN JURUTERA AWAM DI MALAYSIA

ABSTRAK

Pekerja yang berketerampilan adalah merupakan titik tolak kepada kemajuan dan produktiviti yang tinggi dalam sesuatu organisasi sama ada dalam sektor kerajaan mahupun sektor swasta. Secara keseluruhannya pekerja yang berketerampilan merupakan aset yang sangat bernilai kepada sesuatu organisasi tersebut. Di antara elemen utama dalam keterampilan ialah keterampilan pengetahuan. Di dalam bidang kejuruteraan awam terdapat beberapa keterampilan pengetahuan seperti pengetahuan kejuruteraan, pengetahuan pengurusan kejuruteraan, pengetahuan membangunkan diri, pengetahuan perhubungan, pengetahuan IT, pengetahuan kewangan dan pengetahuan perundangan. Tidak dapat dinafikan bahawa jurutera awam mesti memiliki keterampilan pengetahuan sebelum dipertimbangkan sebagai jurutera awam yang berketerampilan. Walau bagaimanapun masih belum terdapat penyelidikan yang dibuat untuk menentukan komponen keterampilan yang sebenar diperlukan oleh seseorang jurutera awam. Untuk merealisasikan impian tersebut di dalam industri pembinaan di Malaysia, suatu rangka kerja keterampilan pengetahuan jurutera awam perlu diwujudkan. Objektif kajian ini ialah untuk mengkaji komponen keterampilan pengetahuan jurutera awam, tahap keterampilan komponen tersebut, perkaitan antara komponen tersebut dengan keterampilan pengetahuan jurutera awam dan membentuk rangka kerja keterampilan pengetahuan jurutera awam di Malaysia. Beberapa hipotesis telah dibangunkan bagi mengenal pasti perkaitan antara komponen keterampilan pengetahuan dengan keterampilan pengetahuan jurutera awam. Kajian

secara pos melalui soal selidik dijalankan di tujuh negeri seluruh Malaysia iaitu Kedah, Pulau Pinang, Kelantan, Melaka, Johor, Sabah and Kuala Lumpur. Responden telah dipilih daripada Lembaga Jurutera Malaysia (BEM). Sebanyak 800 soal selidik telah dihantar dan sebanyak 313 telah dipulangkan iaitu 39%. Data telah dianalisis dengan menggunakan statistik deskriptif, analisis faktor, korelasi dan analisis regresi dan didapati persepsi responden terhadap keterampilan pengetahuan jurutera awam adalah hampir sama. Keputusan menunjukkan terdapat perkaitan yang positif antara komponen keterampilan pengetahuan dengan keterampilan pengetahuan jurutera awam dalam industri pembinaan di Malaysia. Tahap keterampilan pengetahuan yang tinggi adalah berkaitan dengan pengetahuan teknologi terkini dalam industri pembinaan Malaysia. Analisis statistik menunjukkan bahawa komponen keterampilan pengetahuan adalah positif terhadap keterampilan pengetahuan jurutera awam. Dengan ini dicadangkan supaya kajian di masa hadapan sepatutnya melibatkan pemain-pemain lain dalam industri pembinaan seperti kontraktor, konsultan, pelanggan dan pemaju projek. Perbandingan di antara mereka dapat memberikan kefahaman yang lebih tinggi berkenaan dengan keterampilan pengetahuan yang diperlukan dalam industri binaan di Malaysia bagi mengelak daripada berlakunya masalah seperti kelewatan, terlebih perbelanjaan dan kualiti yang tidak memuaskan berlaku di dalam projek pembinaan.

INVESTIGATING THE KNOWLEDGE COMPETENCE OF CIVIL ENGINEERS IN MALAYSIA

ABSTRACT

The competence of workers has always been regarded as the cornerstone of high performance and productivity of organisations, be it in the public or private sectors. It is generally accepted that competent workers significantly add values to their respective organisations. One of the key elements of competence of employees is knowledge competence. In the civil engineering field, knowledge competence is made of by a number of components, namely, engineering knowledge, engineering management knowledge, self-development knowledge, communication knowledge, IT knowledge, finance knowledge and legal knowledge. Without doubt, a civil engineer must possess these subject matters before he can be considered as a competent civil engineer. Nevertheless, no study had previously been conducted to determine such qualities. To fill this research gap, there is a need to develop a model of knowledge competence for civil engineers in the Malaysian context. To drive the research forward, the following objectives are utilise: to identify the knowledge competence components, knowledge competence components level, relationship between the knowledge competence components and the knowledge competence of civil engineers and to develop a framework of knowledge competence for civil engineers. A number of hypotheses have also been used to understand the relationships between knowledge competence requirements and knowledge competency of civil engineers. A survey by means of post questionnaires has been conducted to collect the data. The research sample is constitute of registered civil

