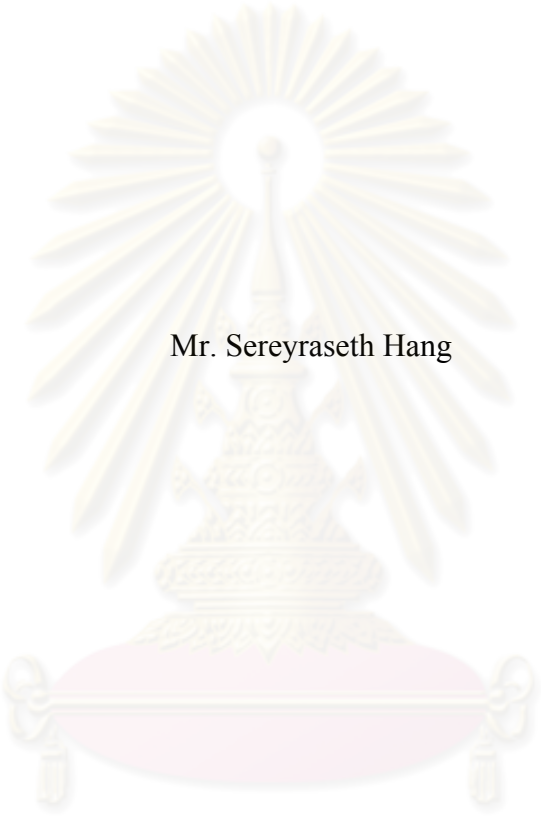
การศึกษาระดับความรู้และความสามารถของผู้จัดการโครงการก่อสร้าง: กรณีศึกษาในประเทศกัมพูชา สาธารณรัฐประชาธิปไตยประชาชนลาว และประเทศไทย

นาย แซเรย์ราเซท ฮอง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
สาขาวิชาวิศวกรรมโยธา ภาควิชาวิศวกรรมโยธา
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2553

A STUDY OF KNOWLEDGE AND COMPETENCY LEVELS OF CONSTRUCTION PROJECT MANAGERS: CASE STUDIES IN CAMBODIA, LAO PDR, AND THAILAND

Mr. Sereyraseth Hang



A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Engineering Program in Civil Engineering

Department of Civil Engineering

Faculty of Engineering

Chulalongkorn University

Academic Year 2010

Thesis Title	A STUDY OF KNOWLEDGE AND COMPETENCY LEVELS OF CONSTRUCTION PROJECT MANAGERS: CASE STUDIES IN CAMBODIA, LAO PDR, AND THAILAND
By	Mr. Sereyraseth Hang
Field of Study	Infrastructure in Civil Engineering
Thesis Advisor	Assistant Professor Noppadon Jokkaw, Ph.D.
Thesis Co-Advisor	Associate Professor Tanit Tongthong, Ph.D.

Accepted by the Faculty of Engineering, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

..... Dean of the Faculty of Engineering
(Associate Professor Boonsom Lerdhirunwong, Dr.Ing.)

THESIS COMMITTEE

..... Chairman
(Assistant Professor Vachara Peansupap, Ph.D.)

..... Thesis Advisor
(Assistant Professor Noppadon Jokkaw, Ph.D.)

..... Thesis Co-Advisor
(Associate Professor Tanit Tongthong, Ph.D.)

..... External Examiner
(Kongkoon Tochaiwat, Ph.D.)

แซเรย์ราเซท ฮอง: การศึกษาระดับความรู้และความสามารถของผู้จัดการโครงการก่อสร้าง: กรณีศึกษาในประเทศกัมพูชา สาธารณรัฐประชาธิปไตยประชาชนลาว และประเทศไทย (A STUDY OF KNOWLEDGE AND COMPETENCY LEVELS OF CONSTRUCTION PROJECT MANAGERS: CASE STUDIES IN CAMBODIA, LAO PDR, AND THAILAND), อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ.ดร.นพดล จอกแก้ว, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ.ดร.ธนิต ธงทอง, 170 หน้า.

ผู้จัดการโครงการก่อสร้างถือเป็นผู้ที่ต้องรับผิดชอบต่อการบริหารจัดการโครงการก่อสร้างในทุกด้าน ดังนั้นการบริหารโครงการก่อสร้างให้มีประสิทธิภาพจึงต้องการผู้จัดการโครงการที่มีความสามารถสูง วัตถุประสงค์ของงานวิจัยนี้คือ 1) เพื่อจัดลำดับความสำคัญขององค์ความรู้ที่จำเป็นสำหรับผู้จัดการโครงการของบริษัทก่อสร้างในประเทศกัมพูชา สาธารณรัฐประชาธิปไตยประชาชนลาว และประเทศไทย 2) เพื่อศึกษาระดับความสามารถในการประยุกต์ใช้องค์ความรู้ของผู้จัดการโครงการก่อสร้างในแต่ละประเทศ และ 3) เพื่อเสนอแนะการปรับปรุงระดับความสามารถของผู้จัดการโครงการก่อสร้างในแต่ละประเทศ ในงานวิจัยนี้ได้ประยุกต์ใช้ วิธีกระบวนการลำดับขั้นเชิงวิเคราะห์ (Analytic Hierarchy Process : AHP) และวิธี Relative Level Index ในการวิเคราะห์ลำดับความสำคัญขององค์ความรู้ และวิเคราะห์ระดับความสามารถของผู้จัดการโครงการในแต่ละประเทศ ตามลำดับ และสามารถตรวจสอบความถูกต้องโดยใช้หลักฐานที่ได้จากการบันทึกในแบบสอบถาม จากผลการวิจัยพบว่า ระดับความสำคัญขององค์ความรู้ในการจัดการด้านเวลา ด้านคุณภาพงาน ด้านต้นทุน และด้านความปลอดภัย เป็น 4 องค์ความรู้ที่มีความสำคัญมากจากองค์ความรู้ทั้งหมด 13 ด้าน ซึ่งผลการศึกษาคล้ายคลึงกันทุกประเทศ สำหรับระดับความสามารถของผู้จัดการโครงการก่อสร้างในประเทศกัมพูชา และสาธารณรัฐประชาธิปไตยประชาชนลาว อยู่ในระดับต่ำถึงปานกลาง ส่วนในประเทศไทยอยู่ในระดับปานกลางถึงสูง และจากช่องว่างระหว่างระดับความสำคัญขององค์ความรู้ และระดับความสามารถของผู้จัดการโครงการ สามารถเสนอแนะการปรับปรุงความสามารถของผู้จัดการโครงการของแต่ละประเทศได้ ตัวอย่างเช่น ควรปรับปรุงความสามารถด้านการจัดการความปลอดภัยของผู้จัดการโครงการก่อสร้างในประเทศกัมพูชา ควรปรับปรุงความสามารถด้านการจัดการเวลาของผู้จัดการโครงการก่อสร้างในสาธารณรัฐประชาธิปไตยประชาชนลาว และควรปรับปรุงความสามารถด้านการจัดการคุณภาพงานของผู้จัดการโครงการในประเทศไทย

ภาควิชา วิศวกรรมโยธา ลายมือชื่อนิสิต.....
สาขาวิชา โครงสร้างพื้นฐานทางวิศวกรรมโยธา ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.....
ปีการศึกษา 2553 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม.....

##5171632821: MAJOR CIVIL ENGINEERING
KEYWORDS : KNOWLEDGE / COMPETENCIES / CONSTRUCTION PROJECT MANAGERS

SEREYRASETH HANG: A STUDY OF KNOWLEDGE AND COMPETENCY LEVELS OF CONSTRUCTION PROJECT MANAGERS: CASE STUDIES IN CAMBODIA, LAO PDR, AND THAILAND.
ADVISOR: ASSIST. PROF. NOPPADON JOKKAW, Ph.D., CO-ADVISOR: ASSOC. PROF. TANIT TONGTHONG, Ph.D., 170 pp.

The construction project manager clearly possesses responsibility for the overall construction project in all dimensions. For a construction project to be effective, it must be managed by a project manager who exhibits high competencies.

The aims of this research are 1) to rank the important knowledge areas of project managers working in construction companies in Cambodia, Lao PDR, and Thailand, 2) to study their competency levels to apply the important knowledge areas in each country and 3) to propose the recommendations to improve their competency levels in each country. Analytic Hierarchy Process (AHP) and Relative Level Index were used for ranking the important knowledge areas and analyzing the levels of competency. The results were validated by the evidences obtained from the questionnaires. The results of this research indicated that time, quality, cost, and safety management, are the top four ranks among 13 important knowledge areas in each country. Their competency levels to apply these important knowledge areas are from low to medium level in Cambodia and Lao PDR, and from medium to high level in Thailand. From the gaps between important knowledge areas and competency levels, there are some weak competencies of local project managers. Therefore, the recommendations for their competency improvements were proposed such as improving competency of safety management for project managers in Cambodia, competency of time management for project managers in Lao PDR, and competency of quality management for project managers in Thailand.

Department: .....Civil Engineering..... Student's Signature .....
Field of Study:...Infrastructure in Civil Engineering.. Advisor's Signature .....
Academic Year:..2010..... Co-Advisor's Signature.....

ACKNOWLEDGEMENTS

I would like to firstly express my profound gratitude and appreciation to my kind advisor; Asst. Prof. Noppadon Jokkaw, for his helpfulness and meaningful advices. He always shared his valuable time to cooperatively discuss my research. My deepest thankfulness is also addressed to my co-advisor; Assoc. Prof. Tanit Tongthong, for his friendly discussion, guidance, and supportive thought. In particular, working with them was an excellent chance for me to gain more invaluable knowledge and experiences which will be useful for the next step in my life.

My thanks and respects are also given to my thesis committees; Asst. Prof. Vachara Peansupap and Dr. Kongkoon Tochaiwat, who are friendly and generous lecturers. They kindly provided me fruitful suggestions and comments for conducting my research. Moreover, I would like to thank all lecturers in Chulalongkorn University, who gave me useful instructions and advices to expand my knowledge.

My profound thanks is given to all of project managers in Cambodia, Lao PDR, and Thailand, who kindly allowed me to have a chance to interview to get the necessary data and information for conducting my thesis. Unforgettably, I wish to deeply thank Ms. Pipong Phimphachanh, Mr. Hungalun Bunthameuang, Mr. Sisomphone Southammavong, and Mr. Kittipong Suthanavut for their continuous help and strong cooperation in collecting data in Lao PDR and Thailand.

I would like to extend my grateful thanks to all official staffs employed in International School of Engineering and AUN/SEED-Net, who always distributed the updated information to me and other students in an attempt to facilitate for our academic study. My great thanks are also due not only to all lecturers in Institute of Technology of Cambodia, who supported me in continuing my Master Degree in Thailand, but also AUN/SEED-Net which was the main financial supporter for me.

Finally, very special thank from the bottom of my heart is gratefully addressed to my respectful parents; Chanthy Hang and San Earng, and my beloved sister, who constantly cared and encouraged me every time I felt down. My parents have tried to do everything and worked hard all the time in order to enable their son and daughter to be able to study from primary school until university. One thought is given to them “I am very proud to be your son”.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I
INTRODUCTION

1.1 Introduction

Construction projects have always been a very important part of human civilization. The rapid technological developments of the last hundred years have resulted in a growing number in construction projects of enormously complex nature. The last decade has seen a steep rise in the quantity and complexity of construction projects in Asia as a result of spectacular economic development of the whole region. Finding the right project manager for a construction project is therefore a major task in project implementation. Furthermore, with the growing complexity of the project, increasing international collaboration within the building industry and growing concern of client's satisfaction, management of construction projects has become an increasingly important issue. One factor contributing to successful project management is the effort spent by a good project manager (Kwok, 2004).

The construction project manager clearly possesses responsibility for the overall project, in all its dimensions. At the top level of construction project, construction project manager concentrates on the schedule, cost and technical performance of the system within the context of a safe project environment. The first place to look in terms of exploring the desired attributes of a construction project manager is the set of tasks that a construction project manager must be able to carry out and the required competencies to execute the tasks. In other words, the project manager is the leader of the contractor's project team and is responsible for identifying project requirements and ensuring that all are accomplished safely and within the desired budget and time frame. To succeed this challenging task, the project manager must organize his or her project team, establish a project management system that monitors project execution, and resolve issues that arise during project execution. These duties of project manager require a lot of useful knowledge and competencies to implement such tasks.

Managing projects with quality requires the implementation of sound project management practices. For any project management system to be effective, a project

must be managed by a project manager who exhibits high quality of knowledge and competencies. Knowledge is one of the most important resources for both managerial decision-making and competitive advantages of any organization (Awazu, 2004). Individuals however have a differing competency-based and experiences thus leading to different problem solving processes and decision-making. Additionally, the fundamental concept on which project management is based is that a single individual, the project manager, is accountable for the success of the project. In this regards, success is achieved when the project satisfies what Rosenau (1984) calls the triple constraint, comprising performance specification, time (schedule), money (budget). As such construction project managers play a crucial role not only in the operational activities of architectural and engineering construction companies but also the development of infrastructure in every country. Although he or she is accountable for the success of the project, the effectiveness of the project manager is only one of many factors that impinge on the outcome of the project. It is therefore of crucial importance that strong competencies required of the construction project manager be clearly known or elaborated in order to make the improvement of inadequacy.

1.2 Problem Statements

Project management is the application of knowledge, tools, and techniques to the many activities required to complete a project successfully. Project management is really crucial for all of components of the whole construction project because it is an approach of planning, organizing, and managing resources to bring about the flourishing achievement of specific project goals and objectives. In construction, project success generally is defined in terms of safety, quality, cost, and schedule. Project management is a long procedure that needs involvement of many persons and required an efficient plan to be followed; otherwise the whole project can go to a chaos. However, many unexpected problems always occur in construction project management; especially in developing countries. The difficult inherence in the project management situations are compounded by the increasing complexity of environmental, regulatory, project financing, and political issues.

Cambodia is officially considered as a developing country in the world. In the current year, the construction industry has been intensively booming in this country; such as building, road, bridge, and so on. Most especially, there are a lot of structural

buildings booming in Cambodia consisting of housing buildings, commercial buildings, condominium buildings, and small towns which are called economic zone development. Simultaneously, many problems have dramatically appeared in construction projects in Cambodia. According to the previous study, Phann (2008) assumed that there are plenty of construction problems occurring in Cambodia due to many factors. Two major problems are accordingly human resource and material resource problems. Human resources problem consists of most of unskillful domestic labor, low productivity of local workmanship, low quality of local engineers, lack of local engineers and experts, and poor design of local engineer in large project. Material resources problem comprises shortage of materials in the country, high cost of machinery, inadequate production of raw material in the country, low quality of local materials, lack of high-technology mechanical equipment, lack of competent suppliers, and so on.

All of these problems must be appropriately managed and dealt with by many capable people and organizations. There are several participants in the construction process, all with important capability in developing a successful project such as, the owner, the designer, the prime contractor, subcontractors, and supplies. Especially, the compulsory need for handling the whole project is mainly effective construction project manager who is the leader of the contractor's project team and is in charge of identifying project requirements and ensuring that all are accomplished safely and within the desired budget and time frame. However, several construction projects may fail because of external factors that are beyond the control of the construction project manager or because he or she possesses low competencies to implement the overall construction project. As Phann (2008) revealed construction project manager's problems frequently occurring in Cambodia, consist of lack of responsibility, poor leadership, inefficient decision analysis, unrealistic project schedule, poor project planning and control, lack of project manager's experience, and unreasonable risk analysis.

Like other developing countries, Lao People's Democratic Republic (Lao PDR) has many construction projects being implemented in various sectors; such as housing projects, dam projects, and some small bridge projects. Undoubtedly, many project management problems have been occurring in construction projects in this

developing country. In this case study, the construction project managers are studied in terms of into account in project management to deal with such problems.

Another country, Thailand is an emerging economy and considered as newly industrialized country. There are plenty of construction projects booming in this country consisting of high rise building projects, condominiums, hotels, shopping centers, factories, and long-span bridge projects. Simultaneously, Ogunlana (2002) posted that Thailand has inadequate and ineffective control strategies for project management problems. The operational modes of contractors are mainly based on sole ownership, headed by entrepreneurs lacking efficient expertise in construction management. Additionally, Ogunlana (1996) concluded that resource supply problems are by far the most acute problems of construction industry in the boom years in Thailand. Projects suffer delays because materials, especially cements, are in short supply, technical personnel are over stretched, having to do so much so soon in their careers. Demands from construction owners for frequent changes also create design and coordination problems for field staff. The result was that many projects are poorly managed and exceeded time forecasts. Construction consultants also create problems for contractors. Some of the problems are however not special problems limited to developing economies but are accentuated by the shortage of technical personnel and other infrastructures which are taken for granted in developed countries. Contractor-caused delays are due mainly to the low technical and managerial competency of contractors in developing countries. This study will focus on the construction project managers who are mainly responsible for dealing with these problems.

That is why it requires effective construction project manager who particularly possesses high knowledge and competencies to effectively and efficiently deal with problems which often occur in developing countries. Furthermore, the existing knowledge and competencies of construction project manager in each country can be possibly different or similar depending upon the area situations including different geographical location, construction regulatory, socio-economic, and political factors. Therefore, all engineers or construction project managers should be well aware well of the insufficiency of knowledge and competencies of construction project manager in their countries so that they (engineers) are able to learn how to become effective

construction project managers and also they (project manager) are able to improve their performances in order to undertake the management of project without any failures or risks in each region. Moreover, in Thailand, Cambodia, and Lao PDR, there is indeed no research that focuses on this issue. That is why this research is accordingly conducted by studying the current knowledge and competency level of construction project managers in these three countries in order to improve their performances.

1.3 Objectives

The main objectives of this research are:

1. To rank the important knowledge areas of construction project manager of contractor as perceived by significant actors in the construction industry (the contractors, the consultants, and the owners) in Cambodia, Lao PDR, and Thailand
2. To explore the current level of competencies of construction project managers of contractor based on the ability to apply their knowledge in construction project activities from the perceptions of three principle construction participants; the contractors, the consultants, and the owners
3. To propose the recommendations for improving the insufficiency of competencies of construction project managers of contractor in Cambodia, Lao PDR, and Thailand by obtaining some suggestions from the perceptions of the contractors, consultants, and owners.

1.4 Scope of Research

It involves the construction project managers' perspectives based on their knowledge and their competencies to apply the knowledge in managing the whole construction projects. The scope of this research empirically covers the competencies of local construction project managers of contractors working in these three countries; Cambodia, Lao PDR, and Thailand. The necessary information and data will be actively collected from building construction projects as one of project types in accordance with the perceptions of the contractors, the consultants, and the owners.

1.5 Research Methodologies

This is a case study which includes the literature reviews, interviews and relevant information gathered from questionnaire survey. This study particularly focused on the exploration of the competencies of construction project managers. The research would be done step by step as shown below:

1. Review the pertinent literature and interviews with some project managers to find the important knowledge areas needed for construction project managers from various sources. The available sources are text books, journals, and international conference papers. They are able to be searched from previous studies, internet websites, online libraries, and electronic database. All of involved literature reviews are entirely presented in Chapter 2.

2. Develop a questionnaire survey based on the relevant literature reviews and interviews. The questionnaire is clearly designed and transmitted to those who play a role as contractors, consultants, and owners in Cambodia, Lao PDR, and Thailand. This questionnaire is officially used to gather the ranking of important knowledge areas and the level of competencies of practical construction project managers. It is also used to collect some evidence used for result validation. Similarly, expectations are obtained from questionnaire.

3. Along with the questionnaire, it is necessary to visit and interview with contractors, consultants, and owners working in construction projects located in Cambodia, Lao PDR, and Thailand to explore the detailed perceptions of the competencies of construction project managers.

4. Analyze the gathered data and information in order to find the ranking of important knowledge of construction project managers and to successively explore the level of their abilities to apply the knowledge in controlling the project activities. The tools used to analyze the data are Analytic Hierarchy Process (AHP) for important knowledge and Average Scoring for level of competencies. The details are clearly illustrated in Chapter 3.

5. Validate the results of competency level by using evidence of each knowledge area as demonstrated in Chapter 3.

6. Enhance the inadequacy of competencies of construction project managers in these countries in accordance with the results by proposing some useful recommendations obtained from the gap between important knowledge and competency level and from the expectations from the contractors, the consultants, and the owners.

7. Conclusions, limitation of study, and further study, are provided in the last section of this research.

1.6 Expected Benefits

The future benefit of this study can be:

1. The recommendations for prioritized improvement of competencies of local project managers in Cambodia, Lao PDR, Thailand

2. In case of international projects, the project managers will be selected to implement the work in construction projects based on their suitable performances which match the required competencies in each country.

CHAPTER II
LITERATURE REVIEW

2.1 General

The objective of this chapter is mainly to elaborate on the knowledge and competencies of construction project managers from many previous researchers who studied in this area. Various researches were widely conducted in different countries, regions and most of them mostly delineated the knowledge and competencies of construction project managers.

2.2 Construction Project Manager

The construction project manager is the leader of the contractor's project team and is responsible for identifying project requirements and ensuring that all are accomplished safely and within the desired budget and time frame. To accomplish this challenging task, the construction project manager must organize his or her project team, establish a project management system that monitors project execution, and resolve issues that arise during project execution.

Although project management has traditionally been associated with 'hard' technology developments, key writers have long identified the construction project manager as one drawing together human, natural and technological resources in dynamic but temporary organization to deliver ends that includes the social as well as the technological. In other words, construction project managers need to be leaders, as they must cope with change where they set the vision, the goals, and assist the organization in attaining those visions and goals. How do we know who the leaders are? According to him, leaders are noticed by the way they participate in groups and usually challenge the way things are done or look for ways to achieve excellence. Leaders influence others and motivate people to achieve something beyond their expectation.

However, according to Verzuh (1999), "the best construction project managers are outstanding leaders. They have vision, they motivate, they bring people together, and, most of all, they accomplish great things". The leader should guide the team members by identifying their roles and responsibilities for the project. In addition, he

should inspire the team members to successfully complete the project tasks for the good of the project. He added “the project manager is a catalyst-the initiator who lifts the entire project and puts it into motion”.

2.3 Introduction to Attributes of a Construction Project Manager

Eisner (2008) listed twenty critical aspects of a construction project manager. These same twenty attributes may also be interpreted as the characteristics of a good boss. Twenty attributes of a construction project manager are to:

1. Communicate well and share information
2. Delegate appropriately
3. Be well-organized
4. Support and motivate people
5. Be a good listener
6. Be open-minded and flexible
7. Give constructive criticism
8. Have a positive attitude
9. Be technically competent
10. Be disciplined
11. Be a team builder and player
12. Be able to evaluate and select people
13. Be dedicated to accomplishing goals
14. Have the courage and skill to resolve conflicts
15. Be balanced
16. Be a problem solver
17. Take initiative
18. Be creative
19. Be an integrator
20. Make decisions

Another interesting concept, Stuckenbruck (1976), in an evocatively titled presentation ‘The ten attributes of the proficient project manager’, proposes and explains in detail ten essential characteristics of the project manager. First, he or she

must be multi-disciplinarily oriented, in that he or she should be sufficiently familiar with each discipline to be able to understand the problems encountered and discuss them with the specialists. Second, he must be 'global problem' oriented, so that he can look at the project as a whole with its multiple interfaces; he must consider the external, political, legal and environmental aspects. Third, he must be an effective problem solver and decision maker. This skill demands common sense, good judgment and intuition. It also assumes training in the use of problem-solving aids, such as mathematics, simulation and other management tools. Fourth, the project manager should be a good manager and administrator, to enable him to manage daily operation efficiently. He should master the basics of the management of planning, budgets, supervision and follow-up. Fifth and sixth, he should possess good analytical abilities coupled with creativity in dealing with information and problems. Seventh, given his vital role in maintaining communications with everyone involved (top management, the project team and the customer), he should be an effective communicator, with a good command of both the spoken and written word. Eighth, he must motivate his team members to achieve fixed goals. Ninth, he should be flexible, and able to adapt to change. Finally, in Stuckenbruck's opinion, most importantly, a project manager should have the right temperament: calm, realistic, dedicated, generous, stable, quick-thinking, disciplined and persistent.

2.4 Knowledge of Construction Project Managers

2.4.1 Knowledge Definition

According to Awazu (2004), Knowledge is one of the most important resources for both managerial decision-making and competitive advantage of any organization. It can also be information, which has been used and becomes a part of individual's experience base and behavioral pattern. It encapsulates the ability of an individual to perform an activity in a job-relevant area as well as what is required from this individual to realize effective performance (Hermosillo, 2002). Moreover, Renck, Kahn, and Gardner (1969) identified that knowledge refers to the content or technical information needed to perform adequately in a job and is normally obtained through formal education, on-the-job training, and information media, such as manuals.

Additionally, the definition of knowledge in Webster's dictionary (1976) is "the fact or condition of possessing within mental grasp through instruction, study, research, or experience one or more truths, facts, principles or other objects of perception". In general, knowledge can be experience, concepts, values, or beliefs that increase an individual's capability to take effective action (Alavi & Leidner, 1999). It is important to address the differences between knowledge, information, and data. Data is raw numbers and facts, while information is a flow of messages or processed data. Knowledge is actionable information that is possessed in the mind (Maglitta, 1996). In other words, knowledge is created and organized by the very flow of information, anchored by the commitment and beliefs of its holders (Alavi & Leidner, 1999). Furthermore, Alavi and Leidner (1999) argued that information becomes knowledge when it is processed in the mind of an individual and knowledge becomes information when it is articulated or communicated to others in the form of text, computer output, speech or written words.

2.4.2 Project Management Knowledge

The Project Management Body of Knowledge (PMBOK, 1996) from Project Management Institute of United States is a collection of processes and knowledge areas generally accepted as best practice within the project management discipline. As internationally recognized, it provides fundamentals of project management, irrespective of type of project be it construction, software, engineering, automotive.

PMBOK recognizes 9 knowledge areas typical of almost all projects:

1. Knowledge of Integration Management
2. Knowledge of Scope Management
3. Knowledge of Time Management
4. Knowledge of Cost Management
5. Knowledge of Quality Management
6. Knowledge of Human Resource Management
7. Knowledge of Communication Management
8. Knowledge of Risk Management
9. Knowledge of Procurement Management

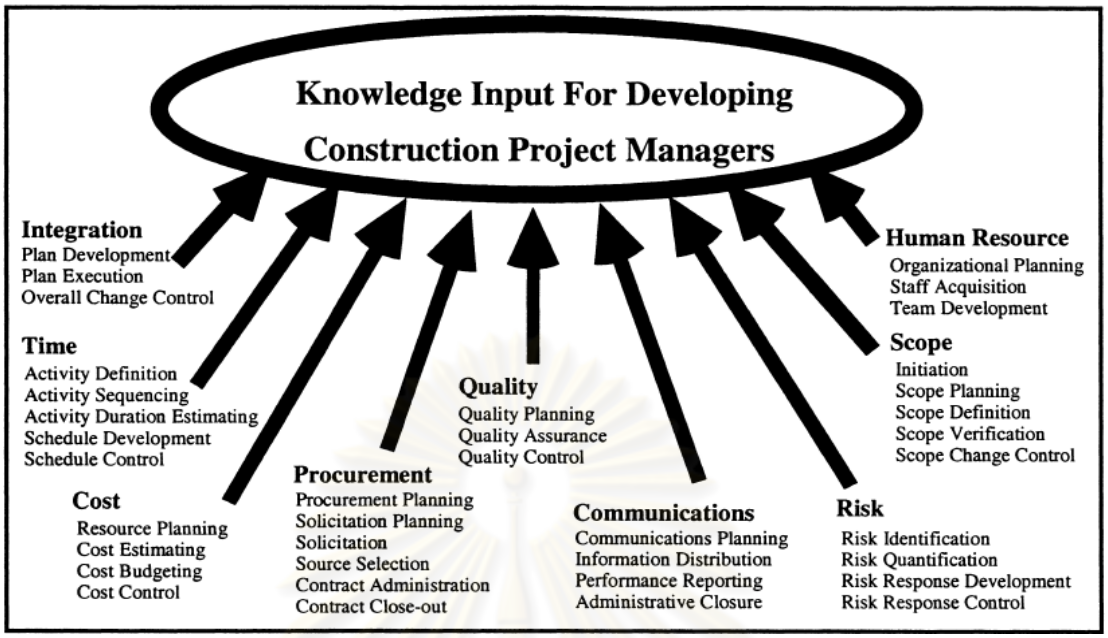


Figure 2.1 Generic knowledge areas of project management (PMBOK, 1996)

The above figure outlines the generic knowledge that construction project managers are usually expected to acquire by various Accreditation Bodies, and which reflect their technical requirements for certification.