engineers in seven states of Malaysia namely, Kedah, Pulau Pinang, Kelantan, Melaka, Johor, Sabah and Kuala Lumpur. The respondents have been selected from a population of civil engineers registered with the Board of Engineering Malaysia (BEM). Out of 800 questionnaires distributed, 313 answered questionnaires have been returned, a response rate of 39 per cent. The data have been analysed with descriptive statistics, factor analysis, correlation, and multiple regression analysis. It is revealed that the perceptions of knowledge competence components towards knowledge competence of civil engineers are almost equal. The result also suggests that there are positive associations between the knowledge competence components and knowledge competence requirements to be a knowledge competence of civil engineers in Malaysia construction industry. Based on the research findings, the results seem to prove that the higher levels of knowledge competence components is referred to the knowledge competence related to the latest technology applied in Malaysia construction industry. The multiple regression analysis shows that all the variables could significantly predict the knowledge competence of civil engineers in Malaysia construction industry. For future studies, it is recommended that more studies involving the other construction industry player such as contractors, consultants, clients and developers should be done. For the conclusion, knowledge competence of civil engineers in construction industry may provide a better understanding of how to improve the development of construction industry to reduce the industry's problem of project delay, cost overrun and sub-specifications.

CHAPTER 1

INTRODUCTION

1.1 Background of Construction Industry

The construction industry is one of the important sectors that contribute to Malaysia's economic growth. This sector accounted for nearly 3.3% of total income in 2009 and employed about 600,000 workers out of which, 109,000 are foreign workers (Zaimi, 1997). The construction sector in Malaysia, as in any other construction industry in many other countries in the world has not managed to break free the problems of delays, cost overruns and substandard quality. In 2009, about 17.3% out of 417 government contract projects in Malaysia were considered below par with more than 3 months of delay or being abandoned (Zaimi, 1997).

This is further complicated by the fact that, in coming years, the construction industry is expected to lose a large portion of its skilled and experienced workforce. At present, there is no single strategy being planned to overcome this potentially serious industry-wide problem (Bahra, 2001). One of the most effective and powerful tools in strengthening the industrial and organizational competition is through systematic identification (Bahra, 2001).

Most of today's construction projects are usually managed by a team of people consisted of construction professional which is inclusive of engineers. These people contribute in many different ways depending on project type, the owner requirements, time and budget involved. These projects involve dozen of firms and workers, who need to be managed and coordinated. They need to know what has to be done, when it should done, who has to do it, how it will be done and what resources need to be

used. So, proper management and planning is the first step to overcome the main problems in the construction industry (Sidney, 2006). The main people involved in construction project management are professional civil engineers, architects and quantity surveyors and contractors as they are the main provider of the service in the construction industry. These professionals come from different training and background (Shenhar and Levy, 1997).

This industry has had a very poor reputation for coping with the adverse effects of changes with many projects failing to meet deadlines, rising cost and quality requirements. This is not surprising due to the fact that there are known perfect engineers, perfect designer or the forces of nature behaving in perfectly predictable ways. Civil engineers are able to improve the problems of management in construction activities by applying the principles of competency requirements for civil engineers (ASCE, 2008).

The academics and industrial people in the construction industry should to establish knowledge competence standards especially for civil engineers. Irrespective of their professional background, competent project engineers should deliver high quality services to the clients in developing the project. Knowledge has been described as information which has been used and integrated with a person's knowledge-based experience and behavioural patterns (Cardoso at el, 2006).

Each individual has different knowledge based capacities and experiences, and these lead to different approaches for problem-solving and decision making. Knowledge and experience are significant when choosing a construction civil engineer. Civil engineers must be capable of knowing how to use, manage and utilize the knowledge in construction industry (Ogunlana et al, 2004).

A previous conducted research attempting to examine the relationships between knowledge factors and the knowledge creation process which made up of socialisation, externalisation, combination and internalisation had cast some interesting findings about knowledge competence (Teerajetgul at el, 2004). A framework was employed to test these relationships, and the empirical evidence supported the relationships. Findings from this study confirmed that three selected factors (IT, finance and individual competency) affected the overall knowledge creation process in South East Asia construction projects. From the research results, it can be assumed that knowledge competence in construction projects is impossible without IT and human interaction (Charoenngam, 2008).

Over the years, despite the acceptance of each other's roles and responsibilities in construction projects, each one of the professionals try to exert their respective influence and authority in projects. Thus, to ensure their main role in the industry, civil engineer must constantly specific and non-construction specific functions demanded of them. Accordingly, the identification of the requisite competence components of civil engineers is of vital importance and should precede a systematic amalgamation of these competence components to fashion a comprehensive knowledge competence (Hsieh at el, 2009).

For the civil engineers, one of the most challenging parts in their existence is to continue being relevant and marketable in the industry. Because of this, they have to go through learning activities in order to support them to fulfil the needs of a project in both construction specific and management specific functions by identifying the routes and mechanisms by which these civil engineers acquire the requisite skills (Russell, 1993).

Indirectly, the construction industry can gain valuable lessons and insights by expanding the scope and coverage of the functions required of civil engineers. This can be done by establishing the additional skills and knowledge that these engineers have to acquire on a continuous basis in order to retain the marketability of their services (Bentil, 1993).

To increase the influence and roles of civil engineers in construction activities, there is no doubt that they have to further improve their knowledge and understanding of their field. Knowledge relates by unlocking and leveraging different types of knowledge so that it becomes available as an organisational asset. Implementing knowledge competence enables an organization to learn from its corporate memory, share knowledge and identify competence in order to become knowledgeable in the organization (Robinson, 2005).

Project information and knowledge competence as well as knowledge acquisition stages are strongly interconnected with all construction project life cycle activities including conceptual planning, design, procurement, construction, operations and maintenance (Faniran et al, 2001). It should be noticed that information and knowledge must be gathered from all different bodies and organizations that participate in the project because the multi discipline communications between these distinct professionals are often problematic. The lack of integration and co-ordination between the industry's distinct professions can be perceived as a major contributory factor to poor project performance (Faniran et al, 2001).

The significance of knowledge competence in the construction industry need to improve, indeed different engineers present diverse approaches to knowledge competence, knowledge competence models, theories as well as strategies. The

adjustment for the construction industry sometimes lacks an integrated approach (Kurul, 2007).

Knowledge is viewed as symbolic and mental constructions in the mind of individuals and also as the outcome of learning. Learning is a process of recognition which occurs with associations through contiguity and repetition (Kurul, 2006). Thus, learners perceive new relations among parts of a problem. They acquired and reorganized the information into understandable cognitive structures (Piaget, 2007). The knowledge is not passively received but actively constructed by the learner, and that the function of cognition is adaptive, serving to organise experience, rather than to discover reality (Wilkinson, 2001). Constructivism is a philosophy of learning used by the leading construction organisations to master the best construction practice (Glosary, 2009).

The organisational form of community of practice, known as "champions of practice" is propagated for use in the construction industry (Toor, 2007). The "champions of practice" is developed as an active know-how platform to provide advice pertaining to the issues of the "best practice" that have been accumulated from various projects. The creation of such a form of community of practice can provide invaluable insights about the best practice, which can be formalised and shared in a meaningful and reflective way (Kurul et al, 2004).

The main problem in construction phases can be reduced by using the competence knowledge (Wen and Hsieh, 2009). The problems regarding the competence knowledge involve in experiences, knowhow, problem solving and innovation. Problems connected with explicit information are mainly connected with construction information issues; information that can be recorded only in part (Tserng, 2004).

1.2 Problem Statement

The right level areas of knowledge and management skills are needed to ensure a greater chance for projects to meet the project objectives. Civil engineers in today's construction industry are facing with situation whereby the fundamental roles and knowledge they perform are the main focus. To maintain their professional competence, practicing project engineers have to adapt to this changing industry environment by relying on knowledge acquired through training and experience. Overall the delay of the project, cost overrun and out of quality are due to poor planning and scheduling problems, site management, slow decision making, inadequate site inspection, poor contractor management, time, cost overrun and lack of communication and management knowledge between all parties (Edum at el, 2000).

Set against the aforementioned problems, civil engineers have to equip themselves so that they can better deal with these issues on construction sites. The problems had been exarcabated by the fact that they are constantly required to speed up reflective decision makings during design and construction stage. It had been noted by (Carrillo, 2000) that knowledge is one of the most important resources contributing to reflective decision making and enhancing the competitive advantage of organizations carrying out construction projects. It is clear that knowledgeable competent civil engineers can positively influence the outcomes of successful projects.

1.3 Research Aim

The aim of this study is to investigate the knowledge competence of civil engineers in Malaysian construction industry.

1.4 Research Objectives

The research aim is to achieve the following objectives:

i) To identify the knowledge competence components of civil engineers.

ii) To identify the knowledge competence components level of civil engineers.

iii) To identify the relationship between the knowledge competence components and the knowledge competence of civil engineers.

iv) To develop a framework of knowledge competence of civil engineers.

1.5 Significance of Research

A review of the published literatures (Appendix B), revealed that not much research has been done in the development of a knowledge competence model. This means that in addition to developing knowledge and competence of civil engineers, this research would also assist the relevant knowledge and competence required to facilitate effective job performance in the construction industry.