❖ ***Project Integration Management***

Project Integration Management includes the processes required to ensure that the various elements of the projects are properly coordinated. It involves making tradeoffs among competing objectives and alternatives in order to meet or exceed stakeholder needs and expectations. While all project management processes are integrative to some extent, the processes described in this chapter are primarily integrative.

- *Project Plan Development*: taking the results of other planning processes and putting them into a consistent, coherent document.
- *Project Plan Execution*: carrying out the project plan by performing the activities included therein.
- *Overall Change Control*: coordinating changes across the entire project.

❖ ***Project Scope Management***

Project Scope Management includes the processes required to ensure that the project includes all the works required, and only the work required, to complete the

project successfully. It is primarily concerned with defining and controlling what is or is not included in the project.

- *Initiation*: committing the organization to begin the next phase of the project.
- *Scope Planning*: developing a written scope statement as the basis for future project decisions.
- *Scope Definition*: subdividing the major project deliverable into smaller, more manageable components.
- *Scope Verification*: formalizing acceptance of the project scope.
- *Scope Change Control*: controlling change to project scope.

❖ ***Project Time Management***

Project Time Management includes the processes required to ensure timely completion of the project.

- *Activity Definition*: identifying the specific activities that must be performed to produce the various projects deliverables.
- *Activity Sequencing*: identifying and documenting interactivities dependencies.
- *Activity Duration Estimating*: estimating the number of work periods which will be needed to complete individual activities.
- *Schedule Development*: Analyzing activity sequences, activity durations, and resource requirements to create the project schedule.
- *Schedule Control*: controlling the changes to the project schedule.

❖ ***Project Cost Management***

Project Cost Management includes the processes required to ensure that the project is completed within the approved budget.

- *Resource Planning*: determining what resources (people, equipment, materials) and what quantities should be used to perform project activities.
- *Cost Estimating*: developing an approximation (estimate) of the costs of the resources needed to complete the project activities.
- *Cost Budgeting*: allocating the overall cost estimate to work items.

- *Cost Control*: controlling changes to the project budget.

❖ ***Project Quality Management***

Project Quality Management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It includes "all activities of the overall management function that determine the policy quality, objectives, and responsibilities and implements by means such as quality planning, quality control, quality assurance, and quality improvement, within the quality system.

- *Quality Planning*: identifying which quality standards are relevant to the project and determining how to satisfy them.
- *Quality Assurance*: evaluating overall project performance on a regular basis to provide confidence that the project satisfies the relevant quality standards.
- *Quality Control*: monitoring specific project results to determine if they comply with relevant quality standard and identifying to eliminate causes of unsatisfactory performance.

❖ ***Project Human Resource Management***

Project Human Resource Management includes the processes required to make most effective use of people involved with the project. It includes all the project stakeholders (sponsors, customers, individual contributors…etc).

- Organizational Planning: identifying, documenting, and assigning project role, responsibilities, and reporting relationships.
- Staff Acquisition: getting the human resources needed assigned to and working on the project.
- Team Development: developing individual and group skills to enhance project performance.

❖ ***Project Communication Management***

Project Communication Management includes the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. Everyone involved in the project must be prepared to send or receive communication in the project "language" and must understand how

the communications they are involved in as individual actors affect the project as a whole.

- *Communication Planning*: determining the information and communication needs of the stakeholders: who needs what information, when will they need it, how will it be given to them.
- *Information Distribution*: making needed information available to project stakeholders in timely manner.
- *Performance Reporting*: collecting and disseminating performance information. This includes status reporting, progress measurement, and forecasting.
- *Administrative Closure*: generating, gathering, disseminating information to formalize or phase completion.

❖ ***Project Risk Management***

Project Risk Management includes the processes concerned with identifying, analyzing, and responding to the project risk. It includes maximizing the results of positive events and minimizing the consequence of adverse events.

- *Risk Identification*: determining which risks are likely to affect project and documenting the characteristics of each.
- *Risk Quantification*: evaluating risk and risk interactions to assess the range of possible project outcomes.
- *Risk Response Development*: defining enhancement steps for opportunities and responses to threats.
- *Risk Response Control*: responding to change in risk of the course of the project.

❖ ***Project Procurement Management***

Project Procurement Management includes the processes required to acquire goods and services from outside the performing organization. For simplicity, goods and services, whether one or many, will generally be referred to as a "product".

- *Procurement Planning*: determining what to procure and when.
- *Solicitation Planning*: documenting product requirements and identifying potential sources.

- *Solicitation*: obtaining quotations, bids, offers, or proposals as appropriate.
- *Source Selection*: choosing from among potential sellers.
- *Contract Administration*: managing the relationship with the seller.
- *Contract Closed-out*: completion and settlement of the contract, including resolution of any open items.

2.4.3 Previous Studies

Jay (2003) addressed some useful frameworks to help project managers and others in conceptualizing and implementing knowledge management initiatives. Knowledge management can enhance the project manager's activities by being better able to leverage knowledge internally and externally through improved knowledge sharing techniques among the project team. A generic knowledge management implementation framework is proposed.

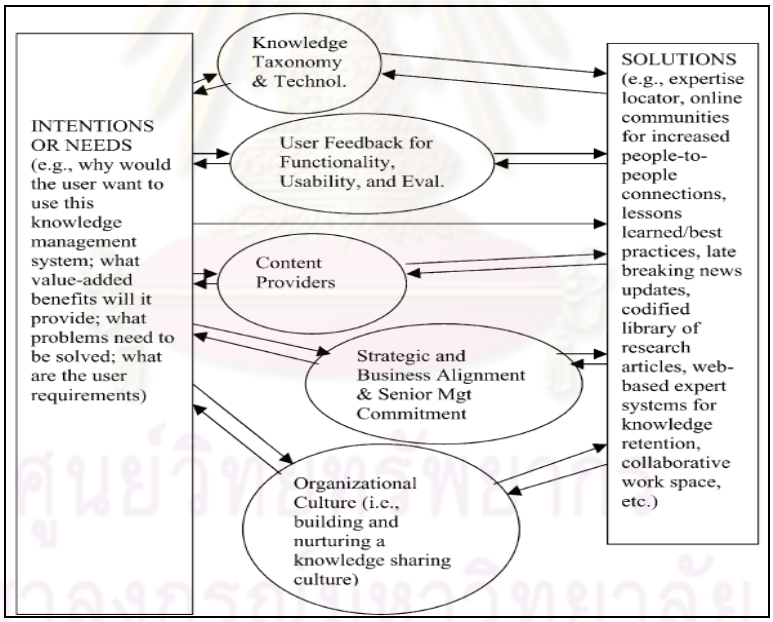


Figure 2.2 A generic knowledge management framework (Jay, 2003)

Another author, Edum-Fotwe (2000) mainly studied about the development of construction project managers and how they maintain their professional performance in a changing construction business environment. His research set out the areas of knowledge required for project management certification, and argues that the traditional engineering orientation of these requirements are insufficient for today's construction project manager. It identified the general knowledge elements that are

perceived as essential for developing project management competency through a survey of project managers in the construction industry. The survey established that the knowledge necessary to maintain their competency, in order to fulfill these changing demands is acquired largely from their experiences. While this is very useful and directly relevant to their job situation, it excludes the benefit of the broader outlook demanded by the senior position of a project manager.

Janice (2008) also discussed new perspectives and concepts for an advanced level of project management education that may help develop the abilities necessary to confidently navigate the dynamic organizational environments and complex projects facing project managers today. First, he described the evolution of project management and project management education. In particular, his review of the literature and of project management programs demonstrated the focus on standardization of the field and on preparation for the professional designation of project managers. Next, he discussed the impact of taking complexity seriously on the requirements for professional development of project managers. He lay out the requirements for preparing project managers to deal with complexity and present a comprehensive model of project manager development. Finally, he discussed the characteristics of an appropriate framework of project management education that does embrace uncertainty and unknown possibilities. In particular, he examined how distance-based education in project management may help develop a learning community that collaboratively questions existing theory and practice and develops innovative approaches as well as caters to the needs of project management practitioners for extensive learning opportunities within a flexible learning environment. Distance education provides an ideal approach for many practicing project managers to accomplish these goals.

Technical knowledge consolidation was researched by Mohamed (2005); he described a new approach for extracting, consolidating, and then retrieving technical construction knowledge that builds on the contradiction resolution concepts of the theory of inventive problem solving. The approach was to extract knowledge from a number of lessons learned describing technical construction problems that belong to different technological domains. These similarities represent the essence of these solutions and are presented using domain-independent terms so that they can be

applied to new problems. Additionally, in order to gain a deeper understanding of the current situation of knowledge sharing at the departmental level in contracting companies, Patrick (2006) carried out one research with the aim of investigating the main barriers to and finding out the critical factors for and benefits resulting from effective knowledge sharing in the tendering department of contracting companies in Hong Kong and the United Kingdom. The research reviews existing theories of knowledge sharing. This research focused on the understanding of current situations and practitioner's opinions towards knowledge sharing and experiences, increasing level of expertise, improving quality of work, learning colleagues' unique knowledge, and improving working morale and motivation. It seeks to contribute to the theory of organizational knowledge sharing by providing an explorative account supported by empirical evidence. It also allows management to continuously anticipate and support knowledge sharing activities related to the successful management of construction project within their particular organizations.

2.5 Competencies of Construction Project Managers

2.5.1 Definition of Competency

The competence concept is multifaceted and no commonly accepted definition exists. In industrial engineering, the concept is often presented as involving the implementation of combined knowledge (theoretical, contextual, and procedural), know-how (practical empirically controlled), and behavior (relational or cognitive attitudes and behaviors) (Harzallah, 2003).

Spencer (1993) also defined competency as "an underlying characteristic of an individual that is casually related to criterion-referenced effective and/or superior performance in a job or situation".

2.5.2 Prior Research

There are many previous studies which widely researched on the competency of construction project managers. Many scholars and specialists have proposed various competency models containing a list of required competencies. For instance, Wei (2007) proposed an effective method combining fuzzy logic and Decision Making Trail and Evaluation Laboratory (DEMATEL) to segment required competencies for better promoting the competency development of global managers.

That proposed method successfully extends the DEMATEL method by applying both linguistic variables and a fuzzy aggregation method, so that it can effectively deal with vague imprecise judgment. In particular, that method can also successfully divide a set of complex factors into a cause group and an effect group, and produce a visible causal diagram. Through, the causal diagram, the complexity of a problem is easier to capture, whereby profound decisions can be made. That proposed fuzzy DEMATEL method is comprehensive and applicable to all companies facing problems that require group decision-making in a fuzzy environment to segment complex factors.

Moreover, Andrew (2005) identified the core competencies associated with the construction management role and, further, develops a predictive model to inform human resource selection and development decisions within large organizations. A range of construction project managers took part in behavioral event interviews where staff were asked to recount critical management incidents, decisions, and actions from which their key competencies could be identified. By delineating the sample according to their levels of performance measured against a range of role-specific performance criteria, the competencies defining superior management performance could be determined. These were then used to construct a logistic regression model from which a project manager's performance can be predicted. The validated results revealed that "self-control" and "team leadership" are the most predictive behaviors of effective project management performance within the framework of the model. The results also showed the practicability of predicting job performance based on manager's behaviors. Specifically, the findings support the hypothesis that superior-performing managers will evidence higher level of specific key behaviors that underpin effective management performance more than average-performance managers.

Table 2.1 Comparison of competency of two levels of Managers (Andrew, 2005)

Variable	Average Managers		Superior Managers		
	Mean	Standard Deviation	Mean	Standard Deviation	ANOVA *F* (1,38)
Achievement orientation	0.56	1.41	3.21	0.78	58.18[a]
Initiative	1.06	1.18	2.75	0.68	33.04[a]
Information seeking	0.75	1.00	2.54	1.53	16.98[a]
Focus on client's needs	-0.44	0.89	1.42	1.28	25.20[a]
Impact and influence	0.94	0.93	2.30	0.69	28.00[a]
Directiveness	0.56	1.21	3.92	2.15	32.12[a]
Teamwork and cooperation	2.19	1.80	4.92	1.44	28.22[a]
Team leadership	0.75	1.34	4.46	1.69	53.97[a]
Analytical thinking	0.94	1.00	3.00	0.83	50.16[a]
Conceptual thinking	0.69	0.79	2.50	1.02	35.84[a]
Self-control	0.31	1.30	2.96	0.75	66.51[a]
Flexibility	1.13	1.26	3.00	0.42	46.22[a]

Another research carried out by Kwok (2004) focusing on competencies needed for a project manager practicing in Hong Kong, and investigated which areas should be focused upon and what measures should be used. It was found that there are significant differences between the level of importance and level of evidence. Project managers in Hong Kong are not performing up to the level they expected. There will be also changes in the requirement of competencies in the future. It was concluded that although technical and managerial skills are still important, more training in business related areas should be provided. Project managers in Hong Kong have the same view with project managers in the UK that experience contributes more in certain areas in developing and maintaining competencies. Thus, in terms of method of narrowing the gap between levels of future importance of level of evident, CPD should be used for all categories of skills while opportunities of application and mentorship program should also be provided for financial skills, IT skills, legal skills and communication skills. Analysis in the section followed shows that project managers in Hong Kong viewed technical skills and managerial skills with prime importance. In particular, basic technical knowledge, planning and scheduling, construction management activities, productivity and cost control, leadership, time

management, decision making, negotiation, delegation, team working, top management relations and sub-contractors relation are placed with exceptional emphasis. This study tries to help project managers in the construction industry to a better focus in the way of preparing themselves for future challenges.

Patanakul (2008) also conducted one research that helps raise awareness in the project management community regarding the difference between the competencies of single-project managers and those of multiple-project managers.

Table 2.2 Competencies of multi-project managers (Patanakul, 2008)

Competencies	**Mean**
Administrative/process	
Monitoring/control	6.67
Risk management	6.50
Planning/scheduling	6.50
Resource management	6.50
Company's project management process	6.00
Interpersonal/interpersonal	
Problem solving	6.33
Conflict management	6.17
Organized and disciplined	6.17
Responsible	6.00
Proactive and ambitious	6.00
Mature and self-controlled	5.67
Flexible	5.17
Business/strategies	
Business sense	6.33
Customer concern	6.00
Integrative capability	6.00
Strategic thinking	5.33
Profit/cost consciousness	5.33
Technical	
Knowledge of product application	5.83
Knowledge of technology and trends	4.67
Knowledge of project products	4.00
Knowledge skills of tech, tools and techniques	3.50
Ability to solve technical problems	2.67

CHAPTER III
RESEARCH METHODOLOGY

3.1 General

Upon completion of this master's degree project thesis, thorough planning and scheduling have been organized on the methodology and research sequence to ensure a smooth running of the research program from literature review, data collection, until discussion and validation of result and conclusion.

3.2 Literature Review

Literature review involves a thorough search and investigation of manager related issues through many different sources such as text books, articles, journals, international conference papers, and project management manuals. Additionally, there is also searching and browsing through internet web pages, internet websites, online library, electronic database, online articles and journals to seek complementary information. The aim of literature review is to gather important information related to the topic and to deepen the proper understanding of the knowledge and competencies of construction project managers.

3.3 Data Collection

In spite of literature review, interviews with mainly practical contractors, consultants, and owners in construction projects are needed to gain practical information, hands-on issues and experiences related to the knowledge and competencies of construction project managers. On the other hand, a series of question are set for conducting a survey to obtain feedback and response from pertinent respondents.

The tool utilized to gather the useful data is questionnaire method. A questionnaire will be developed based on relevant literature reviews. The questions are structured according to the purpose of the research. The pattern questions are composed of open-end question and closed-end question. The questions are prepared on multiple choices with check-boxes for respondents' answers.

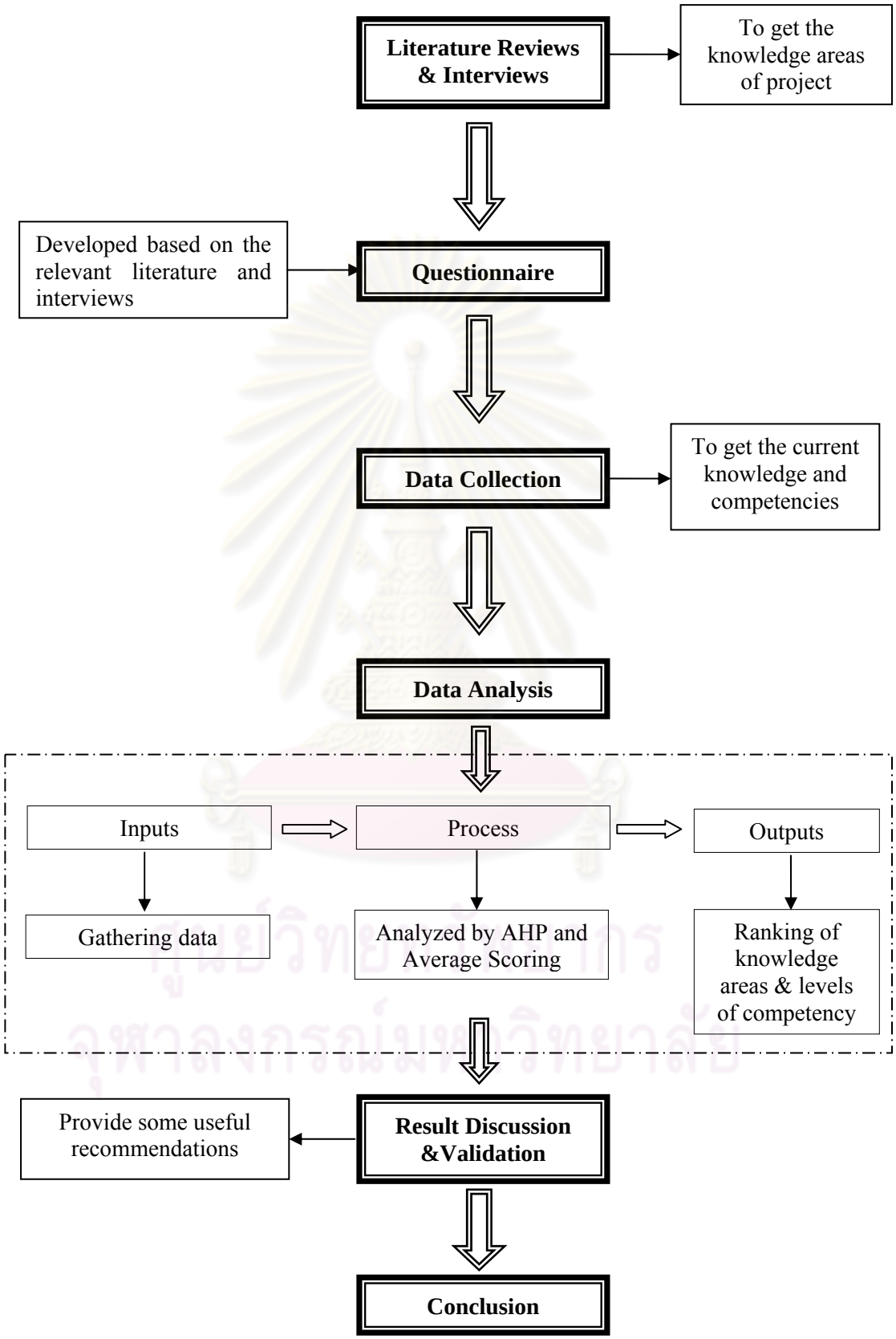


Figure 3.1 Framework of research methodology

The questionnaire is clearly designed and given to those who play a role as contractors, consultants, and owners in Cambodia, Lao PDR, and Thailand. They will be asked to describe personal information and current knowledge and competencies that construction project managers possess.

The project managers working in construction projects need to develop their competencies to apply the knowledge that they are presently utilizing in their works. Simultaneously, the interview is also conducted with managers in construction projects as shown in Figure 3.2. The interviews are accordingly conducted following the questionnaire which consists of the name of the respondent's organization, the profession, the role of the organization in the construction industry. It also contains the number of years the construction project managers have been working in the construction industry. The data collection is an extremely crucial step of the research methodology because it is the significant information which delineates the current knowledge and competencies of construction project managers in pertinent countries: Cambodia, Laos PDR, and Thailand.

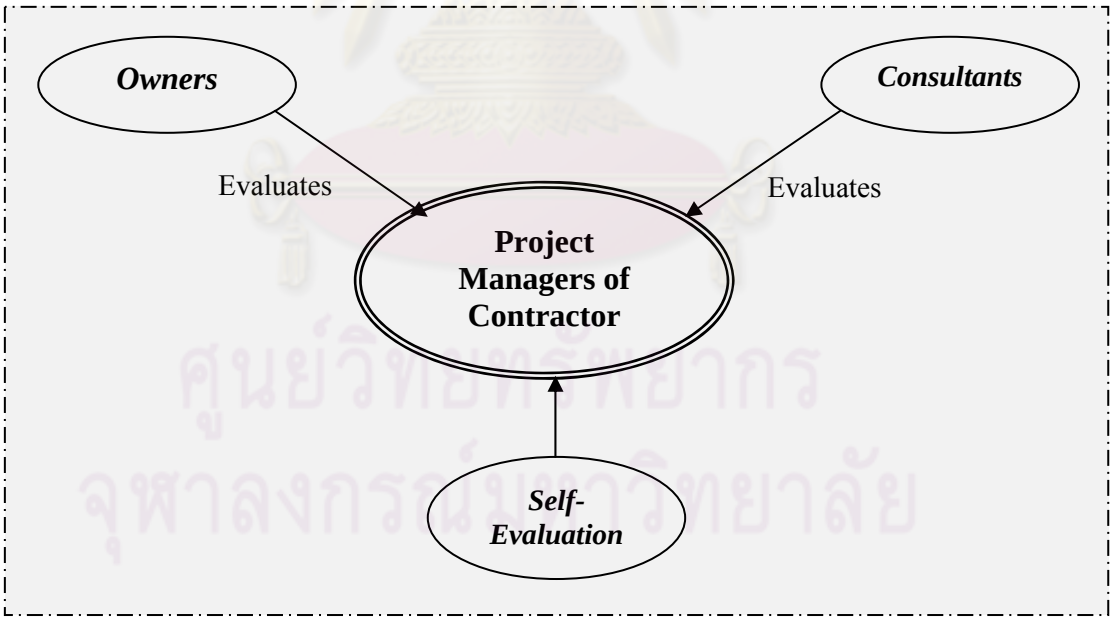


Figure 3.2 Scope of interview

3.4 Sample Size

According to *Yamane (1973)*, he provided a simplified formula to calculate sample sizes. In this case, this formula is used for calculating the sample sizes for 85% confidence level because the necessary data was collected from opinion or feeling of evaluation of respondents.

$$n = \frac{N}{1 + Ne^2}$$

Where, n : Sample size (Construction project)

N : Population size (Total construction project)

e : The error of sampling was appropriately taken 15% because the data was collected from the opinions of respondents which often vary.

The estimated sample size was attempted to conduct the interviews with questionnaire, whereas the questionnaires which were responded to are the real sample size shown in Table 3.1.

Table 3.1 Sample size in each country

Country		Construction Project	Estimated Sample Size	Reponded Sample Size
Cambodia	*Phnom Penh City*	211	37	14
	Siem Reap Province			
Lao PDR	*Vientiane City*	116	32	11
Thailand	*Bangkok City*	Unknown	Unknown	12 (Assumption)

3.5 Data Analysis

After compilation of responses, every type of crucial data received under different respondents will be appropriately analyzed by an analysis tool. In this case of study, there are 2 main types of data; knowledge and competencies, which are taken into account for analysis.

3.5.1 Knowledge Analysis

One interestingly statistical method utilized for analyzing this kind of data is called Analytic Hierarchy Process (AHP).

- **Fundamentals of AHP**

AHP was introduced by Saaty (2000), an American mathematician, as a management tool for decision making in multi-attribute environment. The fundamental approach of AHP is to break down a "big" problem into "small" problems; while the solution of these small problems is relatively simple, it is conducted with a view to the overall solution of the big problem. The main uniqueness of AHP is its inherent capability of weighting a great number of different-nature factors (qualitative and quantitative) in order to make a decision, thereby producing a formal and numeric basis for solution. Although the current study did not deal with decision making, the use of AHP was deemed suitable here given the instrument AHP provides for weighting multiple varied factors.

- **Prescription and benefits of AHP**

AHP is a method for formalizing decision making where there are a limited number of choices but each has a number of attributes and it is difficult to formalize some of those attributes. The AHP has been also used in a large number of applications to provide some structures on a decision making process. Furthermore, an unscrupulous case can easily manipulate the ranking to get a preferred outcome (by using a non-management science technique called "lying"). Despite the rather arbitrary aspects of the procedures, however, it can provide useful insight into the tradeoffs embedded in a decision making problem. AHP helps capture both subjective and objective evaluation measures, providing a useful mechanism for checking the consistency of the evaluation measures and alternatives suggested by the team thus

reducing bias in decision making. AHP allows organizations to minimize common pitfalls of decision making process, such as lack of focus, planning, participation or ownership, which ultimately are costly distractions that can prevent teams from making the right choice.

- **Review steps of AHP**

  1. ***Step 1:*** decompose the decision-making problem and find out the criteria or factor of the problem. Then construct the linear hierarchy of the problem consisting of a finite number of levels or components. Each level consists of a finite number of decision elements. The goal, or focus, of the problem lies at the first level. Usually, the criteria occupy the second and third levels respectively. Lastly, the decision alternatives are placed at the lowest level of the hierarchy.

  2. ***Step 2:*** Construct pairwise comparison matrices for all the criteria, sub-criteria, and alternatives. The typical form of a pairwise comparison matrix is as follows:

'O'	F_1	F_2	…	F_n
F_1	a_{11}	a_{12}	…	a_{1n}
F_2	a_{21}	a_{22}	…	a_{2n}
⋮	⋮	⋮	⋱	⋮
F_n	a_{n1}	a_{n2}	…	a_{nn}

Where $a_{ij} = \frac{w_i}{w_j}$ (for $i, j = 1,2,\ldots,n$) represents the strength of importance/preference of the factor (criterion/alternative) F_i over F_j with respect to the objective 'O', $a_{ji} = \frac{1}{a_{ij}} w_i, i = 1, 2, ..., n$ are the priority weights (to be determined) of the factors. The entries a_{ij}s normally taken from the (1/9-9) ratio-scale. The semantic interpretation of the matrix elements is provided in Table 1.

Table 3.2 Saaty's nine scale and its description

Intensity of importance	Definition	Description
1	Equal importance	Two criteria contribute equally to the objective in the immediate higher level
3	Weak importance of one over another	Experience and judgment slightly favor one criterion over another
5	Strong importance	Experience and judgment strongly favor one criterion over another
7	Very strong importance	A criteria is favored very strongly, its dominance demonstrated in practice
9	Absolute importance	The evidence favoring one criterion over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between adjacent scale values	When compromised is needed

3. ***Step 3:*** Determine the weights of the criteria, sub-criteria, alternatives, from the pairwise comparison matrices obtained in Step 2 by using the eigenvalue method. This is done by solving the following linear simultaneous equations:

$$a_{ij} = \frac{1}{\lambda_{\max}} \sum_{j=1}^{n} a_{ij} w_j, i = 1, 2, ..., n$$

where λ_{max} is the largest eigenvalue of the pairwise comparison matrix *A*.
For uniqueness, we normalize the set of weights such that $\sum_{i=1}^{n} w_i = 1$

4. ***Step 4:*** Using the principle of hierarchy composition, synthesize all the local set of weights and obtain the set of overall or global weights for the alternatives. The alternative that receives the overall highest weight with respect to the goal of the problem is selected as the best.

5. ***Step 5:*** Find consistency ratio to ensure the perception of respondent is consistent.

   Consistency Index, $CI = \frac{\lambda_{max} - n}{n - 1}$

   Random Index, RI = 1.56 (n=13)

   Consistency Ratio, $CR = \frac{CI}{RI}$

   CR ≤ 10%, the result is acceptable.

   CR > 10%, the result is not acceptable.

Remark: The total ranking of knowledge areas would be obtained from average of weight of all respondents by simultaneously checking the variances of all respondents in order to ensure that they do not have quite different variances.