In terms of knowledge competence contribution to civil engineers, this research serves to improve the existing knowledge of civil engineers in seven dimensions, namely: engineering knowledge, engineering management knowledge, self-development knowledge, communication knowledge, IT knowledge, finance knowledge and legal knowledge. The understanding of knowledge competence for civil engineers is essential in establishing a better means for continuing development of training programs as well as the designing and delivery of particular knowledge competence MIM (2006) and TCAP (2003).

This research will sugguest to the existing body of knowledge on knowledge competence in relation to the construction industry. In fact, knowledge competence in the Malaysian construction industry is still a lot to improve. As such, this is an exploratory research proposing a knowledge competence model for civil engineers in Malaysia. The knowledge competence models are not adequate and most of the information are obtained from a number of project management institutes references in addition to the articles in journals. The information collected will be in terms of knowledge competencies and strategic management which will then involve the application of the relevant aspects in the construction industry. This is due to the fact that this knowledge competence model for civil engineers is being proposed as a new developed knowledge for application in the construction industry.

The evidence obtained from this study will highlight the requirements and needs of civil engineers competencies. The identification of these competencies and their subsequent formulation into a comprehensive knowledge competence is important as the knowledge gained from the knowledge competence will help to shape and determine their future as knowledge competence civil engineers. These requirements and needs must, therefore be taken into consideration, particularly, in

relation to the development of training programs. The way forward is to identify, within a certain target market, what the specific requirements are, and then plan the education and training programs accordingly. This research is expected to be a major communication link between academic research and industrial application regarding to knowledge competence of civil engineers. It is hoped that this newly developed model of knowledge competence for civil engineers will offer a viable contribution to the construction industry in Malaysia.

1.6 Scope of the Research

This research is to determine how to generalize data and come out with the effective conclusions. This research focuses on investigating the knowledge competence of civil engineers in the Malaysian construction industry. The scopes of the research are as follows:

a. The area of this research is confined to West Malaysia and Sabah in East Malaysia.

b. The sample consisted a specific number of registered civil engineers, who work with construction industry. These firms are registered with the Ministry of Finance (MOF), Malaysia. The experience of these registered civil engineers will be one of the most important points in this research because professional civil engineers opinions are the best feedback with accurate comment on the current situation in the construction industry.

c. The primary data collection would be conducted over 15 weeks with the dispatch of postal questionnaires. The returned and completed questionnaires received within these 15 weeks would be analysed. Responses beyond this time frame would be neglected.

d. The subject is limited to only knowledge competence of civil engineers in the Malaysian construction industry.

e. Any additional contemporary information relevant to the research problems obtained after the duration of survey would be enclosed as recommendations for further research.

1.7 Research Methodology

This research concerns about investigating the knowledge competence of civil engineers in Malaysian construction industry. Subsequently, opinions for the newly developed would be sought from civil engineers practitioners in the construction industry. The choice and strategy for the collection of data has also been outlined using the postal questionnaire technique. Analysis of data was performed using the quantitative statistics for social sciences (SPSS) software package; descriptive statistics, factor analysis, Pearson correlations and multiple regressions.

The below figure shows the general overview of the research methodology process flow: Problem statement, determine objective and purpose of the research, literature review and gathering information, questionnaire surveys, results and data analysis, then conclusion and discussion of finding.

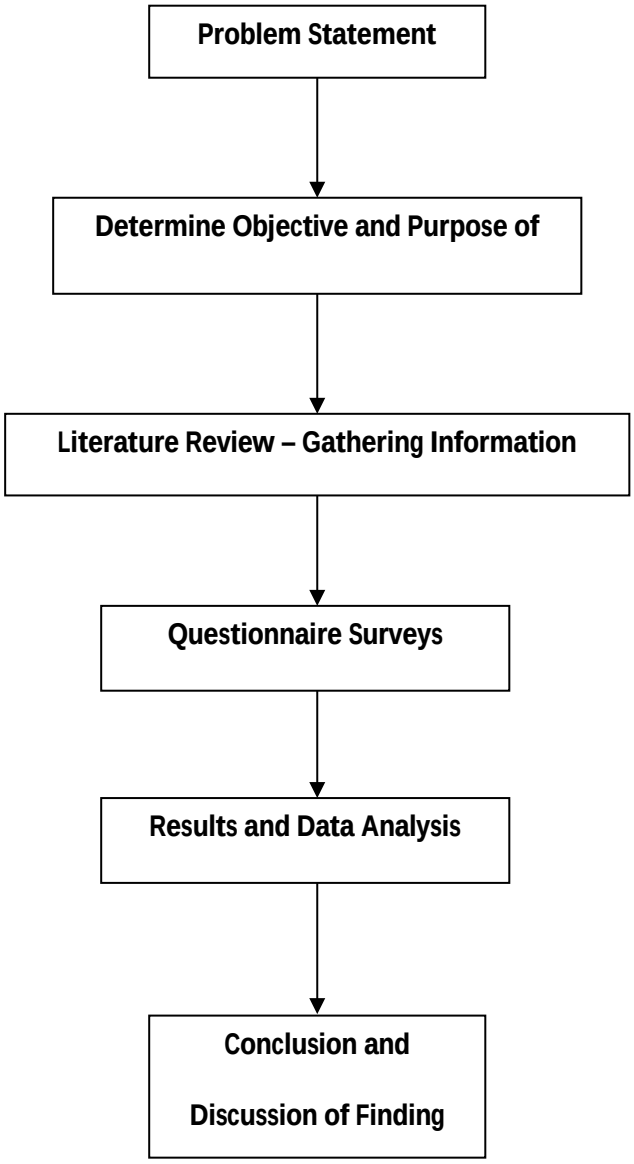

Figure 1.1 Research Methodology Process

1.8 Organization of the Research

Chapter 1: Serves as an introduction to the research. This chapter comprises of the problem statement, research aim, research objectives, significance of the research, scope of the research, and research methodology.

Chapter 2: Sets the context of the research and highlights the theoretical background of the competence of employees in organisations and the definition of competence.

Present the main competence components such as knowledge competence, functional competence, behavioural competence and ethical competence (Cheetham, 2006) with the literature review about the above main competence components.

Chapter 3: Presents a discussion of knowledge competence for civil engineers in Malaysia construction industry and the history of construction industry. Definition of knowledge competence and the literature review of previous knowledge competence of civil engineers. Then, it will identify requirements for knowledge competence of civil engineers. Develop the knowledge competence of civil engineer conception framework. Finally, develop the hypothesis of the relationship between the knowledge competence components and the knowledge competence of civil engineers.

Chapter 4: Introduces the research methodology, a brief on organisation of the research from the development of the questionnaire, data collection, data analysis using SPSS and the method of data analysis. Then, follow by the reliability and validity of instruments tests. This is to ensure that the research process using the right method and procedure to achieve the research objectives.

Chapter 5: Presents the analysis and statistical results of the research. The discussion of the results after analysis the data using descriptive analysis, correlation analysis, factor analysis and regression analysis to answer the research objectives.

Chapter 6: Presents the conclusions of this research and the findings of this research will be discuss and conclude. Lastly, this chapter will propose the new knowledge competence of civil engineers in addition to improve several areas which will benefit the Malaysian construction industry in future.

CHAPTER 2

THE COMPETENCE OF EMPLOYEES IN ORGANIZATIONS

2.1 Introduction

The success of construction project partly depends on the competence possessed by the engineers and their ability to apply the knowledge. In this globally competitive world, it is becoming increasingly important to gain knowledge, establish lifelong learning and continue to compete at the leading edge of business. By definition, competence is about exploiting and realizing knowledge in the workforce, fostering a culture where knowledge sharing can thrive and how an organization develops its people and their knowledge as an individual, as a teams and at an organizational level (Dalkir, 2005).

Competence relies not on technology but on people, who have knowledge, develop it and act on the basis of it. Knowledge is likely to play a big part in corporate culture in the new millennium. The real challenge in competence management is to create a business environment in which knowledge can be aggregated and applied on a continuous basis (Dalkir, 2005).

It is a critical factor affecting an organization's ability to remain competitive in the new global marketplace. Organizations therefore need to recognize it as a valuable resource and develop a mechanism for tapping into the collective intelligence and skills of employees in order to create a greater organizational competence base. Competence management accomplishes this goal (Bollinger, 2001).

"Competencies" are increasingly becoming important in the lives of individuals, employees, career practitioners, and also organization supervisors, team leaders,

managers, executives, and other leaders. Due to their growing importance, it is important to understand what competencies are and are not, and to have a vocabulary and framework for conceptualizing and discussing this important human resource concept and the technology surrounding its application (Dainty, 2005).

2.2 Definition of Competence

Competence is knowledge, skills, attitudes, or behaviours that enable one to perform the activities of a given task or function to the standards expected in employment (Stoner and freeman, 1992). This knowledge or skills, attitudes, or behaviours should be observable and measurable (Gupta et al, 2006). Competence is accepted as encompassing knowledge, skills, attitudes and behaviours that contribute to effective performance of task or job role (Turner, 2007). Competence representation requires the legal knowledge, skill, thoroughness and preparation reasonably necessary for the representation (Robert and Joseph, 1999).