3.5.2 Competency Analysis

The successively main data gathered from the perceptions of main stakeholders (contractors, consultants, and owners) is the evaluation which delineates the ability of construction project managers of how to apply those kinds of important knowledge for carrying out in their current construction projects.

In the developed questionnaire, the level of competencies of construction project managers is divided into 5 levels: (1) Very Low, (2) Low, (3) Medium, (4) High, and (5) Very High, which will be evaluated by opinions of three principle actors in project (the contractors, the consultants, and the owners).

The method used to analyze the level of competencies of construction project managers is Scoring tool. The mean item score for each knowledge area is calculated to obtain the relative level index as follows:

$$\text{Relative Level Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \quad \text{(Gushgar, 1997)}$$

Where n_1 = number of respondents for very low level, n_2 = number of respondents for low level, n_3 = number of respondents for medium level, n_4 = number of respondents for high level, n_5 = number of respondents for very high level and N = total number of respondents.

Table 3.3 Relation between Average Level Index and Level

Average Level Index (ALI)	Level
$1.00 \leq ALI < 0.80$	*Very High*
$0.80 \leq ALI < 0.60$	*High*
$0.60 \leq ALI < 0.40$	*Medium*
$0.40 \leq ALI < 0.20$	*Low*
$0.20 \leq ALI < 0.00$	*Very Low*

3.5.3 Evidence Analysis

In order to validate the result of analysis of levels of competency, evidence of competencies of local project managers would be explored in terms of components of each knowledge areas. In other words, evidence is the components of the 3rd level of each knowledge area as shown in Figure 3.3.

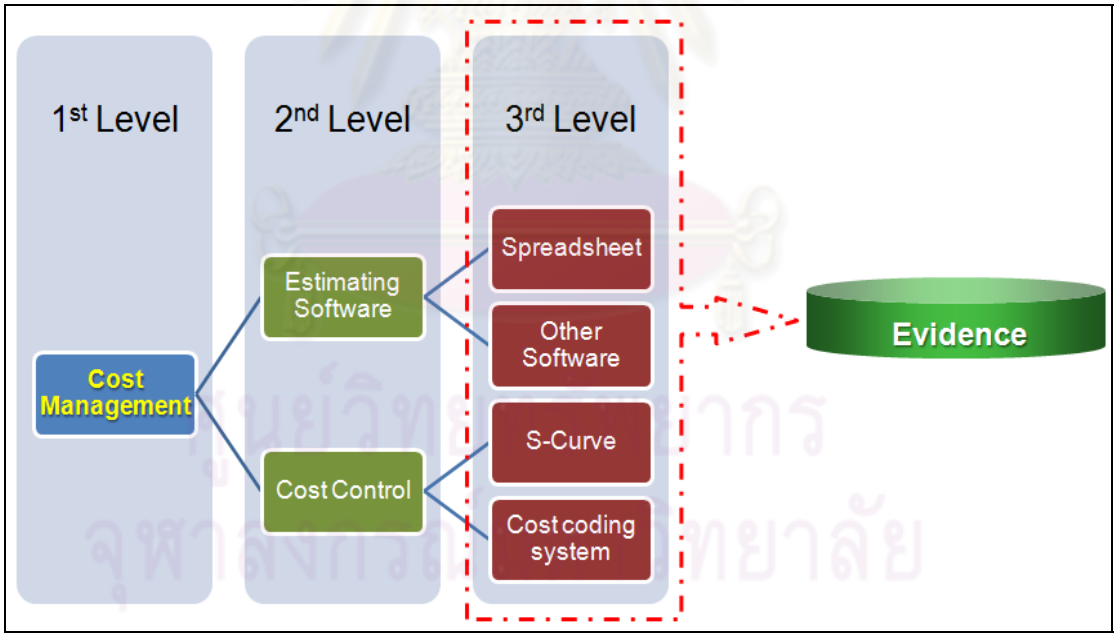


Figure 3.3 Example of evidence of cost management

- **Criteria of Evidence**

There are certainly many components in the 3rd level for one knowledge area. Some of them were especially picked up and assumingly considered as the evidence based on their main influences on competencies of project managers. The example of criteria of evidence is indicated in Figure 3.3.

- **Value of Evidence**

The values of involved evidence are presented as the percentage obtained from quantitative analysis of number of contractors in each country. The analysis is illustrated in detail in Appendix G.

$$\text{Percentage of quantitative competency} = \frac{\text{number of contractor applying each evidence}}{\text{total interviewed contractors}}$$

One example is given as below in order to clearly understand this formula:

The interviewed project managers of contractors in Cambodia using CPM technique in time management is 0 of 14 project managers, which is why the percentage of quantitative competency is 0/14 = 0%.

- **Level of Evidence**

The levels of evidence of each knowledge areas would be explored in an attempt to compare the results of competency level to obtain the validation. Furthermore, the levels of evidence would be set in accordance with the values of evidence in the 3rd level of knowledge area. The level of each component in the 3rd level is, on the other hand, assumed as described and given in below examples:

Four examples of important knowledge areas are given in order to understand well the level of evidence:

Table 3.4 Level of evidence of time management

1st Level	2nd Level	3rd Level
Time Management		*CPM*
		Others (PERT…)
	Scheduling Software	*M. Excel*
		M. Project
		Others (Primavera…)
	Time Control	*CPM*
		Delay Control

The components of knowledge areas in the 3rd level are particularly discussed to obtain the level of evidence.

➢ Scheduling Techniques

- Using *Bar Chart* to develop project schedule is assumed as *medium level* of competency of project managers because it is not effective enough for all projects since it has only a limited ability to show many detailed work activities and their associated interactions. It would become bulky and unwieldy on larger projects with complex activities. It also cannot show clearly the interaction between early and late finish dates of activities and the resulting float of noncritical activities.
- Developing project schedule by using *CPM* is counted as *high level* of competency because it can monitor and track the work done and evaluate progress by comparing planned with actual schedule. Next, forecast progress trends and apply corrective action to keep the project on course. It is also able to reduce project risk and uncertainty by identifying the critical activities.
- Using PERT or Line of Balance is considered as *very high level* of competency of project managers because they are advanced scheduling techniques.

➢ Scheduling Software

- Using *Spreadsheet* to develop bar chart is considered as *low level* of competency because it is not effective enough to clearly show the duration of each activity. It will become very difficult to draw bar chart in large project.
- Using *M. Project* as software to set up bar chart schedule is assumingly considered as *high level* of competency of project managers because of flexibility of its interface.
- Utilization of *other software* (e.g., Primavera, and Project Office…) is counted as *high level* of competency as well because these applications are not so different from M. Project.

Table 3.5 Level of evidence of cost management

1st Level	**2nd Level**	**3rd Level**
Cost Management	Estimating Software	*Spreadsheet*
		Others (WinEstimate…)
	Cost Control	*S-Curve*
		Cost coding system

➢ Estimating Software

- Using *spreadsheet* is not effective enough to estimate the project cost because it is just simple software while there are presently many up-to-date software available. It is therefore considered as *medium level* of competency in using spreadsheet.
- Using other *special software* for cost estimate is counted as *high to very high level* of competency because these tools can organize the estimate, link it to resource database, provide reports, and possibly integrate with other systems.

➢ Cost Control

- Using *S-Curve* technique for controlling project cost is considered as *medium level* of competency because it enables project managers to plan ahead by knowing what budgets are required, when they are required and how much is required and to give timely warning of negative cash flows.
- Using *cost coding system* is considered as *high level* of competency because it provides feedback information essential for effective estimates and bids on new projects.

Table 3.6 Level of evidence of quality management

1st Level	**2nd Level**	**3rd Level**
Quality Management	Quality Control	*Quality testing*
		Quality inspection
		Quality checklist
	Quality Improvement	*Quality problem record*

➢ Quality Control

- Implementing *quality testing and quality checklist* to control the work quality is assumingly counted as *medium level* of competency of project managers.
- Executing *quality inspection* in construction projects is counted as *high level* because it plays a vital role in controlling the whole quality of works by assigning some engineers or inspectors to examine all work activities.

➢ Quality Improvement

Conducting quality problem record in construction projects is considered as high level of competency of project managers because it can record the problems and solutions related to the work quality as the historical data to use for the future works.

Table 3.7 Level of evidence of safety management

1st Level	2nd Level	3rd Level
Safety Management	Safety Strategy Implementation	*Protective tool utilization*
		Safety sign implementation
		Safety inspection
		Safety meeting
	Safety Risk Control	*Accident investigation*
		Accident recording

➢ Safety Strategy Implementation

- Using *protective tools and safety signs* in construction sites is considered as *medium level* of competency because these strategies enable workers to avoid any site accident.
- Conducting *safety inspection and safety meeting* is assumingly counted as *high level* of competency because they are the main strategies to prevent site accidents occurring in construction sites.

➢ Safety Risk Control

- Implementing *accident investigation* in construction sites is considered as *medium level* of competency of project managers because it can determine what happened, and why the accident or incident happened.
- Executing *accident recording* is counted as *high level* of competency because it can determine procedures or policies that should be adopted to minimize the potential for future occurrence of similar accidents or incidents.

3.5.4 Recommendations

To enhance the inadequacy of competencies of construction project managers in these countries, some useful recommendations would be proposed by obtaining

results of the gap between important knowledge and competency level and from expectations obtained from contractors, consultants, and owners, through questionnaire.

CHAPTER IV
DATA COLLECTION

4.1 General

This chapter clearly reveals the real situation of project managers based on their knowledge and competencies implemented in construction projects in Cambodia, Lao PDR, and Thailand. The needed data and information were mostly collected and investigated from construction sites and personal interviews in accordance with developed questionnaire as perceived by the principal actors in construction projects; the contractors, the consultants, and the owners.

4.2 Background

A developing country is a country that has improper standards of democratic governments, civil service, industrialization, social programs, and human rights guarantees that are yet to develop to those met in the developed world or alternative goals of material progress. Developing countries are in general countries which have not achieved a significant degree of industrialization relative to their populations, and which have, in most cases a medium to low standard of living. There is a strong correlation between low income and high population growth. Despite this definition, the levels of development may vary, with some developing countries having higher average standards of living.

4.2.1 Cambodia Background

Cambodia has a land area of 181,035 square kilometers in the southwestern part of the Indochina peninsula, about 20% of which is used for agriculture and the population was estimated about 14,494,293 in 2009. Geographically, it lies completely within tropics with its southernmost points slightly and western regions; the Dangrek Mountains of the north adjoining the Korat Plateau of Thailand; and the Ratanakiri Plateau and Chhlong highlands on the east merging with the Central Highlands of Viet Nam. On the west by a narrow coastal plain: facing the Gulf of Thailand that contains Kampon Som Bay. The Dangrek Mountains at the northern rim of the Tonle Sap Basin, consisting of a steep escarpment on the southern edge of the

Korat Plateau in Thailand, marks the boundary between Thailand and Cambodia. The country's capital city is Phnom Penh. Cambodia has 800 km with Thailand to the west, 450 km with Lao PDR to the north, 1250 km with Viet Nam to the east and coastline of 440 km long. The physical landscape is dominated by the lowland plains around the Mekong River and the Tonle Sap Lake. Of the country's surface, approximately 49% remains covered by forest. There are about 2.5 million hectares of arable land and over 0.5 million hectares of pasture land. The map of Cambodia is shown as below:

Figure 4.1 Map of Cambodia (Wikipedia, 2009)

From 2004 to 2007, the economy grew about 10% per year, driven largely by an expansion in the garment sector, construction, agriculture, and tourism. GDP dropped to below 7% growth in 2008 and probably contracted in 2009 as a result of the global economic slowdown. The global financial crisis is weakening demand for Cambodian exports, and construction is declining due to a shortage of credit. The long-term development of the economy remains a daunting challenge. The Cambodian government is working with bilateral and multilateral donors, including the World Bank and IMF, to address the country's many pressing needs. The major economic challenge for Cambodia over the next decade will be fashioning an

economic environment in which the private sector can create enough jobs to handle Cambodia's demographic imbalance. The population lacks education and productive skills, particularly in the poverty-ridden countryside, which suffers from an almost total lack of basic infrastructure. (UNDP, 2009)

The below figure indicates the ranking of global good practice economy in South East Asia in 2010:

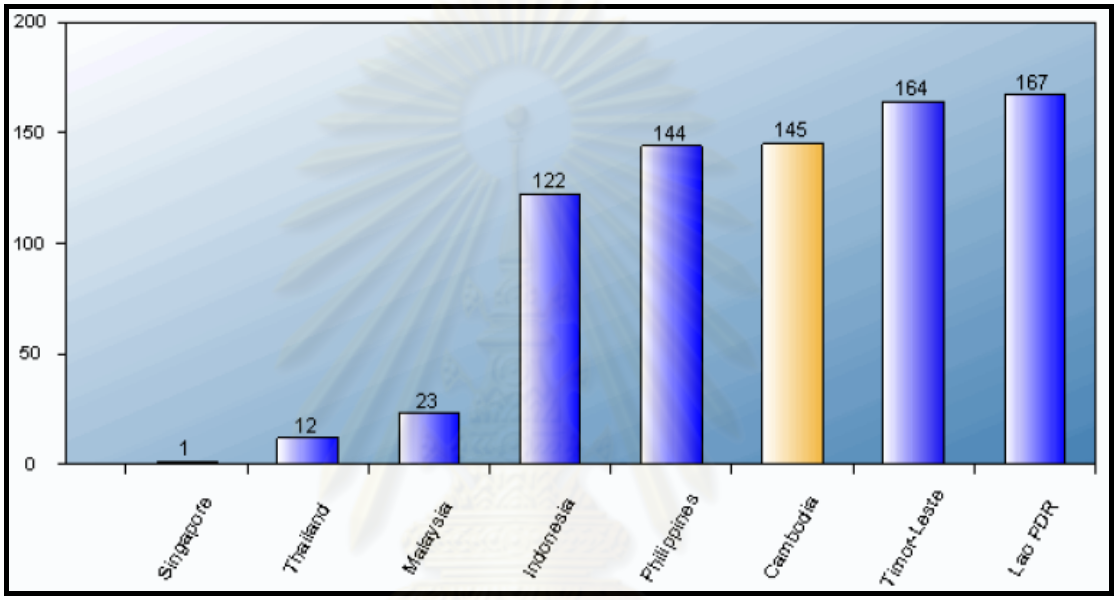


Figure 4.2 Ranking of global good practice economy (World Bank Report, 2010)

Cambodia's construction sector boomed over the last decade with projects increasing. Construction projects have increased in both scale and value with a large number of high-rise apartments, office buildings, residential, commercial and public facilities, villas, condominiums, trade and financial centers, office buildings, shopping centers, hotels, schools and hospitals, currently under construction. Imports of construction materials have rapidly increased hand-in-hand with the construction boom. The importance of the construction sector in relation to international competitiveness depends more on its role as an enabler than as industry in itself. It plays a fundamental role in the economy by providing the necessary public infrastructure and structures for government, business and domestic spheres of life.

The infrastructures in existence in Cambodia nowadays are shown in the figure below:

Figure 4.3 Pictures of infrastructures in Cambodia

4.2.2 Lao PDR Background

The Lao People's Democratic Republic is spread over total area of 236,800 square kilometers and its population is probably about 6,834,942 in 2009. Lao PDR is geographically a landlocked nation in Southeast Asia occupying the northwest portion of the Indochinese peninsula; Lao PDR is surrounded by China, Vietnam, Cambodia, Thailand, and Burma. It is a mountainous country, especially in the north, where peaks rise above 2,800 meters. Dense forests cover the northern and eastern areas covering an estimated 45 percent of Lao PDR, making it one of the most heavily forested countries in South East Asia. Thus, it has significant natural resources like forestry, minerals and hydro-electric power. The Mekong River, which forms the boundary with Burma and Thailand, flows through the country for 1,500 kilometers of its course. The World Bank estimated 70 percent of the country is considered mountainous or hill terrain with altitudes varying between 1,500 and 3,000 meters,

and less than 10 percent of the total area of Lao PDR is suitable for agriculture. The climate is tropical with a wet season from May to October and dry season from November to April. Agriculture is the major sector contributing 51 percent of Gross Domestic Product (GDP) and employing 80 percent of the labor force; the industrial and service sectors account for the rest (23% for industry and 26% for services).

The major cities are Vientiane (the capital), Savannakhet, Pakse, Luang Prabang and Khammoune (Thakek) which are located along Mekong River. Buddhism is the dominant religion with more than 85% of the population as believers. Lao PDR is a popularly communist state which is further sub divided into 15 regions and 1 municipality for convenience of administration. The map of Lao PDR is indicated as the following:

Figure 4.4 Map of Lao PDR (Wikipedia, 2009)

Lao PDR is the Least Development Country (LDC) with high levels of poverty as indicated by UNDP's Human Development Indicators. It is placed 133 out of 177 countries on the UNDP Human Development Index. The government of Lao PDR, one of the few remaining one-party Communist states began decentralizing control and encouraging private enterprise in 1986. The results, starting from an extremely low base, were striking-growth averaged 6% per year from 1988-2008 except during the short-lived drop caused by the Asia financial crisis that began in

1997. Economic growth has reduced poverty rates from 46% in 1992 to 26% in 2009. The economy has until recently benefited from high foreign investment in hydropower, mining, and construction. Despite this growth rate, Lao PDR remains a country with an undeveloped infrastructure, particularly in rural areas. It has a rudimentary, but improving, road system, and limited external and internal telecommunications. The three pillars of the strategy are to foster economic growth with equity, develop and modernize its social and economic infrastructure and enhance human resource development. (UNDP Report, 2009)

Figure 4.1 demonstrates that Lao government has planned from 2005 to 2020 to implement the economic strategy in order to increase the citizen's income following the population in the country.

Table 4.1 Economic strategy plans of Lao government from 2001-2020

Economic Strategy Plans	**Years**		
	2005	2010	2020
Population (million)	5.9	6.7	8.3
GDP (%)	7	7	7
Income/person (US$)	500-550	700-750	1200-1500

(Source: The report of 7th Laos Public's Revolution Committee Conference, 2005)

The construction fields continue growing in Lao PDR, reflecting a big increase in private demand for new construction. Many of private sectors from China, Korea, and Japan, have simultaneously invested various capitals to develop their new assets in this country including commercial banks, and shopping malls. Additionally, not only private works, but also public or infrastructure projects have arising extensively in both cities and rural areas in order to serve such public demands such as road, bridges, and dam system development and public facilities. The public projects are mostly supported by World Bank and Asian Development Bank since Lao government does not have adequate budget or capital to enable conducting many construction projects.

The infrastructures are being developed in the whole country, including building, road, bridge, and dam, which are illustrated in the below figure:

Figure 4.5 Pictures of infrastructure in Lao PDR

4.2.3 Thailand Background

Thailand is on the Southeast Asian mainland, adjoining the Lao PDR and the Union of Myanmar to the North; the Royal Kingdom of Cambodia and the Gulf of Thailand to the East; and the Andamann Sea to the West and Malaysia to the South. The area of Thailand, composed of 99.6% of land and 0.4% of marine territory, is approximately 514,000 square kilometers. Bangkok is the well-known city as the capital of Thailand. The population of Thailand was approximately 62.4 million in 2009, with many ethnic groups. The climate in this country is tropical, with an average low temperature of 23.6 degrees celsius and high temperature of around 39-40 degrees celsius during summer. Three seasons are present in Thailand: monsoon from July to October, cool from November until February and hot from March until June. The map of Thailand is shown in Figure 4.6:

Figure 4.6 Map of Thailand (Wikipedia, 2009)

Thailand is an emerging economy and considered as newly industrialized country in South East Asia, especially for construction industry. In this country, the construction industry has been growing since 1961, when the first National Economic and Social Development Plan was implemented, new technique have been introduced to construct infrastructure. The construction business grows side by side with the rapid development and expansion of the community (Sattayanon, 1984). In other words, Thailand is a rapidly developing country in terms of industrialization especially compared to other countries South East Asia. It also has own budget for infrastructure development. At the present, Thailand is considered as a strong country in terms of finance for infrastructure development. With a well-developed infrastructure, a free enterprise economy, generally pro-investment policies, and strong export industries, Thailand enjoyed solid growth from 2000 to 2008; averaging more than 4% per year, as it covered from the Asian financial crisis of 1997-1998. Thai exports, mostly machinery and electronic components, agricultural commodities, and jewelry, continue to drive the economy, accounting for as much as three-quarters of GDP. The global financial crisis of 2008-2009 severely cut Thailand's exports, with most sectors experiencing double-digit drops. In 2009, the economy contracted

about 2.8%. The Thai government is focusing on financing domestic infrastructure projects and stimulus programs to revive the economy, as external trade is still recovering and persistent internal political tension and investment disputes threaten to damage the investment climate. (UNDP, 2009)

The construction in Thailand derived from a combination of many factors such as local demands in the country, compared to many neighboring countries, the booms in tourism and external investments, mainly from Japan and other Asian tigers (Korea, Taiwan, Hong Kong, and Singapore). There have been lots of construction projects booming in this country consisting of high rise building projects, condominiums, hotels, shopping centers, factories, and other civil engineering projects. Figure 4.7 indicates the current infrastructures in Thailand:

Figure 4.7 Pictures of infrastructures in Bangkok

4.3 Data Collection in Cambodia

The infrastructure sector has been growing remarkably in the whole country including bridges, roads, canals, dams, and building projects. One city and one province in Cambodia; Phnom Penh and Siem Reap, respectively were thoroughly

investigated and surveyed to use in this research by referring to some building construction sites. As mentioned in Table 4.2, there are totally 14 construction sites; mostly large projects, were investigated and also 36 respondents consisting of 14 contractors, 12 consultants, and 10 owners, which were interviewed in detail in accordance with the developed questionnaire to clearly acquire the necessary data and information about specific aspects.

Table 4.2 Number of surveyed construction projects and respondents in Cambodia

Number of Construction Projects	**Number of Respondents**			
14	*Contractors*	*Consultants*	*Owners*	*Total*
	14	12	10	**36**

4.3.1 Construction Project Surveys in Phnom Penh

Phnom Penh Capital city was established at four intersections of rivers; Mekong, Tonle Sab, Tonle Bassac. These rivers provide potential freshwater and river ecosystem as important resource for sustainable environment condition, natural beauty and prosperous culture for people of Phnom Penh Capital City from the past and the present. Phnom Penh lies along the Mekong River which is the main river in Asia, 4,200 kilometers long. The original source of the river is from highland Tibet China. The river crosses Cambodia from North to South with total length 486 kilometers and passes Phnom Penh as an intersection of rivers to create attractive freshwater and ecosystem for the city. Phnom Penh covers on 375 square kilometers which is in rice field 11,401 hectares and wetland, lake, settlement and in roads 26,106 hectares. The agriculture land located in suburban areas in 3 Khans (Khan Doung Kuor, Khan Meanchey and Khan Resey Keo) is 34, 685 square kilometers, which is in irrigated land 1,476 hectares and non-irrigated land 6,724 hectares. Others cropped land is 1,330 hectares. The population in Phnom Penh is approximately 1,325,681 people (2009), with a total population density of 4,571 inhabitants per square kilometer.

The main economy is based on commerce such as garments, trading, small and medium enterprise, especially construction sector. Double-digit economic growth rates in 2008 triggered an economic boom, with new urban development such as new hotels, restaurants, bars, and residential buildings springing up around the Phnom Penh capital city. Unfortunately, the number of construction projects in Phnom Penh has been decreasing slightly due to the world economic crisis. Some projects which were under construction have been suspended or stopped for financial problems. However, there are still small and large construction projects operating in Phnom Penh city such as housing projects and commercial building projects.

In this research, there are only 10 big construction sites in Phnom Penh which were surveyed including tall condominiums, suburban small towns, large supermarkets, office buildings, and five star hotels, as shown in Figure 4.8 and Figure 4.9. Most of those construction projects belong to private owners which have invested the budget resources in developing their assets in Phnom Penh. Some investors have spent their own capital to build high class condominiums and office buildings, and after that they sell or rent these properties to those who can afford them. Similarly, small towns around the city have been developed mostly in the suburbs of the city. Those towns consist of small villas and tall condominiums surrounding them.

Figure 4.8 Building projects under construction in Phnom Penh

Figure 4.8 Building projects under construction in Phnom Penh

Figure 4.9 Interviewing a project manager of contractor in Phnom Penh

4.3.2 Construction Project Surveys in Siem Reap

Siem Reap is one of the best known provinces in the Northwest of Cambodia and is 314 kilometers from Phnom Penh. It borders Oddor Meanchey to the North, Preah Vihear and Kompong Thom to the East, the Tonle Sap Lake to the South and Banteary Meanchey to the West. The area of the province is 10299 square kilometers, while the population is estimated about 896,309 people. The topography of the province is variable from the Tonle Sap floodplains along the Southern border through a belt of lowland paddy fields to lowland/upland mosaic upland forested areas to the north. Siem Reap is classified as a rural province. The World Heritage Site of

Angkor Wat is located in this province. Since Siem Reap is well known for its tourist's spots, there are thousands of visitors from all over the world every year. In order to make them more comfortable and also to increase the number of visitors Siem Reap provincial government is taking a lot of steps to make visitors comfortable. Hotels and guesthouses in Siem Reap are found everywhere and afford able for the budget of tourists. There are about 142 hotels in Siem Reap operating at present. Political stability and improved safety, allied to the active promotion of Angkor Wat as a tourist destination, has resulted in rapidly rising visitor figures, turning sleepy Siem Reap into a Cambodian tourist hot spot. A new local airport was recently completed and is linked to several Asian capitals as well as Phnom Penh, while National Route 6 south to the capital and north to Thailand has been improved and the express boats are popular. With tourism, the town is developing apace, and a steady stream of new hotels, restaurants and bars are appearing though surprisingly, a small-town atmosphere still pervades, giving visitors the best of both worlds.

Like in Phnom Penh city, the construction projects in Siem Reap have been slowing down in recent years due to global financial crisis. This problem has resulted in suspending the construction process of many big projects. At present, there are some projects under construction including a few hotels, and some housing projects, etc. Additionally, Most of housing projects have been constructed by simple or minor contractors which are not the registered companies. This is because those small contractors provide lower charge of construction to clients than standard contractors do.

Consequently, there are merely 4 construction sites in Siem Reap which were surveyed and necessary information gather to study in this research. Those construction projects accordingly consist of one office building, two hotels, and one big flat project zone.

The Figure 4.10 shows the site investigation and the activity of data collection in one of the construction sites in Siem Reap.

Figure 4.10 Interviewing with a project manager of contractor in Siem Reap

4.3.3 Knowledge of Project Managers in Cambodia

All construction project managers who were interviewed and evaluated are local and working for private projects in accordance with the identified scope of study. They were interviewed in detail based on the developed questionnaire about information pertaining to the knowledge areas which are compulsory for project manager's responsibility. Another two interviewees; consultants and owners, also were asked to perceive their own opinions on the importance of knowledge areas for construction project managers of contractors.

According to the survey, the knowledge of local project managers of contractors which is used in construction projects mostly comes from their practical experiences. In other words, some of the local project managers obtain the knowledge and experiences through extensively working and practicing with foreign seniors in the companies. Of course, the construction project management is not available in the program of educational institution due to lack of human resources being capable of

lecturing project management field. After interviewing some contractors, consultants, and owners, the significant 13 knowledge areas for project manager's duties were obtained as the following:

- Cost management
- Time management
- Quality management
- Contract management
- Material management
- Labor management
- Equipment management
- Safety management
- Subcontractor management
- Documental management
- Communication management
- Human resource management
- Risk management

4.3.4 Competencies of Project Managers in Cambodia

Owing to the survey in Cambodia, the competencies of local project managers are partially elaborated and evaluated in terms of current situations and problems appearing in their construction works, which affect the competencies of project managers.

❖ ***Cost management***

Cost is one of the critical attributes that must be controlled by the project manager of contractor. Project costs are estimated to develop a budget within which the project manager must work. By the interviews with all principle actors in construction project, there are always many problems occurring in project process due in Cambodia for the local project managers' responsibilities. Starting with the cost estimating, some local project managers estimate the project cost through collective past experiences and information in order to yield the current project budget. That is to say, when possible, the project manager and superintendent are always responsible for developing the estimate or at a minimum, work as integral members of the estimating team. Their individual inputs regarding constructability and their personal commitments to the estimating product are essential to assure not only success of the estimate, but also the ultimate success of the entire project. In this survey, some project managers in Cambodia do not get along well with some superintendents, and also some team members do not rely on each other, which causes their jobs or cost estimating to be done inaccurately and inefficiently. Moreover, most project managers

in contractor companies are just able to use simple software to develop their estimates. Thus, this may cause some inconveniences in approximating the anticipated cost of a project.