The simple meaning of the word “competence” is the ability to do something well or successfully (Morris and Pinto, 2007). However, the concept of competencies, as known and understood today, developed because of dissatisfaction with the so-called intelligence tests used during the 1970s (Pinto and Slevin, 1988).

2.3 Knowledge Competence

Knowledge competence possessed by individual workers would only be meaningful if it can be harnessed into project team contact (Sabaa, 2001). The team members must bring to the team task, and also the knowledge that is constructed dynamically during the team performance. It has been suggested that when team members have a rich understanding of the task and its demands, and of the strength, weaknesses, preferences, knowledge requirements and tendency of team mates, they are better

able to coordinate their actions. This is particularly important in high workload situations where team members may not have much time to communicate or discuss potential task strategies (Gupta et al, 2006).

To share the existing knowledge, project team members must also be able to build dynamically a compatible situation to coordinate implicitly. These mean that they must understand well how certain particular task cues are related to specific team strategies. This kind of knowledge in project teams has been referred to the situation awareness (Karwowski, 2006a).

The bodies of knowledge for civil engineers are used for certification of individuals as to their qualification in the construction management field. Two types of certifications have emerged over the past decades, each certification has its merits and challenges certification based on a person's knowledge of the profession and certification based on a person's competency in the profession (ASCE, 2006). Two criteria sample areas of knowledge for project engineer are described in Table 2.1. These criteria shown is not representative of any particular society, but given to promote thought on the full range of knowledge that a project engineer practitioner might need in order to be successful.

Table 2.1 Project Engineer Knowledge and Supporting Knowledge Areas

Primary Knowledge Areas:	Supporting Knowledge Areas:
Scope management, Technical management, Schedule management, Cost management, Configuration management, Resources management and Planning.	Risk management, Communication management, Contract administration, Negotiable, Leadership, Decision making, Marketing, Customer relation and Personnel conflict.

· (Sisk, 2008).

The scope of the body of knowledge defines any certification program whether it can be a “knowledge based” or a “competence based certification”. The number of areas included in the body of knowledge will show the range of knowledge needed to master the profession as a competence engineer (Cleland and Ireland, 2007).

There were reports and empirical exploration of Chinese construction project engineers’ ways of conceiving and accomplishing their work (Chen et al, 2008). The results of this China based study confirm the conceptual determinants of construction project management competence first revealed in UK, and provide practical implications for effective training and professional certification of project management competence in China. The sample of this study consisted of 30 project engineers selected from 10 construction firms in Beijing. In order to provide a matched stable context for capturing project engineers conceptions of their work, the sample selection criteria set out in previous study in the UK were closely followed (Chen et al, 2009).

The engineers should have two type of knowledge in order to be competence that is knowledge of construction work and knowledge of commercial management. In knowledge of construction work, engineers should understand the construction processes and technical requirement for the work task, understand the work interfaces and know the construction industry. In knowledge of commercial management, engineers should understand fundamentals rules and practice in business negotiation and administration (Cheng et al, 2008).

The American Society of Civil Engineer (ASCE) list three major knowledge areas for civil engineers that the major knowledge that are needed in order to be a competence

engineer stated are foundational knowledge, technical knowledge and professional knowledge as shows in Table 2.2.

Table 2.2 Item of Knowledge Areas for Civil Engineer (ASCE, 2008).

Foundational Knowledge	Technical Knowledge	Professional Knowledge
Mathematics Natural sciences Humanities Social sciences Safety	Environmental Geotechnical Water resources Highway and traffic Structural Geomatic Site management Project management Contract administration Construction and Computer applications	Communication Organization Financial Legal law Leadership Teamwork Planning Professional and Ethical responsibility IT

The PMBOK is an internationally recognized that provides the fundamentals of project management (PMBOK, 2007). They can be applied to a wide range of projects, including construction project. The guide recognizes nine knowledge areas that are typical useful for almost all projects. From this book, the nine knowledge areas guide to develop competence project engineer are: a) Knowledge of Project Integration Management, b) Knowledge of Project Scope Management, c) Knowledge of Project Time Management, d) Knowledge of Project Cost Management, e) Knowledge of Project Quality Management, f) Knowledge of Project Human Resource Management, g) Knowledge of Project Communications Management, h) Knowledge of Project Risk Management, i) Knowledge of Project Procurement Management. Each of the nine knowledge areas contains the processes that need to be accomplished within its discipline in order to achieve an effective project management programs (PMBOK, 2007).

The knowledge competence for construction project engineer is divided into three major criteria . Firstly, a project engineer must have knowledge in technical aspect so that construction in site will be completed on time. Second, project engineer must have good communication knowledge in order to make sure that the project will be able to complete without any problem. Lastly, project engineer also should has leadership knowledge in himself and to make sure their workers respect him as a leader. Three of those criteria will make sure construction at real site can go on smoothly without any technical problems (Serpell and Ferrada, 2007).

There are three projects knowledge related with project engineer at construction in site: a) Technical knowledge concerning the product, its parts and technologies, b) Procedural knowledge concerning in producing and using the product, c) Organizational knowledge concerning communication and collaboration. The knowledge management in a project is considered to consist four groups of activities: a) Knowledge creation, for example collection, combination and refinement, b) Knowledge administration, for example storage, organization and retrieval, c) Knowledge dissemination within and outside the project, d) Knowledge utilization, for example integration into products and decisions, and application in other projects. One of the main challenges of project management is the minor and tangled accumulation of knowledge. The content and quality of the knowledge created the ability of organizations to utilize it (Jyrki et al., 2008). Identification of critical knowledge and the ability to utilize it is a challenge for any project organization. Successful project management is based, on accumulated knowledge, and, on the other hand, on individual and collective competences (Jyrki et al., 2008).

Project engineer are generalists with many knowledge in their repertoires (Heldman et al, 2008). They are also problem solvers who wear many hats. Below are five knowledge areas that project engineer should have to be a competence project engineer: 1) Communication knowledge; one of the single most important characteristics of a first rate project engineer is excellent communication knowledge. Written and oral communications are the backbone of all successful projects. 2) Organizational; planning knowledge organizational and planning knowledge are closely related to each other probably the most important, after communication knowledge, a project engineer should possess. 3) Budgeting knowledge; project engineer establish and manage budgets and therefore need some knowledge of finance and accounting principles. Especially important in this knowledge area is the ability to perform cost estimates for project budgeting. 4) Conflict management knowledge; conflict management involves solving problems. Problem solving is really a twofold process. 5) Negotiation and influencing knowledge; effective problem solving requires negotiation and influencing skills. Negotiation on projects is necessary in almost every area of the project, from scope definition to budgets, contracts, resource assignments and more (Heldman, 2007).

A project engineer must also be technically knowledge competent and possess the management skill necessary to effectively control the teams of sub-contractors, vendors, and field personnel required (Sinha, 2007). This is to provide the smooth flow of workers and materials needed to get the job done. A little knowledge of accounting procedures, legal matters and state and federal regulations is also best in order to effectively deal with the many forces that bear on the construction process (Sidney, 2006).

These are four areas of knowledge competencies for a project engineer (Walter, 2002): a) Communication knowledge, b) Organization knowledge, c) Technical knowledge, d) Economical knowledge. Project engineers must have good decision making skill knowledge to get a good feedback of the project development (Abbas et al, 2008). When the project engineer makes a wrong decision, probability the project over cost is high. Project engineer also must know about the project information such as understanding and interpreting project data. As a professional, leadership is very important characteristic to make sure the project will be done (Chou and Hsieh, 2009). There are five leadership areas for project engineer such as coaching, conflict resolution, facilitation, motivation and negotiation. Project engineer should know about the organizational management. That will be easy to manage their program or carry out work schedule (Lewis, 2004).

The engineers will have to identify, develop, monitor both human and automatic channels for knowledge sharing in project development (Ahadzie et al, 2007). The knowledge engineers need to be on top of both the hard and soft aspect of knowledge management. Project engineers must be willing and able to discuss the finer points of organizational learning, while at the same time ensuring that knowledge-oriented systems go forward (Boyatzis, 1892). Project engineers must also complete knowledge oriented project activities on time and under budget and engineer also must have good management knowledge such as negotiation (Davenport and Prusak, 2000).

The four major knowledge requirements for the project engineers (Helman, 2007) : 1) Project management process knowledge, engineers should be extremely knowledgeable about project management tools, techniques, and process technology and be able to apply them. Without this knowledge, project engineers will find it very

difficult to coordinate and manage a high quality project plan and to maintain the control of the project. 2) Interpersonal knowledge, from this part the author said soft skills knowledge is important in order to be a good engineer. For engineers coming from a highly technical background, soft skill development can be particularly challenging (Helman, 2007). Some of soft skills knowledge are: a) Team and individual leadership, b) Oral and written communication, c) Conflict resolution, d) Negotiation, e) Influencing, f) Delegating, g) Coaching and mentoring. 3) Technology management knowledge, among these technology management knowledge are the following: a) Process knowledge, b) Product knowledge, c) Desired personal traits. 4) Possessing these traits will stand project engineers in good stead in role as project engineer: a) Honesty and integrity, b) High tolerance for ambiguity, c) High tolerance for uncertainty, d) Persuasive (Jyrki, 2008).