Another issue of cost management in Cambodia is cost control. Some project managers do not start with a detailed estimate, so it is difficult to control the project costs.

❖ ***Time management***

Time management is just as crucial to project success as is cost management. It consists of project planning and project scheduling. Planning must be completed before a schedule can be developed. Certainly, most construction projects experience schedule delays due to many factors such as contractor, consultant, and owner, although, the local project managers of contractors in Cambodia in this study have taken into account project delay problems. Construction projects surveyed in Cambodia are mostly delayed in the completion of the tasks because the project managers do not determine or develop the exact construction schedules. Furthermore, the project managers in Cambodia determined the duration for each activity by using past experiences. Sometime, duration estimating is not accurate enough to be acceptable due to insufficient historical data.

Some of project managers do not update or revise schedules properly when the projects are significantly behind schedule or there has been many change orders. Consequently, the projects get serious delays due to low responsibility and qualification of local project managers.

❖ ***Quality management***

Quality management; an important project management function, is also one of the critical attributes of project success, with the others being cost, time, and safety because it has short-term implications affecting material and labor costs on a project and long-term implications affecting the overall reputation of construction firm. After interviewing consultants and owners in Cambodia, they complain that most project managers of contractors do not seriously take into consideration about quality of project works which is the most essential focus for owners. The project managers and superintendents do not work together well to ensure that all materials used and all

work performed on a project conform to the requirements of the contract plans and specifications. The project managers sometime organize or delegate careless or unreliable superintendents to work as quality controller. This means that project managers ignore or are not very concerned about the selection of those who are under project organizations which reduces the quality of work leading to low level. Relating to quality management, some of serious problems often occur in Cambodia after the construction work items are already installed such as failure of testing, because the project managers do not appropriately develop the quality control plans to use on the project prior to initiating actual construction.

❖ ***Contract management***

The construction contract describes the rights and responsibilities of the owner and the general contractor, as well as the terms and conditions of their relationship. This knowledge is essential if the project manager is to supervise the project effectively. In Cambodia, most construction firms have prepared and used their own contract forms or have had their attorneys customize documents for their firms. Such documents, for the most part, are unproven; they are easily challenged and may end up in court. But some parties in construction projects, especially owners and contractors; can negotiate together to solve the problems when the construction projects have troubles such as schedule delay, based on the construction contracts without going to the court. In additional, some project managers of contractors in Cambodia do not read completely or understand well each contract document of projects to identify contract requirements and any associated risks before deciding to pursue a project. This may causes many troubles to contractors during project execution because contract documents are the basis for determining a project budget and schedule. According to the surveys, there are not many significant problems occurring in construction projects in Cambodia involving contract management because of project managers' accountabilities.

❖ ***Material management***

Building materials are necessary to complete the project. As the surveys in Cambodia, some materials in construction projects are furnished by the subcontractors especially formworks, while others are procured by the main contractors. Most major

construction materials, especially steel, must be imported from other countries such as China, Thailand, and Vietnam, since there is not any steel construction plant in Cambodia yet. Thus, the cost of imported materials is very high if compared to neighboring countries. Material procurement is also a main issue of material management for project managers in Cambodia since some of them are not able to initiate material procurement early in the construction process to ensure that materials are available on site when needed by the construction workers, which causes the project schedules delay. The reason why the materials cannot be delivered on time to the sites is that some of project managers do not develop the appropriate scheduling material deliveries clearly. For instance, special manufactured items including structural steel, reinforcing steel, and some inferior finished items that must be shipped long distances must be ordered early, and adequate time must be scheduled to allow for the submittal and review of shop drawings, product data, and product samples.

Furthermore, some of project managers in Cambodia always concern about material usage during the construction process. This means that it is very difficult to control the materials stocks due to lack of up-to-date software.

❖ ***Labor management***

Labor management is one of the critical problems often occurring in construction sites in Cambodia during the construction processes. From the interviews, local project managers mostly complained that it is very difficult and complicated to control the workers' activities. Starting with the unavailability of workers, most of construction workers are farmers coming from the country side in the dry season in an attempt to perform the works in construction sites at cities or central areas. Then, they usually return to their hometowns to do farming when the rainy season comes, while construction sites require workers to carry out such works. As a result, construction projects are continually delayed due to the uncontrolled variation in amount of workers. Concerning the skills, it is extremely hard to find skillful laborers to work in construction sites because most of them do not formally get any work training before coming into construction fields. In other words, they execute the current construction tasks by using their past experiences from previous sites that causes unsatisfactory quality of works.

Since most of local workers possess very low education, even morality, the conflicts among unknowledgeable workers unavoidably arise in construction sites during the construction process. The local project managers do not pay much attention to this matter which can seriously impinge on the projects' performances including time constraint, limited cost, and requirement quality.

❖ ***Equipment management***

Equipment is a vital resource to the accomplishment of a construction project. Without those things, the construction works are not able to operate smoothly and might take too long time to be achieved. Simultaneously, a correct and complete understanding of the equipment costs is essential for project manager's responsibilities because it can economically provide companies a market advantage that leads to greater profits.

As seen in the surveys in Cambodia, core equipment used in building construction sites such as excavators, pile-driving equipment, and cranes, are mostly supported by owners and sometime they are from subcontractors. That is to say, some contractors do not have adequate resources to purchase the principle equipments due to high cost of machinery. Hence, the project managers of contractors do not frequently participate in managing construction equipment in construction sites beside the determination of the needed equipment to perform the works in project sites. However, the project managers have been largely in charge of the safety of equipment utilization and also the subcontracted cost relating to equipment.

❖ ***Safety management***

The safety management of construction projects in Cambodia is not standardized enough because there have been many workers injured and fatal during construction executions. The primary cause of job site injuries are falling from an elevation, while there are other incidents in industrial work force such as electric shock, being struck by something, and being caught between two objects. The project managers are responsible for orienting the safety management of the workers, equipment, and materials on their project sites. According to the interviews, many construction sites have set safety programs to reduce the risk of injury and to increase worker productivity. For instance, they have some worker training for using machines

and conduct weekly safety meetings with workers to maintain a continuous emphasis on hazard removal and safe work practices. However, some of project managers of contractors often encounter the problem of worker's safety. This means that it is very hard for them to control the worker's safety during construction process because most construction workers have low level knowledge related to the construction safety, and they do not understand how important the safety is. The management's commitment to safety of project managers is crucial in construction sites because job site safety is a significant project management issue which is costly leading to disruption of the construction schedule and demanding significant management time for investigation and reporting.

❖ ***Subcontractor management***

General contractors in Cambodia typically use subcontractors to execute most of the construction tasks involved in the projects in order to reduce risk and provide access to specialized skilled workers and equipment. By subcontracting significant segments of work, the project managers can partially transfer much of the risk to subcontractors because one of the risks in contracting is accurately forecasting the amount and cost of labor required to complete the projects. From the interviews, however, there have been such risks and problems occurring in construction projects in Cambodia involving the subcontractor management since some project managers give up some control when working with subcontractors. Moreover, there has not frequently been mutual trust and respect appropriately between the project managers or superintendents and the subcontractors, which leads to impact on the overall quality, cost, and schedule for the projects.

Another issue is the quality subcontractor selection that is essential for project success and also being able to complete the project to the desired standards without experiencing financial problems. In Cambodia, some project managers select subcontractors simply on price regardless of qualification such as good safety record, skilled workers, and good equipment, which often leads to problems on the projects with quality control or timely execution.

❖ ***Documental management***

A submittal, which is a document or product turned in by the construction team to verify that what they plan to purchase, deliver, and ultimately install, is in fact what the design team intended by their drawings and specification. From the interviews, there are many types of submittals in construction projects in Cambodia such as shop drawings, product data sheets, samples, and monthly progress payments. Late submittal is also one of the main problems for Cambodian project managers, which leads to the delays of construction process. Starting with the determination of submittal requirements from contract specifications, some local project managers fail to do that in such works, which results in the construction projects not progressing smoothly.

Furthermore, most project managers only establish or develop the master project schedules regardless of the submittal schedules which allow project managers to be aware of what critical documents to submit to the stakeholders and also to identify some of the hidden errors of the individual works of all parties in projects.

❖ ***Communication management***

Communication means acquiring and transmitting information. It is the most critical project management tool. In terms of language, English is widely used in construction projects in Cambodia for exchanging information regarding a project to expedite the flow of information among members of the project team in case of having foreign stakeholders.

As stated by the surveys, most of local project managers are able to use English language formally as a communication tool. Electronic mail is being used to coordinate field questions with designers and subcontractors, coordinate material deliveries with suppliers, and coordinate project issues with owners. Therefore, in Cambodia, there is not any significant problem in communication management in construction projects.

❖ ***Human Resource management***

It describes human resource management of construction project responsibilities of the project manager, which involves staffing, performance measurement, and engineer development. Of course, there have been many issues

related to human resources in Cambodia due to lack of qualified engineers. For instance, from the interviews, all of large building projects including condominiums, high rise buildings, and supermarkets…, have been definitely designed by foreign engineers such as Korean, Thai, and Vietnamese…, since local engineers possess insufficient capability to afford the designs of such large projects.

Furthermore, there are not much skill enhancement training and development training conducted by project managers in construction firms in Cambodia to improve local engineer performances in their current position and to provide the local engineers with necessary skills to allow them to compete for higher level positions within the company. This is because most construction companies in Cambodia have limited budgets to support the specific training programs for their staff. However, there are still some construction firms sending their staff to implement some training in other countries in order to get and expand their knowledge.

❖ ***Risk management***

Construction projects are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints, given budget, satisfactory quality. From the surveys, beginning with risk identification, before performing construction phase some project managers in Cambodia do not properly determine which risks are likely to affect the project such as cost estimates and quality planning, and documenting the characteristic of each. This has caused many complicated problems occurring repeatedly in construction projects after the tasks were finished.

Mostly, owners commissioning the construction projects are concerned that the project is within the budget price and operate on time. The contractors have the same objective but their aim is to make a profit on the construction. The contractors' view of the risk is to manage the project within their cost estimate. This means that both parties are seeing the risk from a different viewpoint. Obviously, the primary project risks that most of project managers in Cambodia rarely foresee and control are project schedule and project quality. For instance, one of the real problems occurring in construction sites in Cambodia is bored pile issue. The test indicated that some bored piles did not pass standard strength after installation. This unexpected result caused serious trouble for project manager of contractor regarding bored pile quality.

4.4 Data Collection in Lao PDR

Because there are many construction projects when compared to other cities and provinces, one capital city and one province; Vientiane and Luang Phrabang, was selected to conduct the surveys in order to collect the required data in accordance with this research. Based on the limit of construction projects and proper assumption, only 11 construction projects were investigated and elaborated with detail in this thesis by referring to knowledge and competencies of project managers of contractors in this country. There were 24 respondents including 9 contractors, 8 consultants, and 7 owners, who were directly interviewed in an attempt to obtain the detailed information, as indicated in Table 4.3:

Table 4.3 Number of surveyed construction projects and respondents in Lao PDR

Number of Construction Projects	**Number of Respondents**			
11	*Contractors*	*Consultants*	*Owners*	*Total*
	9	8	7	**24**

4.4.1 Construction Project Surveys in Vientiane

Vientiane is the capital city and also the largest city of Lao PDR, situated on a bend of the Mekong River, which forms the border with Thailand at this point. The estimated population of the city is about 600,000. When compared to the hectic capitals in other Southeast Asian countries, Vientiane offers something unusual for an Asian City, the possibility of some peace and quiet. Moreover, Vientiane is a safe city in terms of crime. This city is served by Wattay International Airport. Economically, an interesting shopping venue is the Morning market that is a large collection of indoor stalls selling most anything. There are also department stores, craft outlets and many restaurants around and in the city. Furthermore, tourism is also one of the main incomes of local people. Many hotels, restaurants, and variety of facilities are comfortably serving domestic and foreign tourists.

After passing a period of data collection, 11 construction projects in Vientiane were surveyed by gathering compulsory information from main actors in projects; contractors, consultants, and owners. Figure 4.11 and Figure 4.12 demonstrate the explored construction projects consisting of shopping mall, commercial building, office building, and road system. Some Korean, Chinese, and Vietnamese investors have invested their capital to establish commercial properties in Vientiane in order to gain mutual benefits. This investment pushes the Lao economic growing by providing various jobs for local people and open-mind trades. Simultaneously, ADB and World Bank also help develop public facilities in Vientiane such as hospitals, and road network, in an attempt to correspond to the local needs.

Figure 4.11 Pictures of surveyed construction sites in Vientiane

Figure 4.12 Interviewing contractors, consultants, and owners in Vientaine

4.4.2 Construction Project Surveys in Luang Phrabang

Luang Phrabang was formerly the capital of a kingdom of the same name. it is also notable as a UNESCO World Heritage Site. It is a province located in north central Lao PDR, where the Nam Khan river meets the Mekong River about 425 kilometers north of Vientiane. The main part of the city consists of four main roads located between the Nam Khan and Mekong rivers. The city is well known for its numerous temples and monasteries. The current population of the province was about 103,000 in 2009. Luang Prabang features a rich local heritage which combines traditional architecture and urbanism with French colonial influences. The city is famous for its scores of Buddhist temple complexes, some dating from as early as the

15th century, which display the highest refinements in decorative arts and building crafts. The traditional system of crafts training and consequently temple maintenance and building was traditionally located within the monkhood.

Luang Phrabang has both natural and historical sites. At the end of the main street is a night market where stalls sell shirts, bracelets, tea-suitable souvenirs. A long with the magnificent pagodas, a significant part of the old towns' appeal are the many French provincial style houses. The number of tourists in the area is expected to increase rapidly, thus creating pressure to modernize the tourist infrastructure is very important to particularly cater to package tourism. (UNDP, 2009)

The data collection was conducted by interviewing some contractors, consultants, and owners, as shown in figure below:

Figure 4.13 Interviewing three parties in Luang Phrabang

There are some construction projects in Luang Phrabang province such as infrastructure projects, and housing projects. It is noticed that housing projects are allowed to construct with maximum 2 floors as authorized limitation because they want to keep the province natural. Therefore, the data collected from this province was not analyzed due to unacceptable scale of projects.

4.4.3 Knowledge of Project Managers in Lao PDR

From the surveys, construction field is not absolutely booming in Lao PDR. Nowadays, it is just starting to increase development in terms of construction projects. That is why the knowledge level of local project managers of contractors is still

limited based on the current situation. Of course, knowledge of senior project managers is derived from their work experiences when they work with foreign partners or organizations. They learn a lot of useful work techniques from external firms. In contrast, some young project managers possess knowledge obtained from a public university which has construction project management courses from Bachelor's degree to Master's degree. However, many Thai instructors cooperatively come to provide some lectures to Lao master students since the university partly lacks human resources in term of lecturers.

4.4.4 Competencies of Project Managers in Lao PDR

❖ ***Cost management***

The first thing of cost management that project manager of contractor must perform is cost estimating which is the process of collecting, analyzing, and summarizing data in order to prepare an educated projection of the anticipated cost of a project for the competitive bidding. Owing to the surveys, cost estimating has been done by Lao project managers of contractors themselves, not by the estimating department; regarding the size of company. They practically use past experiences and historical data for approximating the cost of project. They also check the market price and historical information for material cost and labor cost. However, the greatest risk for Lao project manager in developing a cost estimate is predicting the cost of material and the productivity of the craft workers. The fluctuation of material and labor cost are the most difficult items for Lao project managers to estimate and are therefore the most risk because they do not have proper factor in estimating the cost for reserving the cost variation in the future.

❖ ***Time management***

Schedules are important tools of all members for the owner, design, and construction team. On all the sites surveyed, Lao contractors used the bar chart for planning and monitoring. Some of the plans are decorative and lacking in sufficient detail as the project managers lacked the experience to prepare good plans. Unavoidably, the construction projects in Lao PDR mostly suffer delays because of many unforeseen causes. From the interviews, Lao project managers sometime develop the project schedules without going into the detail of general site conditions

such as site location, and site access, which are significant impacts on delays of projects during construction operation. In addition, schedule development of Lao project managers do not firstly begin to consider many variables such as material deliveries and manpower which are the most risky in construction field. That is to say, material deliveries from other countries are mostly late to supply on sites since local project managers do not mention in detail the duration of material purchase orders in the main schedule. Similarly, they do not put the period of manpower shortage in the developed schedule during long holiday or national festivals, which makes the construction works encounter delay problem.

It is very hard for Lao project managers to monitor the progress of each activity in the construction schedule and to determine the impact of any delayed activities on the overall completion of the projects since regular updating of plans is not done well. Lao contractors argued that since clients are in the habit of changing their minds very often, detailed short term planning is unnecessary. Consequently, without updates, the schedule loses its accuracy. The owners, designers, and subcontractors would stop relying on the schedule, and the contractor would lose a valuable project control tool which the schedule was intended to provide.

❖ ***Quality management***

The project quality management is a detailed planning explaining how the contractor company will assure that the construction work will be made to the client's requirements. According to the surveys, the quality of work is one of main concerns in construction projects for Lao contractors since local project managers possess limited capability to effective quality planning for the entire project. Although they perform construction works following all specification and scope of contract, the problems of work quality always occur due to skill of laborers. The level of skill of Lao workers is relatively low, which leads the quality of work falling. Thus, Lao project managers should better consider this issue because it is also a critical factor that impinges on the client's satisfaction. On the other hand, quality assurance and quality control (QA & QC) are not widely applied in construction projects in Lao PDR regarding the size of projects. This quality management system is not used in some surveyed construction projects, which causes a lot of troubles among all parties in the projects related to the outcome quality.

However, some project owners and consultants cited that Lao project managers are mostly able to control the quality of construction materials including structure and finishing materials, because the specifications of those materials are clearly mentioned in contract documents.

❖ ***Contract management***

The contract documents describe the completed project and the terms and conditions of the contractual relationship between the owner and the contractor. All surveyed projects in Lao PDR preferred to use unit-price contract because it allows some flexibility in meeting variations in the amount and quantity of work encountered during construction. The various contract formats are individually used in construction projects in Lao PDR in accordance with types of project and the clients such as governmental contract, ADB, and World Bank.

The main problem of Lao project managers involving the contract management is the poor understanding of contract because of lack of attentiveness. In other words, they do not clearly read all complex contract documents comprising general agreements and conditions, special conditions, and technical specifications. Unless they unexpectedly encounter serious problems in construction projects, they immediately check and verify in detail everything in the contract but it seems to be too late to deal with such problems.

❖ ***Material management***

Most of main construction materials are accordingly imported from other countries, especially, Thailand and Vietnam, although there are a few corporation factories in Lao PDR such as cement plant and steel plant. Construction productivity is greatly influenced by the organization of the project site and the flow of material through the site in Lao PDR. Supply of major construction materials is less than demand. Continued expansion in the construction sector of the economy creates supply problems which drive up the prices of materials in this country. Local manufacturers can not expand production facilities fast enough to meet demand. Therefore, material suppliers can afford to charge high prices for poor services.

In addition, as can be seen from the structural system, cement is used extensively in the Lao construction industry both for in situ construction and for pre-

casting. Cement shortages also mean that ready mixed concrete is also in short supply. Shortage of other construction materials such as reinforcing steel is also experienced. The government intervenes from time to time to ease the shortage by giving permission for the import of materials to supplement local production, but such importation is often too late for many projects because Lao project managers of contractor do not prepare well the schedule of material orders and deliveries. That is to say, they do not put or mention the material scheduling in master project schedule, which causes reduction of profits from clients when the construction projects experience delays.

❖ ***Labor management***

The construction manpower working in Lao PDR is not only local, but also foreigners consisting of Thai and Vietnamese laborers because not enough local workers are available enough to support the demand of construction field. Combining multi-nation workers together often causes labor conflicts in construction sites due to their poor communication. The critical problem of labor found in nearly all surveyed construction sites is the lack of locally skillful workers and low productivity. According to the surveys, Lao laborers have low skills to implement their works because most of them are farmers coming from remote areas, are have never learnt the basic skills of construction work before. Relatively, the productivity of work also depends on the skill of labor. For instance, the skillful manpower could yield more productivity than those who have low skills.

Manpower is by far the most variable and unpredictable factor. Seasonality of employment in construction is another problem which may lead the project delays because of shortage of labor. Many local workers do not take construction work as all year round work. They usually go back to their village at harvest and planting times. The local manpower problems have created serious quality control difficulties for project management since they possess very low responsibility for their work performance whereas the only thing they think about day by day is money. It is accepted that the often low quality standards of the buildings is due to the quality and supply of construction manpower.

❖ ***Equipment management***

Equipment resources play a major role in any construction activity. Decisions regarding equipment type and combination can have a major impact on the profit-ability of a job of project managers of contractors. The construction equipment used in sites is mostly imported from China and Japan based on the surveys in Lao PDR. Starting with equipment planning, Lao project managers possess some problems to select the equipment combination that yields the maximum production at the best or most reasonable price because they do not have a basic understanding of the exact costs to buy or rent the particular piece of equipment. From the interviews, disputes with neighbors are also cited as being responsible for work stoppages in Lao PDR. This often creates severe restrictions of working space for equipment such as tower cranes and sometimes imposes restrictions on working times such as no over time at night. This is a common problem with projects in all urban centers and is not considered to be a special problem in case of this country. However, this problem might cause construction projects delay or the projects cannot be accelerated to finish on the determined schedule. Furthermore, the equipment operators do not have enough experiences to direct or handle the equipment such as tower cranes, which causes accidents on sites and low productivity as well.

❖ ***Safety management***

The construction industry has many special features which adversely influence the safety and health of those who work in it as compared with workers in manufacturing industries. These influences are felt in all countries; they are especially serious in developing countries. By the observation, safety strategy implementation in construction sites is not good enough for workers because personal protective equipments is not widely used in some surveyed sites in Lao PDR. It is the contractor's responsibility to see that everything possible is done to provide a safe working environment for the work force and the public in general. The local project managers do not take any serious action involving the safety to prevent the site accidents. However, some construction sites still conduct some meetings mentioning about the site safety such as daily, weekly, and monthly meetings.

On the other hand, there is no safety standard for construction sites in Lao PDR because the safety regulations have not yet been issued for execution. That is

why the risk of accidents occurring in construction sites is very high both for the workers and for the public.

❖ ***Subcontractor management***

Generally contractors typically use subcontractors to execute most of the construction tasks involved in a project. From the interviews, there are many problems with subcontractors in construction projects operating in Lao PDR because of many factors. First of all, regarding the subcontractors' experiences, some of them have low qualification based on experiences, technical skills, and safety performance, to carry out the construction work with absolutely satisfactory standard. The next issue is work quality; Lao subcontractors perform their jobs with low responsibility because they are not seriously penalized by the clients directly when the time schedule and project quality are not sufficiently satisfied. Another matter is lack of relationship between main contractors and subcontractors. The project managers and superintendent do not seriously establish a cooperative relationship with the subcontractors and their foremen by conducting regular coordination meetings to discuss their concerns.

Since most of the construction work is performed by subcontractors, efficient management of their works is critical to the project manager's ability to control cost and complete the project on time.

❖ ***Documental management***

Document submittals allow the project manager to identify some of the hidden errors because it is a key part of the overall quality management program for the project. As stated by the interviews, the poor document systems were found in some construction sites in Lao PDR because some project managers do not particularly look at submittals as the first step in quality control, and as a tool to complete a successful project.

Furthermore, late submittals often occur in all surveyed projects because some Lao project managers do not primarily create the effectively managed submittal program which is a necessary tool to achieve the successful construction projects. In summary, late submittals is a major problem of documental management for Lao project managers, which definitely impinges on the project schedule. Certainly, the

submittal is essential because it is a document or product turned in by the construction team to verify what they plan to purchase, deliver, and ultimately install, in fact what the design team intended by their drawings and specifications.

❖ ***Communication management***

A good project manager who knows how to estimate, plan, schedule, and execute most likely will fail unless he also has good communication skills. By the surveys, most Lao project managers of contractors are able to use foreign languages; especially English, to communicate and distribute information with international owners or consultants. They also use both electronic mail and hard-copy to transfer important information to each other from planning process to construction process. Particularly, E-mail is widely used in construction communication in Lao PDR because it is an excellent substitute for telephonic communication and provides a written record of each communication, substituting for the telephone memorandum. Moreover, regular meetings; especially international projects, always hold to provide a forum for direct communication and timely and efficient information exchange, and also allow the parties involved to take appropriate action and make the decisions necessary to maintain the scheduled flow of work.

Unlike international projects, however, local projects still have limited communication system for sharing information because some Lao project managers possess inadequate education on communication management.

❖ ***Human Resource management***

Human resource management activities play a vital role in ensuring that an organization will survive and prosper. Organizational design involves identification of the specific responsibilities of each position. As cited by the interviews, the staff organization is not properly done in some construction projects in Lao PDR because there are some shortages of teams of contractors to work in one construction project. For instance, one engineer is accordingly assigned by project manager to excessively handle or manage many works beyond his or her influenced domain. Furthermore, the main problem related to the human resource is the lack of professional personnel or skillful staff or engineers to work in construction field because the demand increases while supply from educational institutes and training centers is relatively constant.

❖ ***Risk management***

Construction risk is the most hazardous factor which influences the project's delay. Many project managers have not yet realized that there is a need to include project risk as a management issue. From the surveys, there are many consequences of risk during construction operation because Lao project managers do not survey in detail about the project risk before the projects start. For instance, regarding estimated cost for bidding, some contractors provide very low quotation to the bid in order to competitively obtain the project works. Hence, the contractors would encounter high risk of benefit loss after they get the construction works. Moreover, another kind of risk is material supply, late material deliveries often occur in sites in Lao PDR during construction process because local project managers do not prepare well the material procurement scheduling; especially orders from other countries.

Using the old equipments is also one construction risk which can causes delay to the construction projects in Lao PDR. That is to say, the second-hand equipment is not reliable and often breaks down, which leads to some accidents on sites, and needs repairing repeatedly. Sometime it requires quite long time to import some spare-parts of broken equipment from neighboring countries. On the other hand, in terms of labor risk, most Lao project managers develop the project schedule without reserving the time for absence or shortage of workers in big festival or long holiday, which is one of impacts on the delay of project schedule.

4.5 Data Collection in Thailand

The survey was made on building projects, mostly large projects, only located in Bangkok city which is the biggest city in Thailand; therefore it would seem inappropriate to generalize for the whole of Thailand on the basis of the data. However, a large proportion of the high-rise building construction works in Thailand (over 80%) are located in Bangkok. Sampling in this case study, due to some unexpected constraints, covers only 12 construction sites which were surveyed and also 31 respondents were interviewed based on the formal questionnaire, including 12 contractors, 10 consultants, and 9 owners, to obtain their thoughts in terms of the current situation of construction projects, and their knowledge and competencies.

Table 4.4 Number of surveyed construction projects and respondents in Thailand

Number of Construction Projects	**Number of Respondents**			
12	*Contractors*	*Consultants*	*Owners*	*Total*
	12	10	9	**31**

4.5.1 Construction Project Surveys in Bangkok

Bangkok, the capital of Thailand is situated on the low flat plain of Chao Phraya River which extends to the Gulf of Thailand. The total area of Bangkok is about 1,500 square kilometers, while it has a population of approximately 12 million. Formally, as now, it is the country's spiritual, cultural, diplomatic, commercial and educational hub. This great city has had astounding success in combining the ancient and modern world. Bangkok is the economic center of Thailand, dominating the country's economy and dwarfing any other urban centers, also with one official international airport called Sovarnaphumi.

Economically, Bangkok City has been undergoing rapid urbanization and industrialization since 1960. The provision of well-developed infrastructures has enabled development of Bangkok as the focal center for economic, culture and administrative activities. Consequently, the increasing population is due to the development of infrastructures such as highway networks, sky trains, subway systems, real estate developments, land value, public policy as well as advancing economy which resulted in expansion into the surrounding areas. In addition, the city has a registered 1,000 skyscrapers and ranks 17th as the world's tallest city. This does not include hundreds of new buildings predicted as part of the construction boom in the coming years.

Most of surveyed sites under construction in Bangkok are large and high buildings including office buildings, multi-purpose buildings, and tall condominiums, as shown in Figure 4.13. They are being constructed with high management performances in accordance with the surveys. For instance, there are sufficient facilities on sites and office sites as well such as proper protection fences and

conscientious security guards, sufficient major equipment, internet access, and various safety accessories.

Figure 4.14 Pictures of surveyed construction sites in Thailand

Figure 4.14 Pictures of surveyed construction sites in Thailand

4.5.2 Knowledge of Project Managers in Thailand

Successful construction projects are delivered by knowledgeable project managers. According to the surveys, the construction project management is available in undergraduate courses in almost every university in Thailand. That is why all local

project managers have a basic understanding of the construction process, the construction methods used in the industry, cost estimating, and project planning and scheduling. In addition, some of local project managers are sent abroad by their own construction companies for training in order to expand and gain new knowledge.

4.5.3 Competencies of Project Managers in Thailand

Current features and problems in construction projects caused by project managers are mentioned in this study based on the surveys in order to roughly reveal their competencies to apply the knowledge of management in controlling the whole projects.

❖ ***Cost management***

Building construction estimating is the determination of probable construction cost of any given project. Many items influence and contribute to the cost of a project; each item must be compiled, analyzed, quantified, and priced. By the interviews in Thailand, some consultants complained that cost estimates were prepared by the estimating office of the construction firms, not project managers. Thus, some project managers who must directly build the projects within the budget developed from the estimate do not understand well how it was prepared, which leads the project to troubles related to the cost control. Additionally, the obvious sources for estimating project costs are past experiences of individual project manager and historical information. The knowledge of the procedures for estimating is required by almost everyone involved in or associated with the field of construction such as construction teams, designers, drafters, subcontractors, and material suppliers.

It is similar to Cambodia engaging with cost control; to control cost is an obvious objective of most project managers, but it should be recognized that no amount of project managers' works in Thailand achieves this cost control in accordance with the surveys. Most especially, it is more difficult to control material cost variances than anything else.

❖ ***Time management***

Thai project managers estimate an activity's duration by collecting the information available from previous projects. If an activity has been performed

before, its duration should be accurately predicted, whereas activities with a new scope of work for project managers are difficult to measure or dependent on other uncertain variables. In addition, they stated that skilled laborers are also one effect on project's schedule. If most of workers were full of specialized skills in construction process, the project schedule would be pushed forward to reach the requirement. In contrast, construction operation would be slower than the developed schedule because of lack of skilled laborers to perform such work.

Most Thai project managers normally use computers to develop the project schedule. Computer-generated schedules allow the project managers to determine quickly the effects of changes in schedule logic, delays in delivery of critical materials, or adjustments to resource requirements.

❖ ***Quality management***

Total quality management is a management philosophy that focuses on continuous process improvement and customer satisfaction. Owing to the interviews in Thailand, the contractors have a policy to do construction tasks following the identified project standards or specifications mentioned in contracts. The performances or quality of construction works would be done based on all specifications in every dimension. They also opined that with the attention to conformance as the measure of quality during the construction process, the specification of quality requirements in the design and contract documentation becomes extremely important. However, the work quality might depend on the skill or specialty of laborers, especially workers of subcontractors. That is to say, some of Thai project managers seem to have difficulty in selecting subcontractors with skillful laborers since they do not have past relations from previous construction projects. They also stated that the work quality would be accordingly in low level if they definitely chose unreliable subcontractors with low skill of laborers.

Another issue from some construction projects in Thailand is related to the shop drawing combination among structural, architectural, and M & E drawings. Those drawings are sometime not compatible or relative to each other because of lack of strong coordination. This might lead to some problems occurring involving the quality of work after some work components is completed.

❖ ***Contract management***

The general contractor is responsible for completing the entire project in strict accordance with the plans, specifications, terms and conditions of construction contract. After doing surveys, it is noticed that a number of Thai project managers encounter some problems with complicated or large construction contracts. Some of them misunderstand construction scopes declared in contracts because they read the complex contracts carelessly. Another matter from the surveys is obviously the ignorance of project managers to contract documents. Some Thai project managers let head offices manage and control the construction contracts. They do not see any contract in detail by themselves. Eventually; unexpected problems arise over job sites such as out of scope of contract, risky construction process.

Moreover, a number of Thai project managers complained that some contract documents are not well-defined and detailed with adequate information which leads to some difficulty for them in terms of scope and specification of work.

❖ ***Material management***

The successful operation of materials in buildings requires an understanding of their characteristics as they affect the building at all stages of its lifetime. In fact, construction materials used in construction projects in Thailand are mostly local products because there are many factories and plants operating intensively in this country such as steel, cement, finishing materials. Regarding to construction projects, first of all, material procurement for most of the sites surveyed is made by the head office though few sites can purchase materials directly in emergencies. Blame for materials shortages on sites are placed on unreliable supply from materials suppliers and also there are specific instances in which there is poor communication between project managers at sites and head offices and material suppliers. Likewise, material procurement sometime takes quite a long time to delivery on site in term of size of company, which certainly affects the construction period because the project managers do not set up effective material scheduling.

Concerning material stock management, in terms of size of company, most of Thai project managers always complained that it is very hard to monitor the material stocks at construction sites.

❖ ***Labor management***

The quality and quantity of labor supply is one of major impacts in construction projects. It is found that low productivity and shortage of laborers are the critical impacts on construction performances in Thailand. From the survey, construction sites in Thailand mostly contain not only local workers, but also foreign workers, especially from Laos, Burma, and Cambodia, because of high work demand in construction field. The difficulty of communication among foreign and local workers is one main problem influencing the quality of construction works. The low productivity and quality of foreign workers are also one of main factors affecting the efficiency of project progress.

Additionally, most Thai project managers complained about variation in number of workers that is short of skillful laborers in construction sites when urgently required during big festivals or long holidays in the country. Additionally, it is considered as a simple problem in Thailand that construction workers return to their home town in the rainy season to do farm field work because most of them are originally farmers who did not have any skill of construction before.

❖ ***Equipment management***

Equipment used in construction project in Thailand is mostly imported from other countries such as Europe, Japan, China, and the like. Equipment related significant problems do not feature prominently on the construction sites in Thailand. However, some construction sites have problems of insufficient numbers or improper types of equipment and breakdowns. Furthermore, the second-hand or old equipment is partly used in construction sites since the price of new equipment is very high. Old equipment definitely slows construction progress because it sometimes mal-functions and breaks. Time is spent out of the construction schedule to repair such equipments frequently.

What is more, equipment planning is also one factor contributing to delay cause of the project progress. A number of Thai construction sites often encounter equipment usage problem because they are not ready to use when the sites requires them to perform the works. This shows that some Thai project managers do not pay much attention to setting up the equipment planning to facilitate the construction process.

❖ ***Safety management***

The construction industry continues to be the industrial sector responsible for the most occupational accidents, injuries, and fatalities. Many reasons have been postulated for the poor safety record of construction. Like other countries, Thailand unavoidably faces such problems of safety in construction sites due to inadequacy of safety planning and regular inspection although many projects have similar repeat requirements, such as hard hats and personal equipment for preventing job site accidents during construction process. A number of surveyed Thai project managers sometime do not strictly consider about safety matters in construction sites based on opinions of consultants. In other words, they are not that concerned about unforeseen job site accidents, and they also fail to yield effective regulations and practices for alleviating such safety problems in construction sites.

Another difficulty to control is workers' activities which are done without careful performances to safety of each job on construction sites. Most construction laborers possess low knowledge related to safety, which can frequently cause them to fall easily in job site accident aspects. This is because some Thai project managers are not willing to convincingly motivate workers to not only properly use personal protection equipments but also to show considerably concern to construction safety.

❖ ***Subcontractor management***

Subcontractors are essential members of the project manager's team; typically, they perform most of the work on a construction project. According to the interviews, some contractors in Thailand have limited competent subcontractors to support the construction projects, especially in terms of quality, safety, and environment. Moreover, some Thai project managers cannot control subcontractors' works effectively because of incomprehensive subcontracts which cause the delay schedules and low quality of works.

The shortage of laborers of subcontractor also influences the construction progress of contractors' projects. The total number of subcontractors' workers is not clearly specified because of the uncontrollable variation of worker quantities.

❖ ***Documental management***

Document submittal is one part of the main process in yielding construction projects operating smoothly without any misunderstanding. Some interviewed Thai consultants cited that project managers possess inappropriate accountability in managing critical documents by letting project engineers handle those papers. The submittal problems sometime occur by some misunderstandings of project engineers since some of them are short of experiences of document management. In addition, Thai owners and consultants complained that there have often been late submittals in processing construction projects. This is because project managers do not appropriately have effective submittal scheduling at the starting of projects.

❖ ***Communication management***

Construction communications involve exchanging information regarding a project. They may be written, oral, or electronic. Transmittals are used to transmit documents and provide a written record. Regarding the communication language, interviewed Thai project managers mostly use English for communicating and sharing information with each other in case of foreign projects. There are also several formats and techniques that have been developed to expedite the flow of information among members of the project team. Thus, there is no significant problem related to communication management.

❖ ***Human Resource management***

Human resource involves the design of the project management organization, recruitment and selection of new employees, management of subordinates' work performance, and professional development of subordinates. As stated by the surveys, there are many highly skilled engineers, project managers, technicians and foremen, though the major problem is that there is also an extremely high demand for those skilled individuals. This frequently results in trained personnel being heavily overloaded and forced to undertake tasks for which their training and experience is inadequate.

Sometime, the conflict among teams, such as young engineers and senior foremen, occurs in sites since senior foremen do not pay respect to engineers whereas the engineers deem foremen are not working by following the engineering principles.

❖ ***Risk management***

Risk is a permanent element of each decision making process, including design and planning decision. Risk management on the other hand is defined as a set of methods and activities designed to reduce the disturbances occurring during the realization of the project. Even though Thai project managers have learned and been aware of construction project risk, they still confront complicated problems with unanticipated risks because the risk identification is not properly set up in planning phase. In other words, they do not mainly identify and analyze all risk events which may occur during the realization of the project and subsequently allow undertaking of appropriate mitigating actions. They rely on their experience and judgment and rarely believe in systematic risk assessment which is widely used in commerce and economics.

CHAPTER V
RESULTS, DISCUSSIONS, AND RECOMMENDATIONS

5.1 General

This chapter is significant in that all the results and discussions of this research from data analysis are illustrated in this chapter. The collected data obtained from questionnaire and interviews in three countries; Cambodia, Lao PDR, and Thailand, were separately analyzed. Basically, the analysis is divided into two types in this study. First, Analytic Hierarchy Process was applied to find the rank of important knowledge of project managers. It is then to find how effective and efficient is the knowledge that local project managers apply for performing construction projects. Thus, the level of competencies of project manager to apply these knowledge areas in construction field was explored.

It is crucial that the results needed to discuss in detail for each country in order to dig out the critical weakness of local project managers and then to set up a significant guideline for upgrading their competencies in implementing the tasks construction projects. In particular, in order to validate the result of analysis of levels of competency, some evidence of competencies of local project managers would be explored in term of components of each knowledge areas. The values of all evidence are presented as the percentage obtaining from quantitative analysis of number of contractors in each country.

The recommendations, on the other hand, were realized and written down in this chapter based on the results of research and opinions of respondents. These suggestions are to help project managers of contractors practically enhance their performance with various approaches and techniques.

5.2 Results in Cambodia

The results were analyzed based on the collected data from 14 contractors, 12 consultants, and 10 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.2.1 Ranking of Critical Knowledge of Project Managers in Cambodia

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix C. Figure 5.1 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

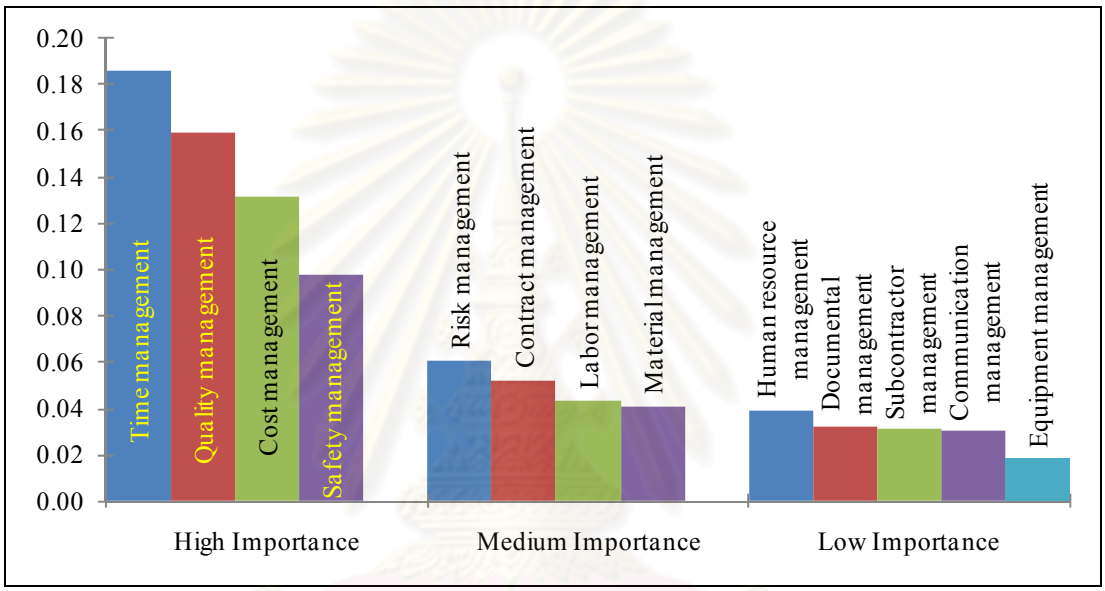


Figure 5.1 Ranking of critical knowledge from overall perceptions in Cambodia

5.2.2 Levels of Competency of Project Managers in Cambodia

Figure 5.2 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Cambodia.

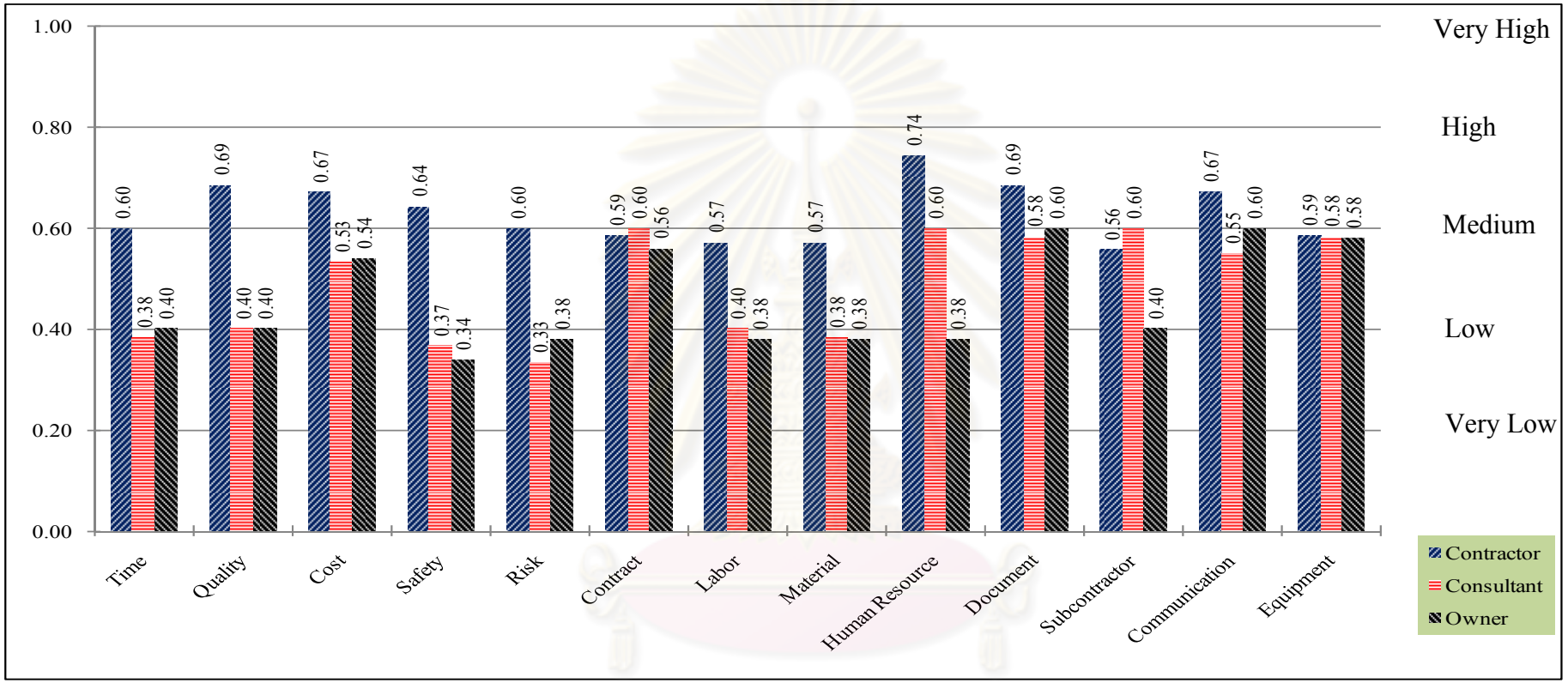


Figure 5.2 Levels of competency of project managers in Cambodia

As stated by overall perceptions, the levels of competency of local project managers in Cambodia are in medium level for all knowledge areas as illustrated in Figure 5.3:

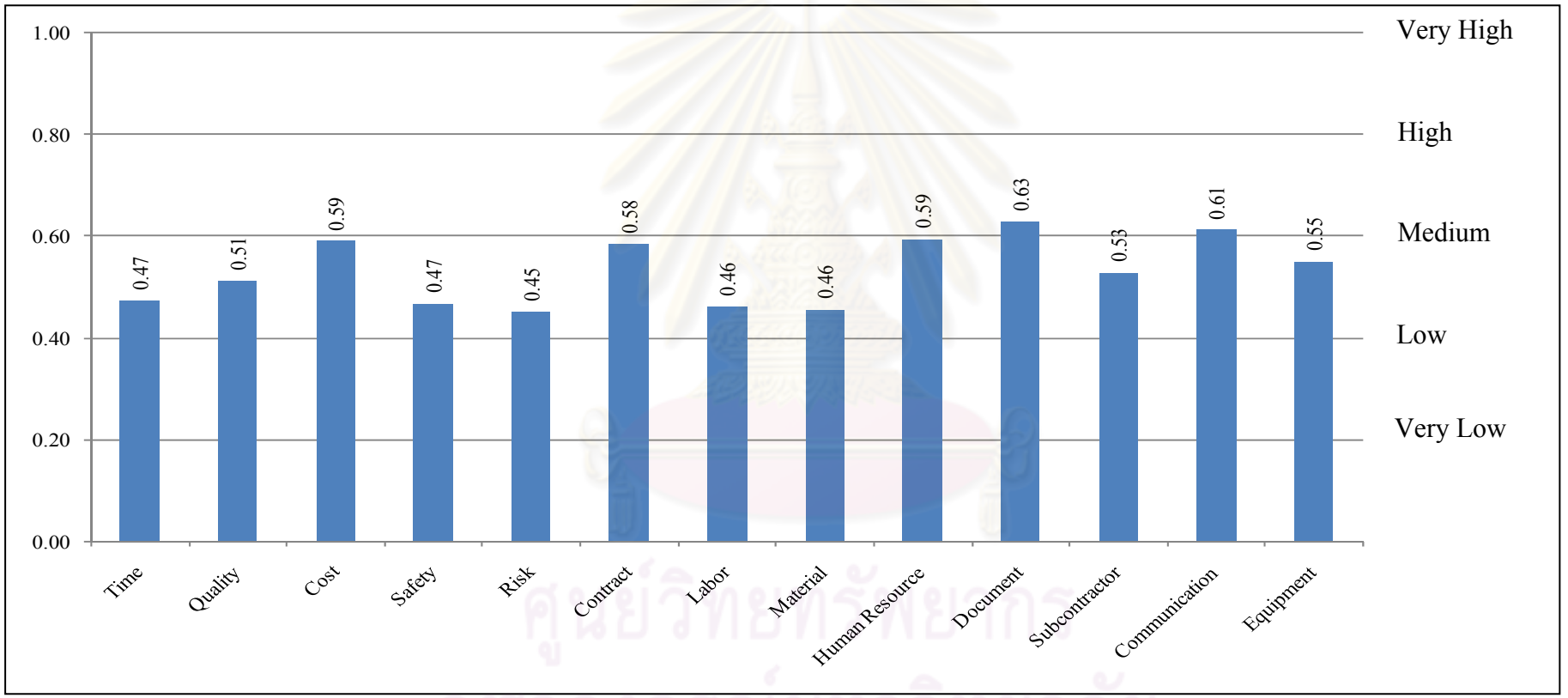


Figure 5.3 Levels of competency from overall perceptions in Cambodia

5.3 Results in Lao PDR

The results were analyzed based on the collected data from 9 contractors, 8 consultants, and 7 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.3.1 Ranking of Critical Knowledge of Project Managers in Lao PDR

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix D. Figure 5.4 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

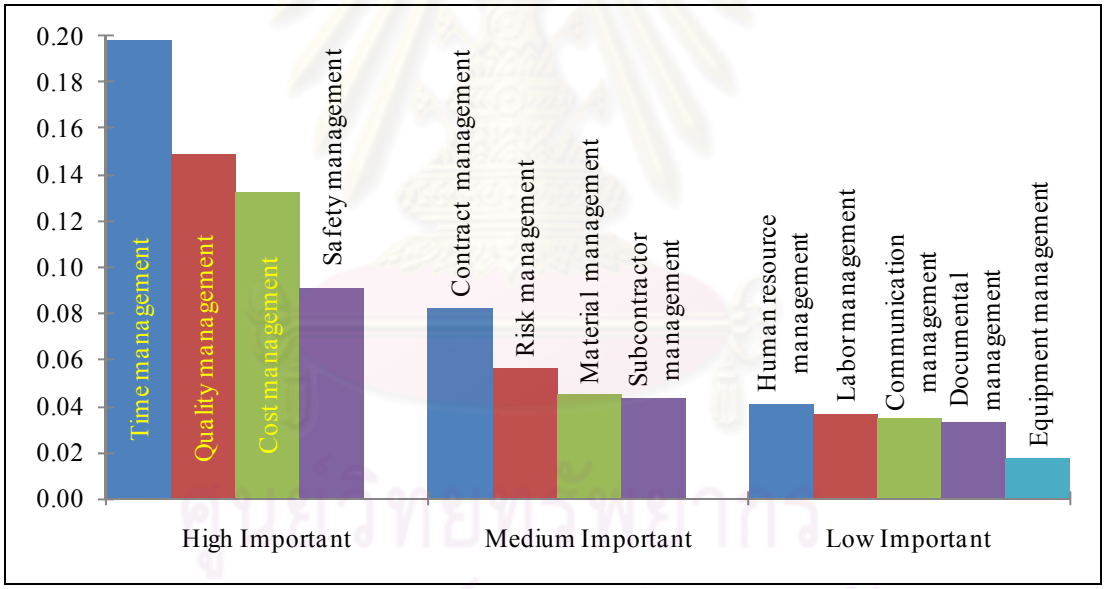


Figure 5.4 Ranking of critical knowledge from overall perceptions in Lao PDR

5.3.2 Levels of Competency of Project Managers in Lao PDR

Figure 5.5 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Lao PDR.

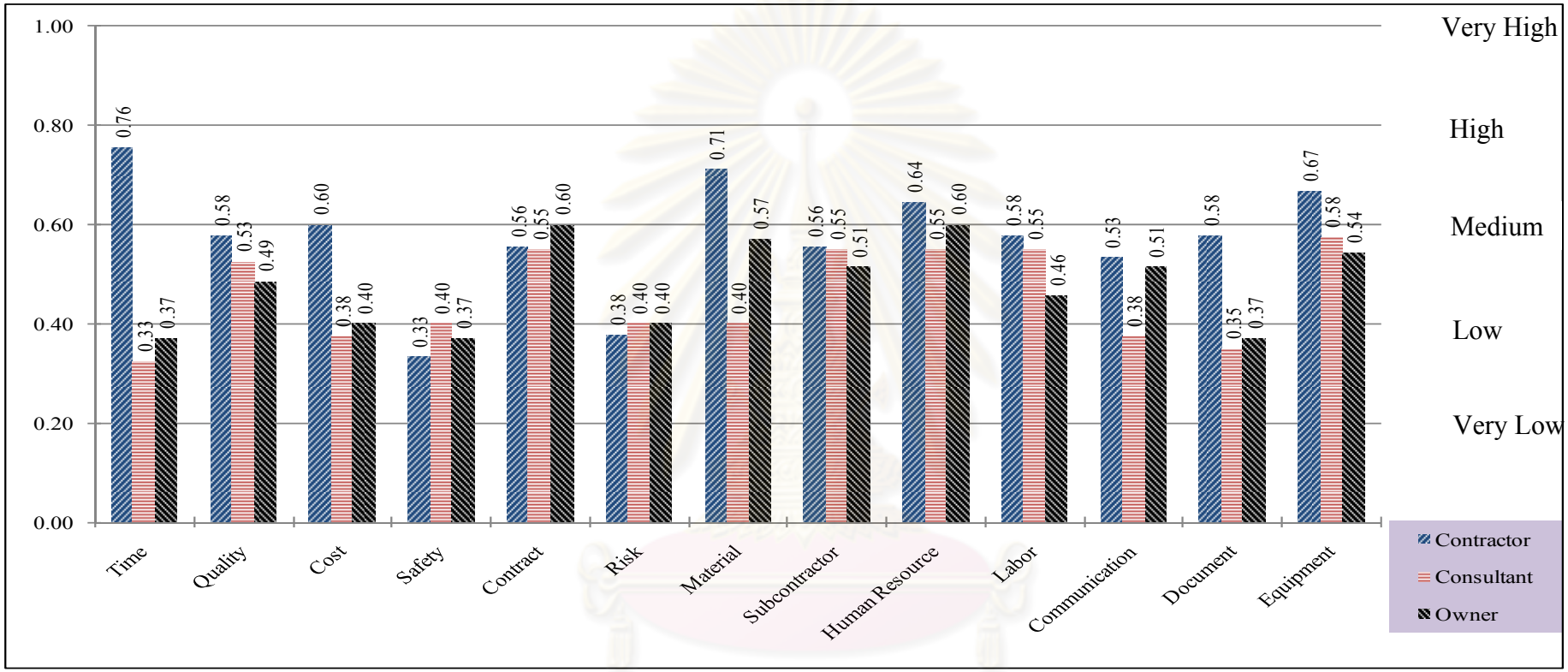


Figure 5.5 Levels of competency of project managers in Lao PDR

As stated by overall perceptions, the levels of competency of local project managers in Lao PDR are mostly in medium level for all knowledge areas as illustrated in Figure 5.6:

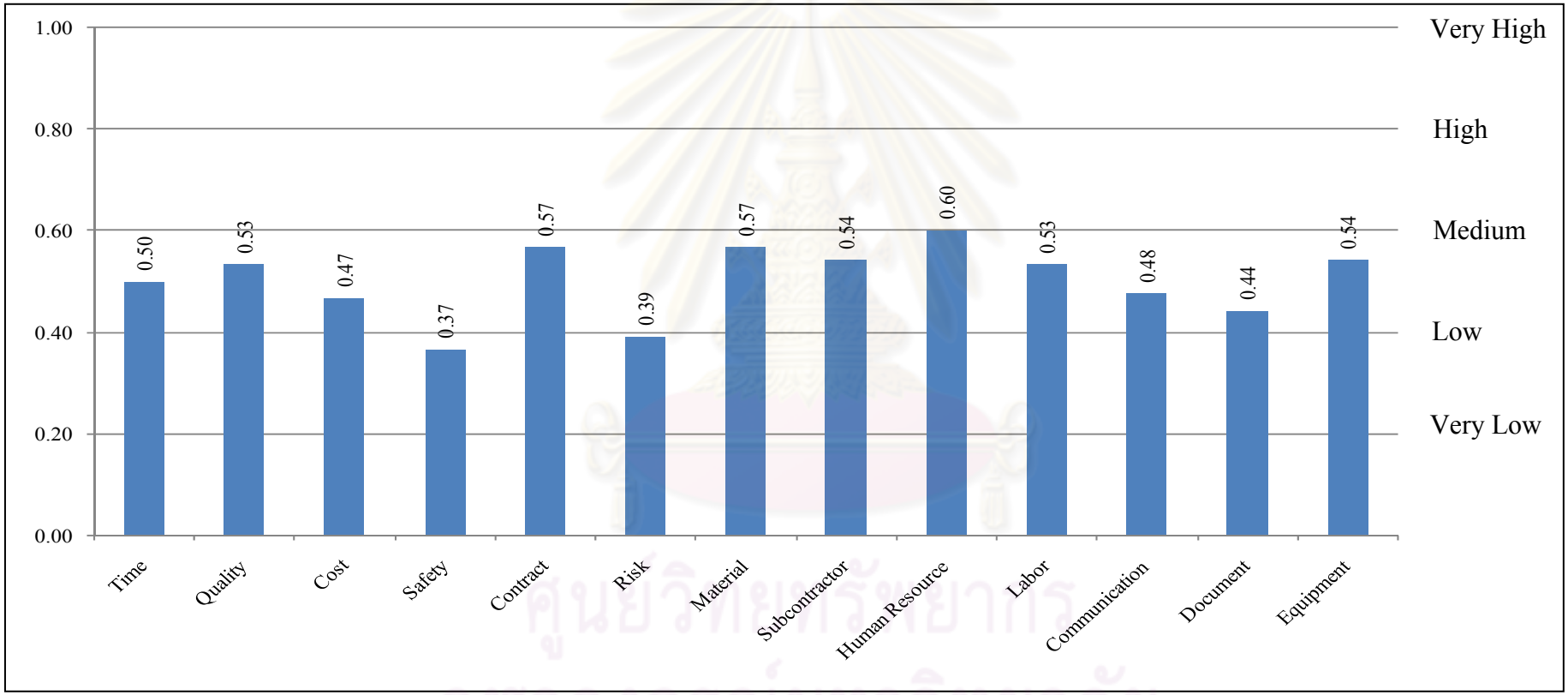


Figure 5.6 Levels of competency from overall perceptions in Lao PDR

5.4 Results in Thailand

The results were analyzed based on the collected data from 12 contractors, 10 consultants, and 9 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.4.1 Ranking of Critical Knowledge of Project Managers in Thailand

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix E. Figure 5.7 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

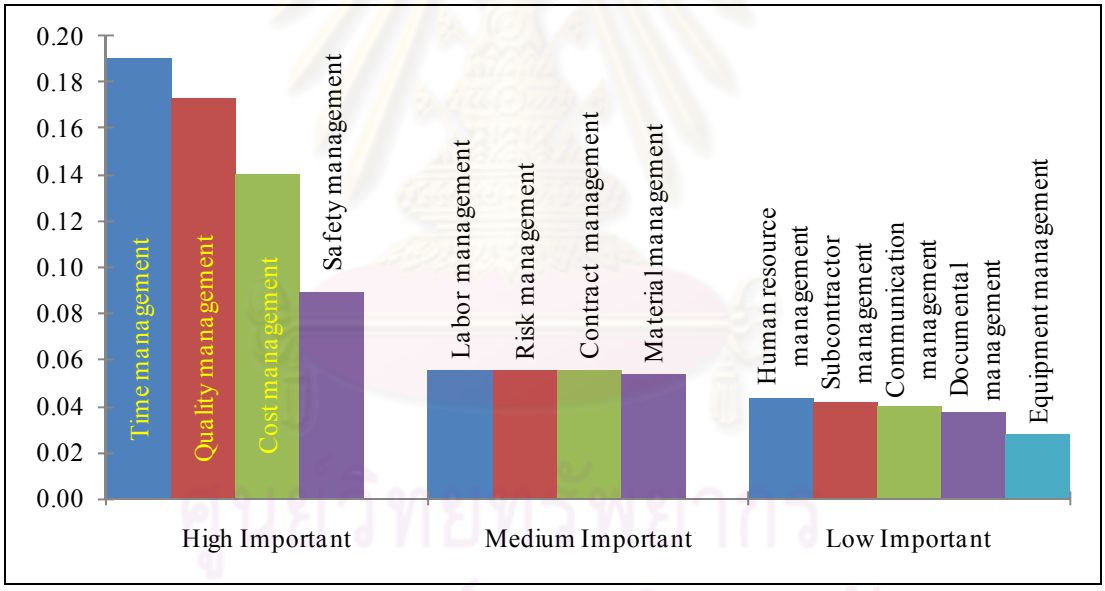


Figure 5.7 Ranking of critical knowledge from overall perceptions in Thailand

5.4.2 Levels of Competency of Project Managers in Thailand

Figure 5.8 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Thailand.

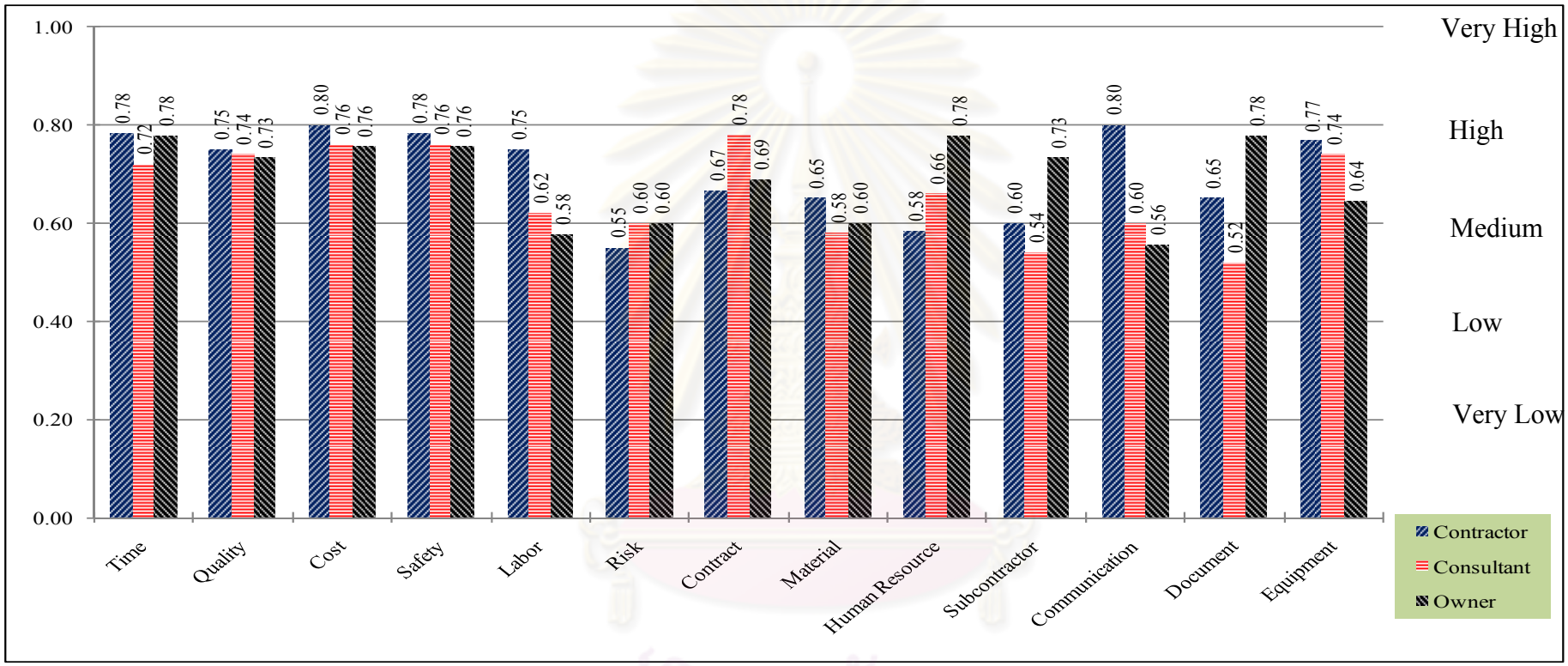


Figure 5.8 Levels of competency of project managers in Thailand

As stated by overall perceptions, the levels of competency of local project managers in Thailand are in high and medium level for all knowledge areas as illustrated in Figure 5.9:

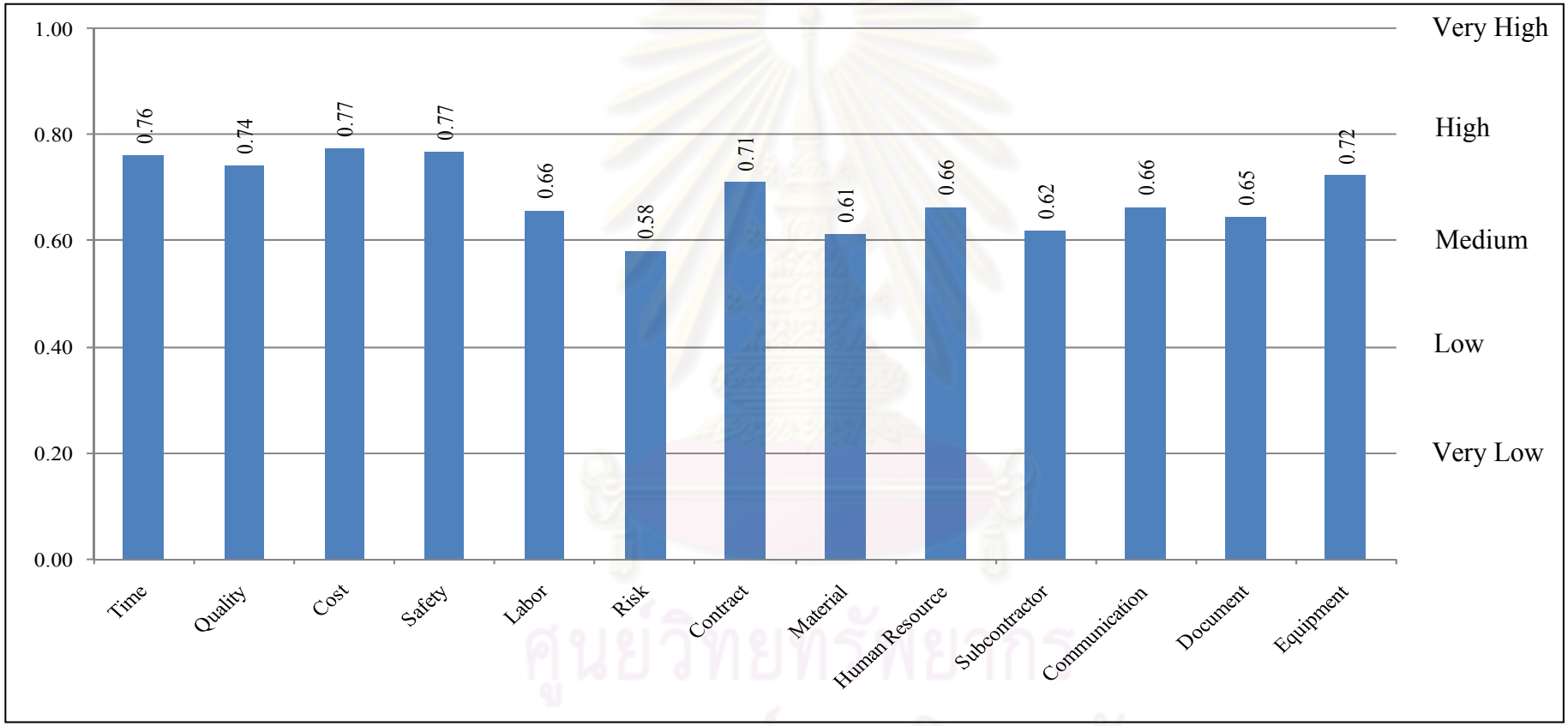


Figure 5.9 Levels of competency from overall's perceptions in Thailand

5.5 Result Validations

After obtaining the accurate results of competency levels of project managers, it is essential to validate the results in each country by using the evidence. Not all, some of knowledge areas were appropriately validated and discussed in detail as examples in accordance with the specialized and compulsory needs of each country.

The important knowledge ranking was accordingly divided into three levels. First, the high important knowledge areas are from the 1st rank to the 4th rank. Second, the medium important knowledge areas comprise of the 5th to the 8th rank. Third, the low medium important knowledge areas start from the 9th rank to 13th rank. Consequently, the high important knowledge areas were clearly validated and discussed in detail one by one involving the competencies of project managers to apply these knowledge areas.

5.5.1 Result Validations for Cambodia

The high important knowledge areas in Cambodia consist of time management, quality management, cost management, and safety management.

- ***Time Management***

The result indicated that time management is certainly one of the significant knowledge areas for project managers while their competency to apply this kind of knowledge is still in medium level because of many factors. Starting with schedule development, most local project managers only use M. Project to produce Bar Chart in order to represent the duration of each activity in the entire project. Using only Bar Chart is not effective enough for all projects since it has only a limited ability to show many detailed work activities and their associated interactions. It would become bulky and unwieldy on larger projects with complex activities. It also cannot show clearly the interaction between early start and late finish dates of activities and the resulting float of noncritical activities. Apart from Bar Chart, they are never aware of other techniques to yield and control the project schedule such as Critical Path Method (CPM), PERT, etc. because they gained the limited level of education from local universities. This reveals that local project managers lack some knowledge involving the components of time management, as shown in Figure 5.10. Subsequently, all

construction projects in Cambodia normally face delayed schedules due to lack of some useful techniques for controlling the time schedules.

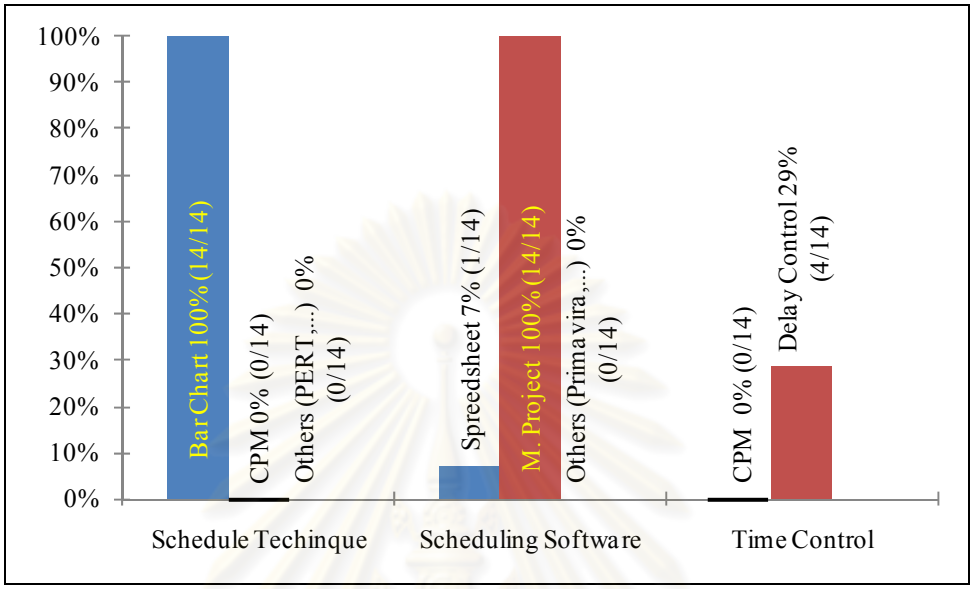


Figure 5.10 Percentage of Evidence for Time Management in Cambodia

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in medium level. Regarding to quality assurance in Cambodia, construction projects do not have enough standards to perform the works with high quality because quality management in this developing country is not totally standardized, though, quality control is always available to be widely executed in construction projects in order to ensure the work quality corresponding to the identified specifications; such as reports of quality testing, as described in Figure 5.11. There are some quality control strategies, however, missing in some construction projects. For instance, the local project managers do not properly assign any engineer to inspect or keep up the work quality of workers in construction sites because they stated that it is consultant's job. In term of quality improvement, some local project managers enhance the quality by recording the problems and solutions related to the work quality as the historical data to use for the future works.

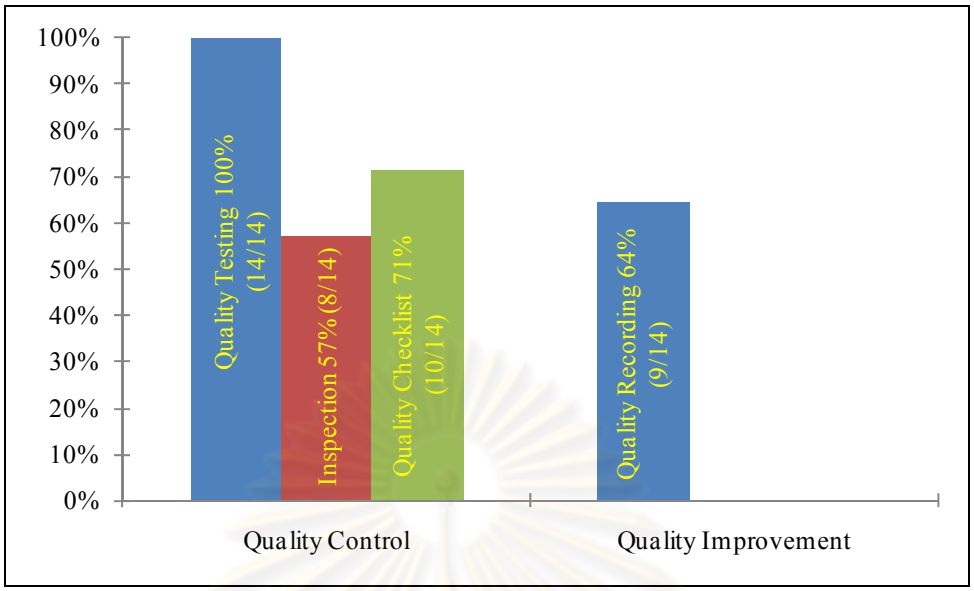


Figure 5.11 Percentage of Evidence for Quality Management in Cambodia

- ***Cost Management***

The results showed that the level of competency of local project managers to apply this important knowledge is in medium level. This is because cost management course is not available in any educational program in Cambodia due to lack of specific lecturers on this subject. Hence, the local project managers estimate and control the project cost by using their practical past experiences. Some of them also learn by jobs from working in foreign firms or international projects. For instance, local project managers use only spreadsheet as the main software to estimate the cost in the whole projects since they lack of knowledge in using up-to-date software. Moreover, they never use or even know the S-curve for controlling the project cost. Another technique they are missing is cost coding system. Few of them use cost coding system to control the project cost. That is to say, they are short of this important technique to make the project operation go smoothly without any serious trouble, as demonstrated in Figure 5.12.

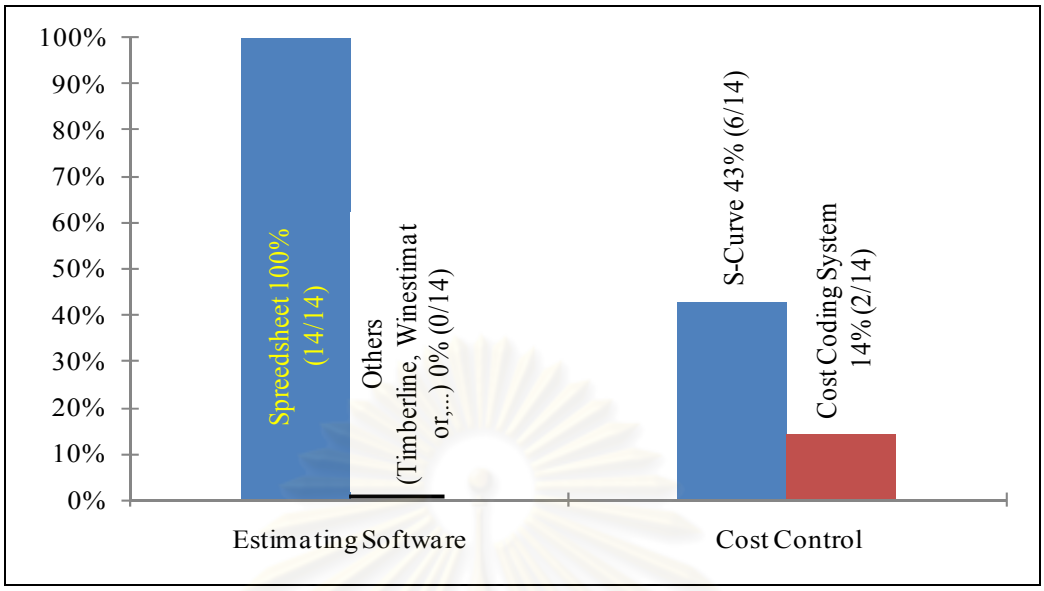


Figure 5.12 Percentage of Evidence for Cost Management in Cambodia

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in medium level. The safety of construction sites in Cambodia is not standardized enough since there have been many workers injured and fatal during construction process. The main cause of job site accidents is the ignorance of local project managers. Although there is a number of personal protective equipment used by workers and safety signs installed in construction sites, the accidents to both neighboring public properties, people and construction workers always occur because local project managers are short of high attention and experiences of safety management. Furthermore, only some safety meetings are conducted in the sites when the site accidents particularly incurred. Safety engineers are assigned to control all safety issues in only some construction sites because the local project managers do not take serious on site safety for a reason of insufficient knowledge. Accident investigation and recording are, on the other hand, not appropriately conducted in construction sites. Some local project managers are lacking safety risk control which causes their construction works to encounter many troubles pertaining to the accident, as illustrated in Figure 5.13.

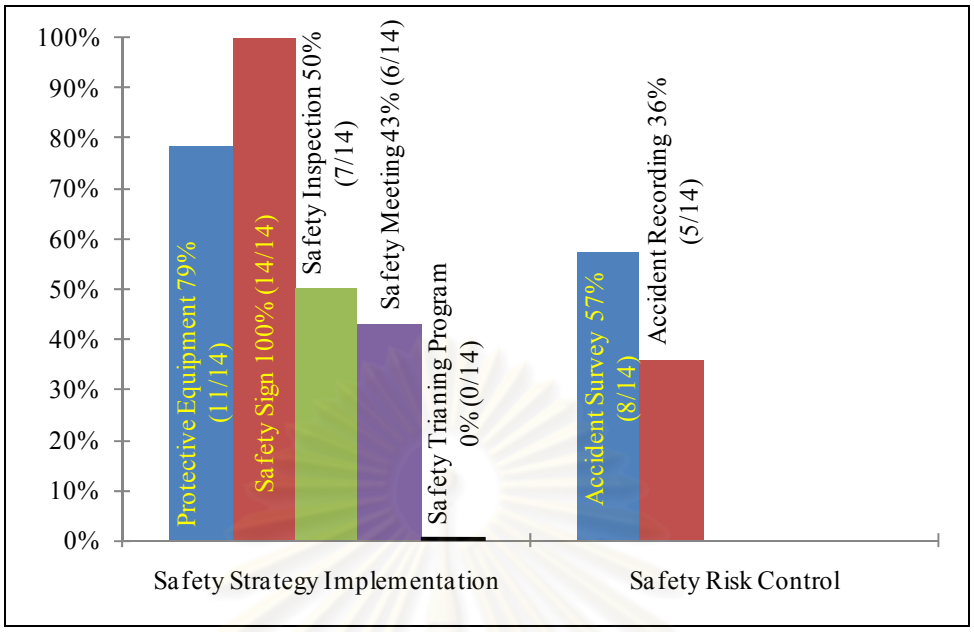


Figure 5.13 Percentage of Evidence for Safety Management in Cambodia

After thoroughly calculating and discussing the results and evidence in Cambodia, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results as demonstrated in Table 5.1. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.1 Validations of competency results in Cambodia

Knowledge Areas	**Results of Competency Levels**	***Level of Evidence***
Time management	Medium	*Low - Medium*
Quality management	Medium	*Low - Medium*
Cost management	Medium	*Medium*
Safety management	Medium	*Low - Medium*

5.5.2 Result Validations for Lao PDR

Time management, quality management, cost management, and safety management are accordingly the high important knowledge areas in Lao PDR.

- ***Time Management***

Time management is also the 1st rank of important knowledge areas in Lao PDR in accordance with the above result. Whereas, the competency of local project managers to apply this kind of knowledge is not efficient enough to achieve the construction projects within the limited time. This is because they are missing some effective techniques for applying in construction work. Nowadays, they only use Bar Chart developed by M. Excel and M. Project to show the entire project schedule, while there are some other techniques such as Critical Path Method (CPM), PERT and so on, which are more efficient than Bar Chart. The shortage of application of new techniques causes most of construction projects in Lao PDR always face delayed schedules, as stated in Figure 5.14.

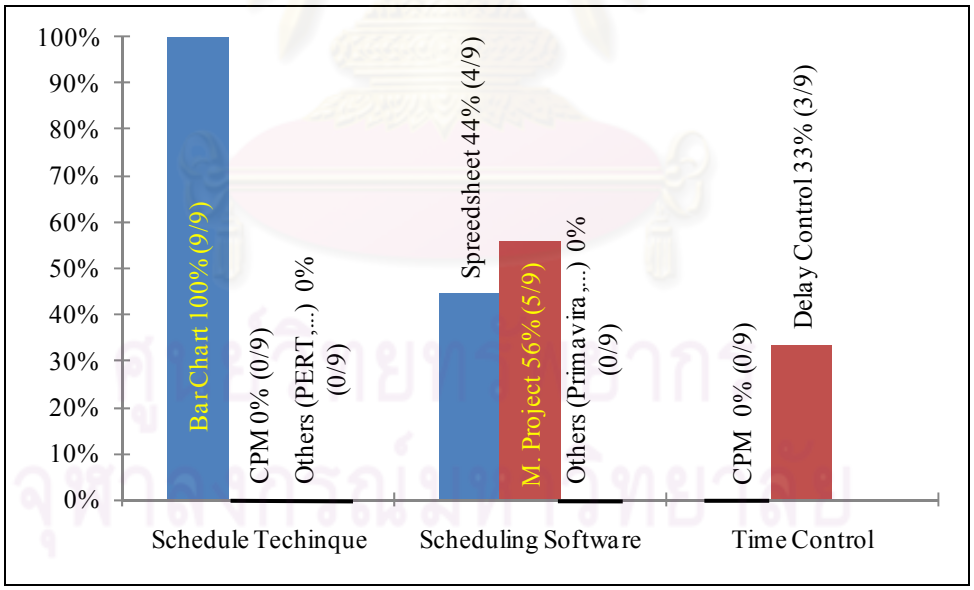


Figure 5.14 Percentage of Evidence for Time Management in Lao PDR

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in medium level. There is no any quality assurance to apply in construction projects in Lao PDR for assuring the standard of

work quality because this country is under step by step development. Local project managers carry out the quality control by implementing some measures such as quality testing, quality inspection, quality document control. However, there are some limitations of these executions since local project managers do not pay much attention to work quality and care only about cost and their profit from the projects. For instance, during construction process, the work quality is not inspected by quality engineer because local project managers are short of knowledge and experiences to appropriately assign suitable quality engineers to perform the inspection in construction site. Regarding the quality improvement, some quality problems and solutions occurring in construction project are recorded by merely some local project managers. The evidence of this knowledge is shown in Figure 5.15.