There are 10 knowledge areas are considered very important knowledge ares to be a good project engineer and will be knowledgeable (Iffland, 1994): a) Cost/budget control/resource management, b) Mastery of project management software, c) Communication skills, d) Planning and scheduling, e) Time management, f) Quality assurance, g) Meeting management, h) Legal knowledge, i) Documentation skills, j) Presentation skills. Also identifies an additional 10 knowledge areas which consider the “Art” of project management: a) Team management, b) Business savvy, c) Problem solving, d) Strategic thinking, e) Marketing and spin control, f) Leadership skills, g) Negotiating skills, h) Mediation skills, i) Cultural awareness and sensitivity, j) Training. To improve civil engineers knowledge and mastery of knowledge project they need to combine the art and science knowledge. Most good civil engineers are quite familiar with the elements of science in project management and most would pride themselves on these skills (Xalles, 2005).

The knowledge competence component is seen as consisted of four constituents: a) Tacit/ practical knowledge, b) Technical and theoretical knowledge but also includes their application, transfer, synthesis, extrapolation), c) Procedural knowledge (this consists of the how, what, when, etc. of the more routine tasks within professional activity), d) Contextual knowledge (Cheetham and Chivers, 1996).

There are nine knowledge areas of civil engineers in project management body of knowledge requirements. The project management knowledge areas describes, project management knowledge and practice in terms of the various component processes (PMI, 2000): a) Project integration management, describes the process required to ensure that the various elements of the project are properly coordinated. It consists of project plan development and execution, and integrated change control, b) Project scope management describes, the process required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. It consists of initiation, scope planning, scope definition, scope verification, and scope change control, c) Project time management, describes the processes required to ensure timely completion of the project. It consists of activity definition, activity sequencing, activity duration estimating, schedule development, and schedule control, d) Project Cost Management, describes the processes required to ensure that the project is completed within the approved budget. It consists of resource planning, cost estimating, cost budgeting and cost control, e) Project quality management, describes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It consists of quality planning, quality assurance, and quality control, f) Project human resource management, describes the processes required to make the most effective use of the people involved with the project (Choudhuri, 2008).

It consists of organizational planning, staff acquisition, and team development, i) Project communications management describes the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. It consists of communications planning, information distribution, performance reporting, and administrative closure, ii) Project risk management, describes the processes concerned with identifying, analysing, and responding to project risk. It consists of risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, and risk monitoring and control, iii) Project procurement management, describes the processes required to acquire goods and services from outside the performing organization. It consists of procurement planning, solicitation planning, solicitation, source selection, contract administration, and contract close out (Choudhuri, 2008).

The results of an effective and competence civil engineers in knowledge areas in Australia that the interviewees were asked to specify the personal qualities or knowledge characteristics expected of the most competence civil engineers (Glossary, 2001). Their responses produced an initial list of over 200 qualities and questionnaire technique was distributed. Below are the result of research: 1) Factual knowledge: a) Business knowledge, b) Environmental issues, c) Political issues, d) Community issues; 2) Experiential knowledge: a) Practical experience, b) Technical experience, c) Procedural experience, d) Contextual experience; 3) Information knowledge: a) Inquisitive, b) Perceptive, c) Resourceful; 4) Analytical skills: a) Easily able to separate feelings from ideas, b) Recognition of wider issues, c) Application of lateral thought critiquing skills; 5) Action skills: a) Initiative, b) Decisiveness, c) Good

judgment; 6) Social knowledge: a) Leadership, b) Interpersonal, c) Negotiation, d) Respect for others' opinions, e) Teamwork (Newport, 1997).

Knowledge on construction project management is a key issue in today's construction industry across Europe (Sahin and Kurul, 2005). This applies to the whole range of project participants from inception to conclusion of construction undertakings thereby involving professionals focusing in distinct perspectives yet working for a common goal (Cardoso et al, 2006).

Several countries in Europe, with special relevance to the UK, have developed substantial knowledge in this topic through academic courses, professional training and experience of the practitioners. The survey was carried through a questionnaire administered to a set of organizations of the construction cluster of the four countries involved, these are Poland, Portugal, Spain and Lithuania (Cardoso et al, 2006). The analysis is based on the questionnaire circulated by the Construction Management knowledge areas section of the Civil Engineering. According to the results of this research, the most relevant knowledge management areas selected were: a) Project conception development/feasibility, b) Planning and scheduling, c) Project cost estimation and cost management, d) Quality management, e) Procurement and tendering procedures, f) Health and safety management (Cardoso et al, 2006).

The project managers or project engineers differ with respect to the attributes, knowledge, skills and experiences (Sabaa, 2001). They were associated with successful management performance and careers. The parts discussed in this paper are: 1) Human skill knowledge, this knowledge is used to connate the ability of a project engineer to work effectively as a group member and to build a cooperative effort within the team he leads. This knowledge is demonstrated in the way the