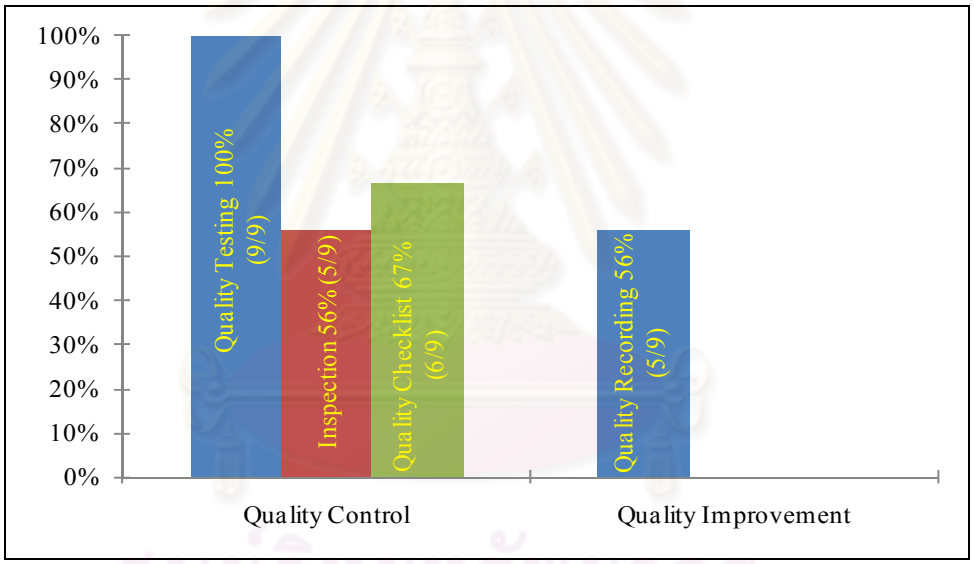


Figure 5.15 Percentage of Evidence for Quality Management in Lao PDR

- ***Cost Management***

The result showed that the level of competency of local project managers to apply this important knowledge is in medium level. Starting with cost estimating, local project managers practically use the past experiences and historical data for approximating the cost of project. They normally check the market price and historical information for material cost and labor cost. Simple software; spreadsheet, is widely used by Lao project managers for estimating the project cost. It is also used for calculating by putting the unit price and multiplying with the taken-off quantity of breakdown items. Using only spreadsheet is not effective enough to estimate the

project cost because there are presently many up-to-date software available in the market such as Win Estimate, Timberline, and the like. These software tools can organize the estimate, link it to resource database, provide reports, and possibly integrate with other systems. Furthermore, some local project managers are able to create S-curve analysis for modeling the cash flow which provides the link between the bar chart and the budget. Of course, they develop S curve to control the cost of project and particularly to claim the monthly payment from the owners. Regarding another technique for cost control; cost coding system, most of them do not use this technique to control the project cost because their knowledge and ability are in a certain limitation. The evidence of this knowledge is demonstrated in Figure 5.16.

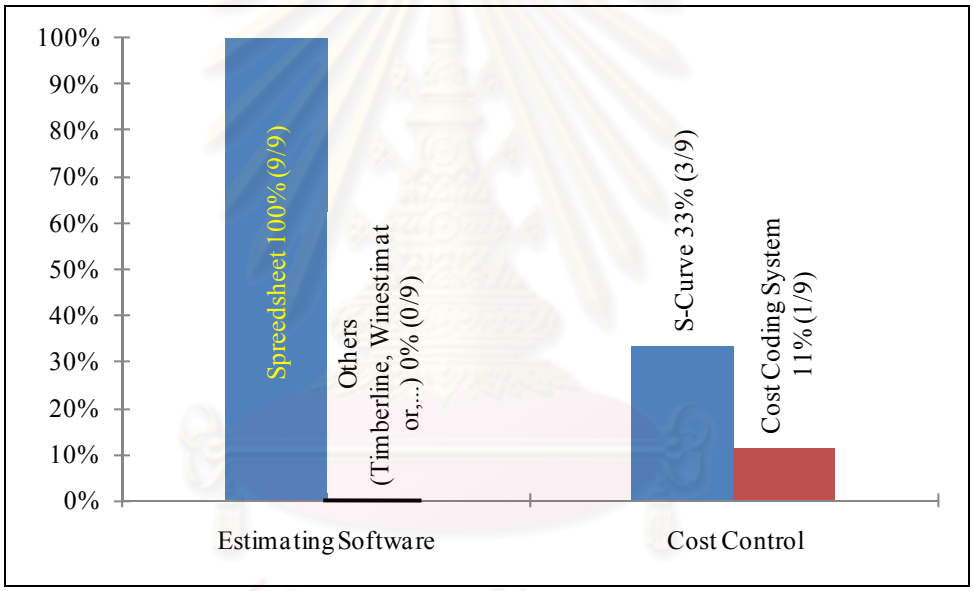


Figure 5.16 Percentage of Evidence for Cost Management in Lao PDR

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in low level. There is no safety standard for construction sites in Lao PDR because the safety regulation has not been issued to execute yet in this country. That is why the risk of accident occurring in construction sites is very high both for the workers and for the public. Simultaneously, local project managers do not pay much attention to safety in construction sites which leads to problems on the project in terms of safety issue, as illustrated in Figure 5.17. Although protective equipment and safety signs are mostly implemented in some construction sites to

prevent any site accident, there are still many incidents causing both workers and public neighboring people to get injured and fatal due to lack of some safety strategies such as safety inspection and safety meeting. In other words, most local project managers do not seriously assign safety engineers for inspecting the site safety, and also safety meeting is not properly made among engineers, foreman, and subcontractors in construction sites. There is no local safety training program for engineers, foremen, and laborers in construction sites because project managers lack of knowledge and experiences as well. Moreover, accident investigation and recording are the deficient points of local project managers to be filled up.

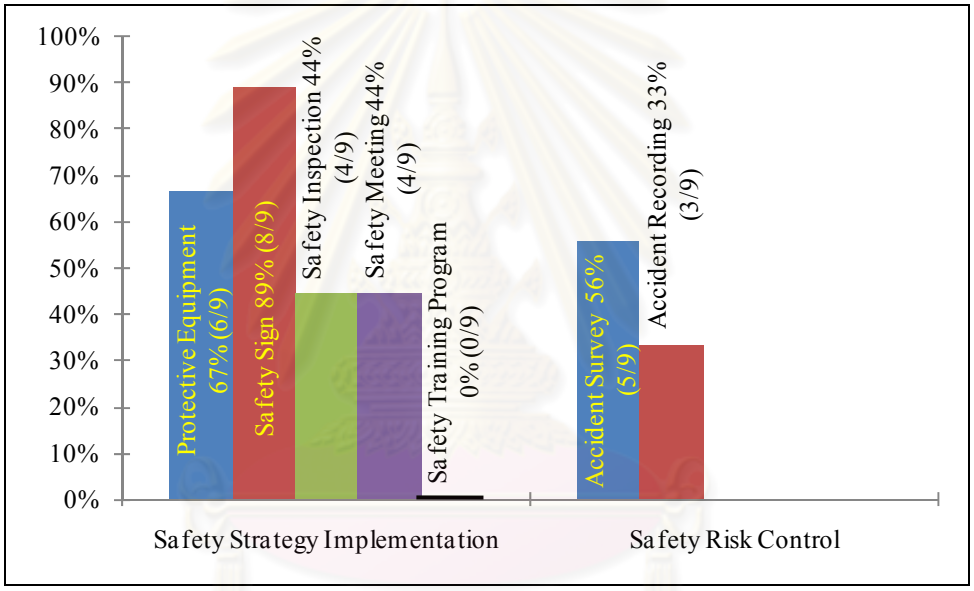


Figure 5.17 Percentage of Evidence for Safety Management in Lao PDR

After thoroughly calculating and discussing the results and evidence in Lao PDR, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results as illustrated in Table 5.2. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.2 Validations of competency results in Lao PDR

Knowledge Areas	Results of Competency Levels	*Level of Evidence*
Time management	Medium	*Low-Medium*
Quality management	Medium	*Low-Medium*
Cost management	Medium	*Low-Medium*
Safety management	Low	*Low*

5.5.3 Result Validations for Thailand

The high important knowledge areas in Thailand consist of time management, quality management, cost management, and safety management.

- ***Time Management***

The result indicated that time management is certainly one of significant knowledge areas for project managers while their competency to apply this kind of knowledge is still in high level. Beginning with schedule development, Thai project managers know what a CPM is but most of them are just not up with the current technology and its applications. Their preferred planning tool is that old favorite; Bar Chart developed by M. Project, because it provides an effective presentation which is not only easy to understand and assimilate by a wide range of people, but also conveys the planning and scheduling information accurately and precisely. Whereas, as projects became larger and more complex, the Bar Chart was found to be lacking as a planning and control tool because it could not indicate the logical relationships between activities. Similarly, most of them do not use CPM or PERT to control and monitor the project progress which causes the project fall into risk of delay due to schedule variance, as mentioned in Figure 5.18.

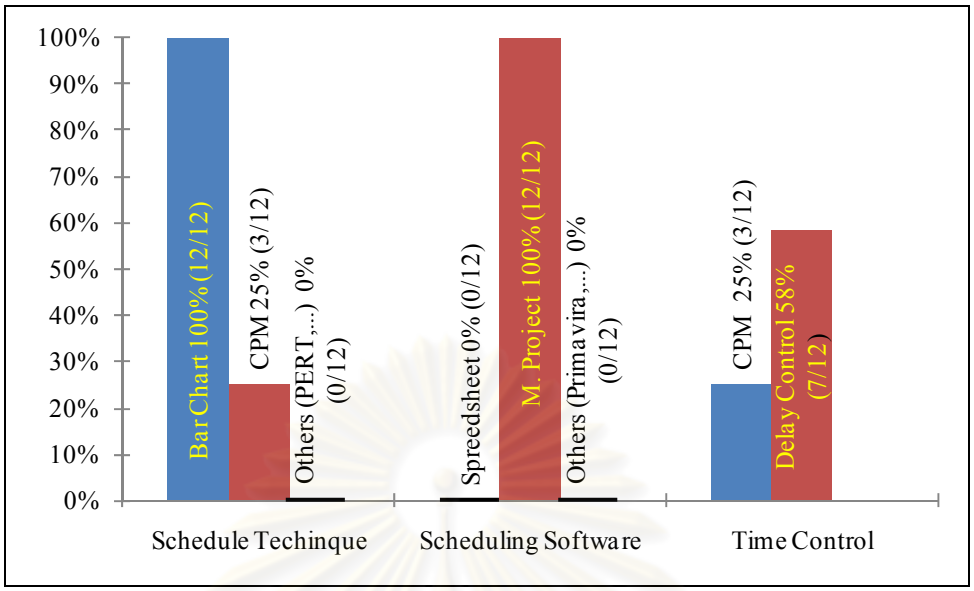


Figure 5.18 Percentage of Evidence for Time Management in Thailand

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in high level. Regarding to the owner's demand, all surveyed construction projects in Thailand do not apply quality assurance for ensuring the quality standard of work. In principal, quality control is intensively conducted by local project managers in all construction sites to make sure all the construction works and materials following the requirements of quality in contract. To control the quality, they perform some strategies such as quality testing, quality inspection, and quality document or checklist control. Nevertheless, these methods are not definitely implemented by local project managers, as illustrated in Figure 5.19. For instance, some of them do not have construction team to inspect the work quality during construction process, which consultants criticize because of lack of proper inspector.

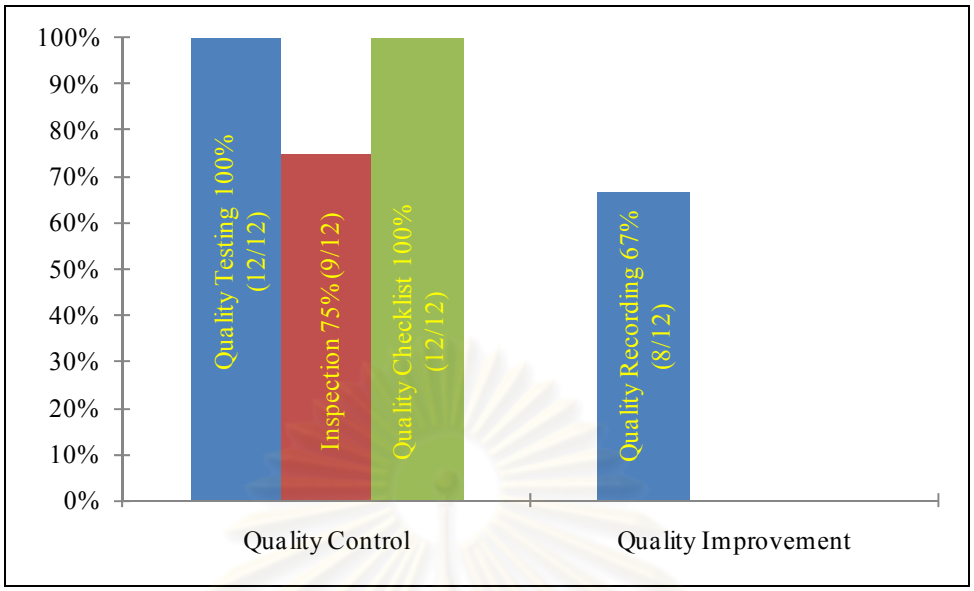


Figure 5.19 Percentage of Evidence for Quality Management in Thailand

- ***Cost Management***

The result showed that the level of competency of local project managers to apply this important knowledge is in high level. Like other project managers, Thai project managers stated that the obvious sources for estimating project costs are past experiences of individual project manager and historical information. The knowledge of the procedures for estimating is required by almost everyone involved in or associated with the field of construction such as construction teams, designers, drafters, subcontractors, material suppliers, and the like. All local project managers, on the other hand, are widely and only using computer programs in estimating building costs; especially spreadsheet programs. Using a computer to estimate makes the estimator's job easier in many ways. Employing computer calculation or formulas helps reduce calculation errors. To control the project cost, most of them develop S-Curve which enables them to plan ahead by knowing what budgets are required, when they are required and how much is required and to give timely warning of negative cash flows. In addition, some of them are able to use cost coding system to control the cost data which is important not only to project management in decision making process but also to the company's estimating and planning departments because these data provide feedback information essential for effective estimates and bids on new projects. The percentage of local project managers applying the evidence of this knowledge is shown in Figure 5.20.

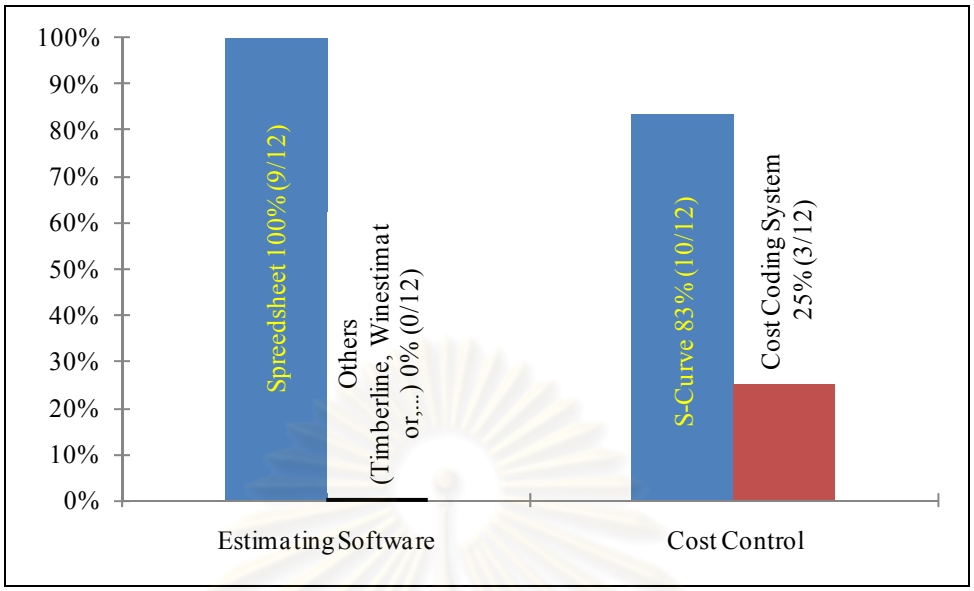


Figure 5.20 Percentage of Evidence for Cost Management in Thailand

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in high level. Like other countries, Thailand unavoidably faces such problems of safety in construction sites due to inadequacy of safety strategies implementation and regular inspection although all construction projects have similar repeat requirements, such as hard hats and personal equipment for preventing job site accidents during construction process. Some of them sometime do not strictly consider safety matters in construction sites by ignoring the conducting of the regularly safety meeting in some manners. In other words, they are not that concerned about unforeseen job site accidents, and they also fail to yield effective regulations and practices for alleviating such safety problems in construction sites, as described in Figure 5.21.

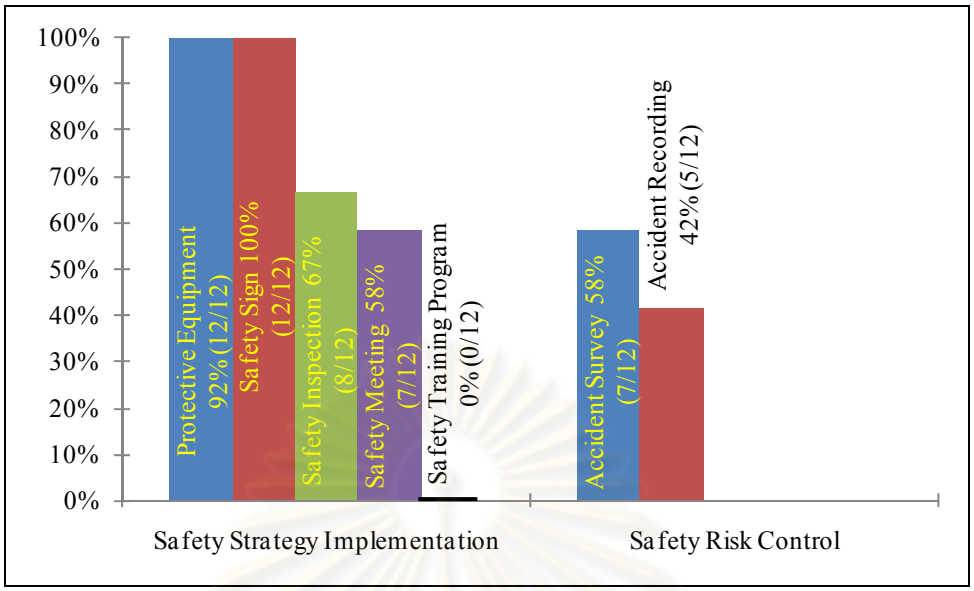


Figure 5.21 Percentage of Evidence for Safety Management in Thailand

After thoroughly calculating and discussing the results and evidence in Thailand, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.3 Validations of competency results in Thailand

Knowledge Areas	Results of Competency Levels	*Level of Evidence*
Time management	High	*High*
Quality management	High	*Medium-High*
Cost management	High	*High*
Safety management	High	*Medium-High*

5.6 Recommendations

The recommendations were obtained from suggestions of main actors in construction projects; contractors, consultants, and owners, in Cambodia, Lao PDR, and Thailand, which are demonstrated in Appendix F as quantitative percentage. Summarily, to enhance the performance of project, the knowledge and competencies of local project managers should be upgraded by providing training programs so that they could learn how to manage their construction projects effectively and efficiently.

5.6.1 Recommendations for Cambodia

According to the result, time management is urgently needed as the crucial tool in construction project. That is why Cambodian project managers should learn more about time management from other sources not only to develop their own knowledge but also to make the projects finish within the limited time. In particular, new scheduling techniques should be widely offered to local project managers for enhancing their ability in estimating and controlling the project time.

The principle actors in construction projects cited that local project managers should regularly control the work quality to ensure that all materials used and all works performed on a project conform to the requirements of the contract plans of specifications.

It is recommended that, regarding the estimating software, additional workshops or trainings should be increasingly conducted in Cambodia in order to show local project managers new techniques or software for estimating the project cost with more accuracy. More especially, new cost control technique which can show the cash flow process, cash flow overrun, and cash flow shortage, should be provided for local project managers by capable outsource lecturers or experts in an attempt to expand and develop their knowledge and capability to estimate and control the total project cost.

The only critical approaches to improve safety management in Cambodia is to expand the knowledge of local project managers by providing some training courses, seminars, and workshops, which let them be aware of how to manage an effective safety program in their sites. Another key to a good safety program is to prevent such accidents violently occurring in construction sites in Cambodia. The local project managers should learn more how to effectively implement safety strategies or plans for eliminating, reducing, or responding to the hazards. All accidents, eventually, should be investigated promptly, whether or not injuries and damage occurred. The results of the investigation should be also recorded what happened, why the incident happened, and what procedures or policies should be adopted to minimize the safety risk for future occurrence of similar accidents or incidents. Furthermore, it is suggested that the Cambodian project managers of contractor should learn how to identify the risk sources, and to provide efficient strategies to control the project risk.

Another competency of local project managers is contract management, which is needed to be improved in construction projects in Cambodia. Local project managers should completely read and clearly identify the contract requirements and particularly determine any risk associated with contract because this knowledge is essential if they expect to satisfy all contractual requirements. After being aware of project risks and risk sources, they should take all measures to eliminate the anticipated risk which is the weak point of Cambodian project managers.

In terms of labor management, it is obvious that local project managers should learn how to basically select the laborers to ensure their acceptable qualifications. Especially, they ought to allocate or consider more about the labor variation which always occurs in construction sites. That is to say, they should better control the shortage of labor in order to avoid the delayed schedule because the number of laborers often varies due to many factors. They should also consider and keep up more on the work quality of workers, labor safety, and conflict among workers, to assure everything is going properly in terms of labor issue. Skill-enhancement training and development training, eventually, should be conducted in construction sites in Cambodia to develop the laborer's skills as these programs are presently not available.

Moreover, material procurement should be mainly conducted to ensure that construction activities are not delayed because of a lack of materials. Regarding the material stock management, they should use spreadsheet or other software to control the material flows in sites instead of manual by material keepers, in order to conveniently improve the stock management. Local project managers should learn from training how to effectively select all required staff based on their qualification. Moreover, they should control the working staffs by examining and managing their progress works in construction projects. In particular, the vital thing local project managers should perform is to develop the project team by providing fruitful training in an attempt to upgrade their skills.

After receiving award of the contract, the Cambodian project managers should clearly review each specification section and needed documents for submittal requirements. The only important task that local project managers should carry out is to develop suitable submittal schedule and also mention it in master schedule in order

to avoid project delay due to late submittal. Related to the subcontractor selection, local project managers should learn from training how to select subcontractors based on not only price but also other criteria such as good safety record, experienced craftspeople, good equipment, and are able to complete the project to the desired standards without experiencing financial problems. To ensure quality work, there must be mutual trust and respect between the local project manager and the subcontractors, because each can achieve success only by working cooperatively with the other. They also should not give up some control when working with subcontractors which often leads to problems on the project with quality and timely execution.

The competency of Cambodian project managers to apply communication knowledge in construction projects is acceptable because they are able to use English in terms of language to communicate for international projects.

Basically, the only way to improve the competency of local project managers in terms of equipment management is to provide some training for local project managers so that they can know more how to control the equipment safety and also how to take any action for equipment maintenance program, to ensure the construction works are not delayed due to problems involving equipment.

5.6.2 Recommendations for Lao PDR

First of all, the competency of local project managers should be improved in terms of time management in order to succeed in the estimated project schedule management. New software and new scheduling techniques should be particularly provided to local project managers through short course and training so that they could better learn what the advantages of these software and techniques are and how to apply these methods for construction project.

Of course, the necessary and essential methods to improve the competency of local project managers are training, short course and seminar, which will significantly get them to realize the importance of quality management in project, how to successfully control the work quality and how to efficiently improve the quality.

In principal, possible training or short course ought to be set up for Lao project managers to order to expand and enhance both their knowledge and competency by

showing more cost estimating software and techniques to efficiently develop the estimated cost and to control cost of the entire project.

It is proposed that the competency of Lao project managers should be improved in terms of knowledge of safety management. It is similar to other knowledge areas; the best way to enrich competency of local project managers is to greatly promote training program, fruitful seminar, and short course pertaining to the safety management. Local project managers should strictly conduct the safety strategy implementation and safety control.

Undoubtedly, the knowledge and competency of local project managers must be upgraded involving contract management knowledge. Training program and short course should be offered for local project managers. They would also, through, this training, understand the importance of contract and how to identify the contract risks and implement risk mitigation measures for the project with efficiency.

Continuing to risk management, local project managers should better learn how to clearly determine what risks seem to occur in the entire project, and then to identify at what sources those risks originated. After being aware of risk sources, they should also learn how to effectively reduce the whole project risks which would occur by any measure.

Another issue is material management; the only way to improve the competency of local project managers is to provide some training related to the method of how to develop the schedule of material order and delivery in order to avoid any project delay due to shortage of material on site. In other words, local project managers should initiate material procurement early in the construction process to ensure that materials are available on site when needed by the construction workers.

Local project managers should upgrade their ability in terms of knowledge of subcontractor management through training, seminar, or short course. Local project managers should look at all these conditions in selecting subcontractors to perform their construction works because subcontractor’s works absolutely impinge on project schedule. Another important thing that local project managers should gain from training is about how to effectively control the subcontractor. Furthermore, local project managers should learn more from training how to select the qualified staffs or

engineers. Involving staff control, on the other hand, project managers ought to learn more and more in establishing the organizational chart and in directing staff in order to control their employees successfully. Regarding team development, they should enhance their ability by training in setting up the skill-enhancement training and development training for their staffs or engineers.

Labor management is similar to human resource management in terms of selection. Labor selection and labor control are the insufficient of local project managers. Thus, their inadequacy should be filled up by various training to improve their knowledge and competency in term of labor management.

Most Lao project managers of contractors are able to use foreign languages; especially English, to communicate and distribute information with international owners or consultants. This shows that the competency of local project managers to apply this kind of knowledge is positive response; but they still need some training to improve their knowledge and capability related to communication management.

In order to archive for documental management, training or short course should be offered to Lao project managers so that they can learn more how to primarily create and effectively manage the submittal program which is a necessary tool to achieve successful construction projects. Moreover, through training, they can be aware of how important submittal planning is and then develop schedule for document submittal in the entire project.

The knowledge and competency of equipment management of local project managers should be also improved by training to allow them to understand more critical features they are missing to manage the equipment. They should be taught how to allocate and control equipment which is a weakness of Lao project managers.

5.6.3 Recommendations for Thailand

It is recommended that Thai project managers better use new and advanced techniques in case of complex projects. When the projects fall in delay, they would be able to accelerate early finish in an attempt to reduce project risk and uncertainty by identifying the critical works. The best way to improve the ability of local project managers is that training should be conducted to encourage them to supportively use and practice other advanced techniques because those techniques enable them to

significantly contribute not only to the planning, control, and on-time completion of construction projects, but also to define and plan the work in detail from start to finish, thus permitting early identification of potential problem.

Of course, there is no significant problem pertaining to the competency of local project managers to apply the knowledge of quality management. However, advantageous training or short course should be conducted in Thailand in an attempt to provide new perceptions to fill up their inadequacy of knowledge and competency related to the quality management.

In particular, it is important that new and advanced cost estimating software and cost control should be introduced for Thai project managers to be aware and learn to apply these up-to-date computer programs and techniques in their current construction projects.

The local project managers should learn from training how to set the standard regarding safety on their projects and enforce safety standards at all times. Training is extremely required to enhance their knowledge and competency involving the safety management. For instance, local project managers should learn more how to train construction teams such as engineers, foremen, and laborers, to implement the safety strategies all the time. They should also learn how to attentively investigate and record the site accidents as historical data which will be beneficial for the future work.

The competency of local project managers should be enhanced by training or seminar in terms of knowledge of labor management. They should learn more how to select the skillful laborers to work in construction sites. In particular, they should also learn how to train laborers working in sites to update their skills which can increase their work productivity and then boost the construction project finish on limited time.

Even though Thai project managers have learned and are aware of what construction project risk is, they still confront complicated problems with unanticipated risks since they rely in their experience and judgment and rarely believe on systematic risk assessment which is widely used in commerce and economics. Thus, the risk identification should be properly set up in planning phase. They should undertake or propose actions which reduce or eliminate the effects of risk or uncertainty. Construction project risk mainly influences project cost, time, and quality which are the major constraints of construction projects. That is why Thai project

managers must understand the project risk in order to avoid any crucial issue which may occur in construction projects. Their insufficient knowledge and competency should be further improved by training, seminar, short course, or workshop.

It is similar to risk management that Thai local project managers should realize the importance of fully reading the contract for understanding in order to identify the contract risk and then to find out the measure to reduce the project risk regarding to the contract. Useful training should be provided to let them know how to effectively control the contract in project.

In terms of material management, the main weakness of local project manages is material delivery scheduling or material procurement. They should regularly develop the schedule of material order and delivery to ensure the materials are available in sites when required. Concerning material stock management, they usually use management manual for checking or recording material flows in sites and sometime they use simple software such as Spreadsheet to do these works. These kinds of approach are not efficient and appropriate enough to apply in large and complex construction sites. Therefore, training should demonstrate new or efficient software for controlling the material stock to them to be aware of and apply in complex construction projects.

Concerning human resource management, training should be offered to all Thai project managers so that they can learn how to select skillful staffs or engineers. They should regularly monitor and have a look at staffs' activities to control their staffs. Another important thing is team development which is rarely conducted by local project managers in Thailand. They ought to learn more how to train the construction team to develop their skills and then to improve the performance of the project. Another competency of local project managers needed to be developed is subcontractor management. They should not principally select subcontractors in accordance with only price or quotation. They should also learn from training how to efficiently control subcontractors for ensuring their work quality following the identified specifications.

Regarding the communication language, all Thai project managers are able to use English for communicating and sharing information with each other in case of foreign projects. There are also several formats and techniques that have been

developed to expedite the flow of information among members of the project team such as regularly meeting, electronic mail. However, training is still needed to provide new techniques and features related to communication management to local project managers.

In addition, Thai owners and consultants complained that there have often been late submittals in processing construction projects. Hence, local project managers should better learn how to appropriately set up an effective submittal planning at the starting of projects and mention in the master schedule to prevent any risk of delay due to late submittal.

Last but not least, equipment management training should be conducted to let local project managers know how to particularly choose and control equipment operating in construction projects.

CHAPTER VI
CONCLUSIONS

6.1 Conclusions

Many unexpected problems usually occur in construction project management in Cambodia mainly consisting of human resource problems and material resource problems due to many factors. Moreover, Lao PDR also has many project management problems in construction projects because the difficult inherence in the project management situations are compounded by the increasing complexity of environmental, regulatory, and project financing. Another country, Thailand has inadequate and ineffective control strategies for project management problems because contractor-caused delays are due mainly to the low technical and managerial competency of contractors. All of these problems must be appropriately managed and dealt with by many capable people in construction project; especially construction project manager who is the leader of the contractor's project team and is in charge of identifying project requirements and ensuring that all are accomplished safely and within the desired budget and time frame.

The first objective of this study is to rank the important knowledge areas of construction project manager of contractors as perceived by contractors, consultants, and owners in Cambodia, Lao PDR, and Thailand. Secondly, it is to successively explore their current level of competencies to apply the important knowledge areas in construction projects. Lastly, the recommendations would be proposed for improving the insufficiency of competencies of project managers of contractors by obtaining some suggestions from the perceptions of the contractors, consultants, and owners.

The necessary data was collected from contractors, consultants, and owners; three principle actors in building construction project, who would be asked to evaluate the knowledge and competencies of project managers of contractor based on the developed questionnaire. First of all, for Cambodia, there were 14 construction projects surveyed and 36 respondents interviewed including 14 contractors, 12 consultants, and 10 owners. Next, 11 construction projects were investigated in Lao PDR, and 24 respondents were interviewed consisting of 9 contractors, 8 consultants,

and 7 owners. The last country is Thailand whose 12 construction projects were surveyed and 31 respondents were interviewed comprising 12 contractors, 10 consultants, and 9 owners.

After firstly analyzing the collected data using Analytic Hierarchy Process, the results remarkably indicated that time management, quality management, cost management, and safety management, are respectively the 1st to 4th ranking of 13 knowledge areas in Cambodia, Lao PDR, and Thailand, based on the overall perception. These four knowledge areas are considered as the high important knowledge. Other analyzed knowledge areas are, on the other hand, in different rankings for each country.

On the other hand, the Relative Level Index (RLI) showed that the competencies of local project managers to apply the important knowledge from perceptions of contractors are generally in higher level than the perceptions of consultants and owners in each country. According to the results, the competencies to apply the important knowledge are mostly medium in Cambodia from overall perceptions, whereas they are mostly low from perceptions of consultants and owners such as time management, quality management, safety management, risk management, material management, labor management, human resource management, and subcontractor management. Similarly, all relevant competencies of Lao project managers are in medium level from overall perceptions, and all of their competencies are in low level from perceptions of consultants and owners including time, safety, cost, risk, document, communication, and material management. Unlike these two countries, the competencies of Thai project managers to apply the important knowledge are mostly medium and high from the perceptions of contractors, consultants, owners, and overall perceptions. Although competencies of Thai project managers are mostly in high level, it still needs some approaches to improve their competencies in order to reach the advanced level.

These results illustrated that the competencies of local project managers to apply the important knowledge in each country are still in a limited or certain level. That is why the components of each knowledge areas were studied and surveyed in detail in order to discover the weakness or inadequacy of local project managers in each country. The elements of each knowledge areas are also considered as the

evidence to validate the result of competency. After completing results and evidence discussion, it is well-defined that obtained results of competency levels and studied evidence are almost in same direction of level of competencies in each country.

From literature reviews to result discussions; the ways to improve performances of construction project managers in Cambodia, Lao PDR, and Thailand, were successfully explored. An example of improvement method is by conducting training which should be intensively provided by various methods in each country in an attempt to fulfill the partially or typically insufficient competencies of local project managers.

In summary, the competencies of Cambodian project managers involving time management, quality management, cost management, and safety management, should significantly be improved because these knowledge areas were considered as high importance whereas their competencies to apply these important knowledge areas are in low level based on the perceptions of consultants and owners. For instance, Cambodian project managers should learn how to use new scheduling techniques in terms of time management knowledge not only to develop their own knowledge but also to effectively estimate and control the completion of project within the limited time. Moreover, the competencies of quality control and improvement should be enhanced in order to increase the performance of quality management of project. It is recommended that, regarding the cost estimating software, additional workshops or trainings should be increasingly conducted in Cambodia in order to show local project managers new techniques or software and new cost control techniques for estimating and controlling the project cost with more accuracy. Lastly, the local project managers should learn more about safety management of how efficiently to conduct the safety strategy implementation and safety risk control.

The competencies of Lao project managers should be also enhanced in terms of high important knowledge areas and their competencies to apply these knowledge areas which are in low level, consisting of time management, quality management, cost management, and safety management. Regarding to time management, the new estimating software and techniques should be particularly provided to local project managers through short course and training so that they could learn more about the advantages of these software and techniques and how to apply these methods for

construction project while nowadays they are mostly using spreadsheet as the main time estimating tool. Of course, training will significantly allow them know more about the importance of quality management in project, how to successfully control the work quality and how to efficiently improve the quality. Furthermore, possible training or short course ought to be set up for Lao project managers in order to principally expand and enhance both their knowledge and competency of cost management by showing more estimating software and cost control techniques to develop the estimated cost and to control cost of the entire project. It is found that the competency of safety management is needed to be improved by letting them know more how to implement the safety strategies in construction sites.

For the last country, even though there are mostly high levels of competencies of Thai project managers, it is still necessary to improve their knowledge and competency to reach excellent or outstanding goal. For instance, the training should be conducted in term of time management to encourage them to supportively use and practice advanced scheduling techniques. Of course, advantageous training or short course should be conducted in Thailand in an attempt to provide new perceptions to improve their inadequacy of knowledge and competency related to the quality management. Additionally, regarding to cost management, new and efficient cost estimating software should be introduced for Thai project managers to be aware and learn to apply new computer programs for their current construction projects in order to improve their competencies and performance of project. In particular, regarding safety management, local project managers should learn more about how to set up the safety training programs for training construction teams such as engineers, foremen, and laborers, to implement the safety strategies all the time.

6.2 Limitation of Study

The main constraint of this research is the limited time because there were a lot of data to be collected from not only three parties in construction project; contractor, consultant, and owner, but also three countries; Cambodia, Lao PDR, and Thailand. The short period of data collection significantly caused the collected sample not to correspond to the estimated sample. In particular, because the data were directly collected from the opinions or sensitivities of respondents, the questionnaire

should be more detail to get such data. Another constraint is the impossibility of data collection of private building construction projects. The research was supposed to gather data from both public and private construction projects to reach the required sample. This combination subsequently leads to having some differences between perspectives of project managers in private and governmental projects.

6.3 Further Study

It is suggested that the further study should be conducted on this topic by some ways as following:

1) Each country should be studied in detail to find out the serious deficiencies and needs in terms of knowledge and competencies of local project managers

2) Other countries should be researched on this issue in order to represent the whole aspect in South East Asia

REFERENCES

Alavi, J. and Leidner, S. Knowledge Management Systems: Issues, Challenges, and Benefits. *Communication of AIS* 1:7, 1999.

Andrew, R.J. Competency-Based Model for Predicting Construction Project Managers' Performance. *American Society of Civil Engineering* 21:1, 2005.

Awazu, Y. Informal Network Player, Knowledge Integration, and Competitive Advantage. *Journal of Knowledge Management* 8 (2004): 62-70.

Edum-Fotwe, F.T. Developing Project Management Competency: Perspectives from the Construction Industry. *International Journal of Project Management* 18 (2000): 111-124.

Eisner, H. *Essentials of Project and Systems Engineering Management*. Wiley Publication, 2008.

Gushgar, S. K., Francis, P. A., and Saklou, J. H. Skills Critical to Long-Term Profitability of Engineering Firms. *Journal of Management Engineering* 13:2 (1997): 46-56.

Harzallah, M. Human Resource Competency Management in Enterprise Engineering. *Proceedings of the IFAC World Congress 99. Beijing* (1999):181-186.

Hermosillo, W.J. Competence and knowledge: Introducing human resources in BPR, *ACS-SCM, Szczecin* (2002): 245-152.

Janice, T. Preparing Project Managers to Deal with Complexity: Advanced Project Management Education. *International Journal of Project Management* 26 (2008): 304-315.

Jay, L. A Set of Frameworks to Aid: The Project Manager in Conceptualizing and Implementing Knowledge Management Initiatives. *International Journal of Project Management* 21 (2003): 189-198.

Kwok, C. Competencies of Project Managers in Hong Kong. *A Dissertation Submitted to the Faculty of Architecture in Candidacy for the Degree of Bachelor of Science in Surveying*, 2004.

Maglitta, J. Know-how, Inc. *Computerworld* 30:1 (1996).

Mohamed, Y. Technical Knowledge Consolidation Using Theory of Inventive Problem Solving. *Journal of Construction Engineering and Management* 131:9 (2005).

Ogunlana, S. Factors and Procedures Used in Matching Project Managers to Construction Projects in Bangkok. *International Journal of Project Management* 25 (2002): 659-665.

Phann, M. *An Exploration of Cambodian Construction Industry: A Case Study of Contractors' Problem*. Master's Thesis, Department of Civil Engineering, Chulalongkorn University, 2008.

Patanakul, P. A Competency Model for Effectiveness in Managing Multiple Projects. *Journal of High Technology Management Research* 18 (2008): 118-131.

Patrick, S.W. Organizational Culture and Knowledge Management Success at Project and Organizational Levels in Contracting Firms. *Journal of Construction Engineering and Management*, 135:12, 2009.

PMBOK, Project Management Body of Knowledge. *Project Manageement Institute*. USA, 1996.

Renck, R., Kahn, E.L., and Gardner, B.B. *Continuing Education R&D Careers*. Prepared by the social Research, Inc., Government Printing Office, Washington D.C, 1969.

Roseau, M. *Project Management for Engineers*. Van Nostrand Reinhold Publication, 1984.

Saaty, T. *Fundamentals of Analytical Hierarchy Process*. RWS Publications, 4922 Ellsworth Avenue, Pittsburgh, PA 15413, USA, 2000.

Spencer, L.M. and Spencer, S.M. *Competency at Work: Model of Superior Performance*. John Wiley & Sons, New York, 1993.

Stuckenbruck, L.C. The Ten Attributes of The Proficient Project Manager. *8th Project management Institute Sem./Symp, Montreal,* 1976.

UNDP, *United Nation of Development Program*, 2009.

Verzuh, E. *The Fast Forward MBA in Project Management*. John Wiley & Sons, Inc., New York, 1999.

Wei, W.W. Developing Global Managers' Competencies Using: The Fuzzy DEMATEL Method. *Expert System with Applications* 32 (2007): 499-507.

Webster, D. *Webster's Dictionary Collegiate Thesaurus*. First Edition, 1976.

Wikipedia, available from http://en.wikipedia.org/wiki/cambodia, http://en.wikipedia.org/wiki/laos, and http://en.wikipedia.org/wiki/thailand [2009, November].

Yamane, T. *Statistic, an Introductory Analysis*. Harper and Row Publication, 1973.

APPENDICES

APPENDIX A

Questionnaire for Data Collection

CHULALONGKORN UNIVERSITY

FACULTY OF CIVIL ENGINEERING

QUESTIONNAIRE FORM

SURVEY ON THE PROJECT MANAGER OF CONSTRUCTION INDUSTRY FROM THE PERSPECTIVE OF KNOWLEDGE AND COMPETENCIES

PREPARED BY:

SEREYRASETH HANG
MASTER OF ENGINEERING
(CIVIL – CONSTRUCTION AND MANAGEMENT)

Company Name : _____

Respondent Name : _____

Position : _____

Date : _____

Project Name : _____

I. Please tick (√) one of the choices shown below:

1. Which of the following **Functions** most accurately describes your organization?

☐ Contractor

☐ Consultant

☐ Owner

2. How long have you been involved with construction industry and how many projects have you done so far?

1. Experience: ☐ Years ☐ Months
2. Number of Projects: ☐ Projects

3. Which of the following **Age Categories** most suitable describes yourself?

☐ 18 – 24 years old

☐ 25 – 29 years old

☐ 30 – 34 years old

☐ 35 – 39 years old

☐ 40 – 44 years old

☐ 45 – 50 years old

☐ > 50 years old

II. Please circle one of the choices shown below:

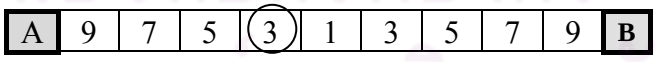
- List of knowledge area of construction project manager

A. Cost Management
B. Time Management
C. Quality Management
D. Contract Management
E. Material Management
F. Labor Management
G. Safety Management
H. Equipment Management
I. Subcontractor Management
J. Documental Management
K. Communication Management
L. Human Resource Management
M. Risk Management

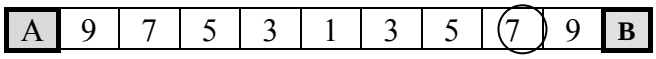
- Instruction of Analytic Hierarchy Process

Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two activities are equally important
3	Weak importance	One activity is more important than another weakly
5	Strong importance	One activity is more important than another strongly
7	Very strong importance	One activity is more important than another very strongly
9	Absolutely importance	One activity is more important than another absolutely

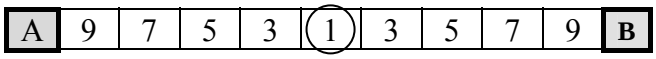
- Example: If **A** is more important than **B** weakly, please choose Number 3 at **A**.



But if **B** is more important than **A** strongly, please choose Number 5 at **B**-side.



But if **A** and **B** has the equal importance, please choose Number **1**.



How do you think that one knowledge area of **Construction Project Manager** is more important than another one in construction project?

A: Cost Management

A	9	7	5	3	1	3	5	7	9	Time management
A	9	7	5	3	1	3	5	7	9	Quality management
A	9	7	5	3	1	3	5	7	9	Contract management
A	9	7	5	3	1	3	5	7	9	Material management
A	9	7	5	3	1	3	5	7	9	Labor management
A	9	7	5	3	1	3	5	7	9	Equipment management
A	9	7	5	3	1	3	5	7	9	Safety management
A	9	7	5	3	1	3	5	7	9	Subcontractor management
A	9	7	5	3	1	3	5	7	9	Documental management
A	9	7	5	3	1	3	5	7	9	Communication management
A	9	7	5	3	1	3	5	7	9	Human Resource management
A	9	7	5	3	1	3	5	7	9	Risk management

B: Time Management

B	9	7	5	3	1	3	5	7	9	Quality management
B	9	7	5	3	1	3	5	7	9	Contract management
B	9	7	5	3	1	3	5	7	9	Material management
B	9	7	5	3	1	3	5	7	9	Labor management
B	9	7	5	3	1	3	5	7	9	Equipment management
B	9	7	5	3	1	3	5	7	9	Safety management
B	9	7	5	3	1	3	5	7	9	Subcontractor management
B	9	7	5	3	1	3	5	7	9	Documental management
B	9	7	5	3	1	3	5	7	9	Communication management
B	9	7	5	3	1	3	5	7	9	Human Resource management
B	9	7	5	3	1	3	5	7	9	Risk management

C: Quality Management

C	9	7	5	3	1	3	5	7	9	Contract management
C	9	7	5	3	1	3	5	7	9	Material management
C	9	7	5	3	1	3	5	7	9	Labor management
C	9	7	5	3	1	3	5	7	9	Equipment management
C	9	7	5	3	1	3	5	7	9	Safety management
C	9	7	5	3	1	3	5	7	9	Subcontractor management
C	9	7	5	3	1	3	5	7	9	Documental management

C	9	7	5	3	1	3	5	7	9	Communication management
C	9	7	5	3	1	3	5	7	9	Human Resource management
C	9	7	5	3	1	3	5	7	9	Risk management

D: Contract Management

D	9	7	5	3	1	3	5	7	9	Material management
D	9	7	5	3	1	3	5	7	9	Labor management
D	9	7	5	3	1	3	5	7	9	Equipment management
D	9	7	5	3	1	3	5	7	9	Safety management
D	9	7	5	3	1	3	5	7	9	Subcontractor management
D	9	7	5	3	1	3	5	7	9	Documental management
D	9	7	5	3	1	3	5	7	9	Communication management
D	9	7	5	3	1	3	5	7	9	Human Resource management
D	9	7	5	3	1	3	5	7	9	Risk management

E: Material Management

E	9	7	5	3	1	3	5	7	9	Labor management
E	9	7	5	3	1	3	5	7	9	Equipment management
E	9	7	5	3	1	3	5	7	9	Safety management
E	9	7	5	3	1	3	5	7	9	Subcontractor management
E	9	7	5	3	1	3	5	7	9	Documental management
E	9	7	5	3	1	3	5	7	9	Communication management
E	9	7	5	3	1	3	5	7	9	Human Resource management
E	9	7	5	3	1	3	5	7	9	Risk management

F: Labor Management

F	9	7	5	3	1	3	5	7	9	Equipment management
F	9	7	5	3	1	3	5	7	9	Safety management
F	9	7	5	3	1	3	5	7	9	Subcontractor management
F	9	7	5	3	1	3	5	7	9	Documental management
F	9	7	5	3	1	3	5	7	9	Communication management
F	9	7	5	3	1	3	5	7	9	Human Resource management
F	9	7	5	3	1	3	5	7	9	Risk management

G: Equipment Management

G	9	7	5	3	1	3	5	7	9	Safety management
G	9	7	5	3	1	3	5	7	9	Subcontractor management
G	9	7	5	3	1	3	5	7	9	Documental management
G	9	7	5	3	1	3	5	7	9	Communication management

G	9	7	5	3	1	3	5	7	9	Human Resource management
G	9	7	5	3	1	3	5	7	9	Risk management

H: Safety Management

H	9	7	5	3	1	3	5	7	9	Subcontractor management
H	9	7	5	3	1	3	5	7	9	Documental management
H	9	7	5	3	1	3	5	7	9	Communication management
H	9	7	5	3	1	3	5	7	9	Human Resource management
H	9	7	5	3	1	3	5	7	9	Risk management

I: Subcontractor Management

I	9	7	5	3	1	3	5	7	9	Documental management
I	9	7	5	3	1	3	5	7	9	Communication management
I	9	7	5	3	1	3	5	7	9	Human Resource management
I	9	7	5	3	1	3	5	7	9	Risk management

J: Documental Management

J	9	7	5	3	1	3	5	7	9	Communication management
J	9	7	5	3	1	3	5	7	9	Human Resource management
J	9	7	5	3	1	3	5	7	9	Risk management

K: Communication Management

K	9	7	5	3	1	3	5	7	9	Human Resource management
K	9	7	5	3	1	3	5	7	9	Risk management

L: Human Resource Management

L	9	7	5	3	1	3	5	7	9	Risk management

III. Please tick (√) one of the choices shown below:

III.1 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***cost management*** in your current construction project?

[Cost Management merely focuses on:

Cost estimating: Spreadsheet, and Others (Timberline, WinEstimate...)

Cost control: S-Curve and Cost Coding System]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the problems of ***cost management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the expectations needed to improve the construction project managers based on their ***cost management knowledge***?

  ……
  ……
  ……

III.2 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***time management*** in your current construction project?

[Time Management refers to:

Schedule development: *Bar Chart, CPM, and Others (PERT, Line of Balance…)*

Schedule software: (Primavera…) *Spreadsheet, M. Project, and Others*

Schedule control: *CPM and Delay control]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the problems of ***time management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the expectations needed to improve the construction project managers based on their ***time management knowledge***?

  ……
  ……
  ……

III.3 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***quality management*** in your current construction project?

[Quality Management concentrates on:

Quality control: Quality testing, quality inspection and quality document control

Quality improvement: Quality problem and solution recording]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***quality management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***quality management knowledge***?

  ……
  ……
  ……

III.4 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***contract management*** in your current construction project?

[Contract Management focus on:

Contract comprehension: *Contract requirement identification and contract risk identification*

Contract control: *Contract risk reduction and contract change control]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the problems of ***contract management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the expectations needed to improve the construction project managers based on their ***contract management knowledge***?

  ……
  ……
  ……

III.5 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***material management*** in your current construction project?

[Material Management refers to:

Material procurement: *Material delivery scheduling and purchase order preparation*

Material storage: *Proper location and reliable security system*

Stock management software: *Manual, Spreadsheet, and others (commercial software…)]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***material management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***material management knowledge***?

  ……
  ……
  ……

III.6 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***labor management*** in your current construction project?

[Laborer Management concentrates on:

Labor selection: *Formal skill test action and formal interview conduction*

Labor control: *Work quality, labor variation, labor safety, conflict*

Labor Development: *Skill-enhancement training and development training]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the problems of ***labor management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the expectations needed to improve the construction project managers based on their ***labor management knowledge***?

  ……
  ……
  ……

III.7 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***equipment management*** in your current construction project?

[Equipment Management focuses on:

Equipment planning: Right equipment identification and proper location determination

Equipment control: Equipment safety, noise impact control and maintenance program]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***equipment management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***equipment management knowledge***?

  ……
  ……
  ……

III.8 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***safety management*** in your current construction project?

[Safety Management concentrates on:

Safety strategy implementation: *Protective equipment action, safety sign, safety meeting, and safety training program*

Safety risk control: *Accident investigation and accident recording]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***safety management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***safety management knowledge***?

  ……
  ……
  ……

III.9 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***subcontractor management*** in your current construction project?

(Subcontractor Management refers to:

Subcontractor selection: *Quotation consideration, past project information, sufficiency of good equipment, and past safety performance*

Subcontractor control: *Subcontractor coordinating, scheduling, and work quality control]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***subcontractor management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***subcontractor management knowledge***?

  ……
  ……
  ……

III.10 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***documental management*** in your current construction project?

[Documental Management concentrates on:

Standard document: Needed document identification

Submittal planning: Needed submittal identification and submittal scheduling

Submittal control: Late submittal control]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***Documental management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***Documental management knowledge***?

  ……
  ……
  ……

III.11 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***communication management*** in your current construction project?

[Communication Management refers to:

Communication language: English speaking

Information distribution: Meeting and electronic mail]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***communication management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***communication management knowledge***?

  ……
  ……
  ……

III.12 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***human resource management*** in your current construction project?

[Human Resource Management concentrates on:

Staff recruitment: *Formal test action and formal interview conduction*

Staff control: *Organizational chart establishing and staff reporting action*

Team development: *Skill-enhancement training and development training]*

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the problems of ***human resource management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the expectations needed to improve the construction project managers based on their ***human resource management knowledge***?

  ……
  ……
  ……

III.13 According to your opinion, what is the ***level of competency (ability)*** of project manager to apply the knowledge of ***risk management*** in your current construction project?

[Risk Management focuses on:

Risk identification: Project risk identification and risk source determination

Risk control: Risk reduction measures, high project control]

☐ Very High

☐ High

☐ Medium

☐ Low

☐ Very Low

- What are the <u>problems</u> of ***risk management*** occurring in your construction project involving ***construction project manager's responsibilities***?

  ……
  ……
  ……

- What are the <u>expectations</u> needed to improve the construction project managers based on their ***risk management knowledge***?

  ……
  ……
  ……

APPENDIX B

Example of Data Analysis by AHP

Table B.1 Raw data from one contractor by AHP questionnaire

Knowledge Areas		Contractor (Canadia)												
			A	B	C	D	E	F	G	H	I	J	K	L	M
A	Cost managment	A	1	3	3	5	3	3	5	3	5	5	5	3	3
B	Time management	B		1	1	3	1	1	3	1	3	3	3	1	1
C	Quality management	C			1	3	1	1	3	1	3	3	3	1	1
D	Contract management	D				1	1/3	1/3	1	1/3	1	1	1	3	3
E	Material management	E					1	1	3	1	3	3	3	1	1
F	Labor management	F						1	3	1	3	3	3	1	1
G	Equipment management	G							1	1/3	1	1	1	1/3	1/3
H	Safety management	H								1	3	3	3	1	1
I	Subcontractor management	I									1	1	1	3	3
J	Documental management	J										1	1	1/3	1/3
K	Communication management	K											1	1/3	1/3
L	Human resource management	L												1	1
M	Risk management	M													1

Table B.2 Pair wise comparison by AHP

Pairwise Comparison													
	A	B	C	D	E	F	G	H	I	J	K	L	M
A	1.00	3.00	3.00	5.00	3.00	3.00	5.00	3.00	5.00	5.00	5.00	3.00	3.00
B	0.33	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
C	0.33	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
D	0.20	0.33	0.33	1.00	0.33	0.33	1.00	0.33	1.00	1.00	1.00	3.00	3.00
E	0.33	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
F	0.33	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
G	0.20	0.33	0.33	1.00	0.33	0.33	1.00	0.33	1.00	1.00	1.00	0.33	0.33
H	0.33	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
I	0.20	0.33	0.33	1.00	0.33	0.33	1.00	0.33	1.00	1.00	1.00	3.00	3.00
J	0.20	0.33	0.33	1.00	0.33	0.33	1.00	0.33	1.00	1.00	1.00	0.33	0.33
K	0.20	0.33	0.33	1.00	0.33	0.33	1.00	0.33	1.00	1.00	1.00	0.33	0.33
L	0.33	1.00	1.00	0.33	1.00	1.00	3.00	1.00	0.33	3.00	3.00	1.00	1.00
M	0.33	1.00	1.00	0.33	1.00	1.00	3.00	1.00	0.33	3.00	3.00	1.00	1.00

Table B.3 Matrix square and analysis by AHP

Matrix Square														Analysis		
	A	B	C	D	E	F	G	H	I	J	K	L	M	Sum	Weight	Rank
A	13.00	32.33	32.33	77.00	32.33	32.33	93.00	32.33	77.00	93.00	93.00	59.00	59.00	725.67	0.2083	1
B	5.67	13.00	32.33	32.33	13.00	13.00	37.67	13.00	32.33	37.67	37.67	29.00	29.00	325.67	0.0935	2
C	5.67	13.00	13.00	32.33	13.00	32.33	37.67	13.00	32.33	37.67	37.67	29.00	29.00	325.67	0.0935	2
D	3.76	9.93	9.93	13.00	9.93	9.93	29.00	9.93	13.00	29.00	29.00	15.27	15.27	196.96	0.0565	9
E	5.67	13.00	13.00	32.33	13.00	13.00	37.67	13.00	32.33	37.67	37.67	29.00	29.00	306.33	0.0879	4
F	5.67	13.00	13.00	32.33	13.00	13.00	37.67	13.00	32.33	37.67	37.67	29.00	29.00	306.33	0.0879	4
G	1.98	4.60	4.60	11.22	4.60	4.60	13.00	4.60	11.22	13.00	13.00	9.93	9.93	106.29	0.0305	11
H	5.67	13.00	13.00	32.33	13.00	13.00	37.67	13.00	32.33	37.67	37.67	29.00	29.00	306.33	0.0879	4
I	3.76	9.93	9.93	13.00	9.93	9.93	29.00	9.93	13.00	29.00	29.00	15.27	15.27	196.96	0.0565	9
J	1.98	4.60	4.60	11.22	4.60	4.60	13.00	4.60	11.22	13.00	13.00	9.93	9.93	106.29	0.0305	11
K	1.98	4.60	4.60	11.22	4.60	4.60	13.00	4.60	11.22	13.00	13.00	9.93	9.93	106.29	0.0305	11
L	4.60	11.22	11.22	27.00	11.22	11.22	32.33	11.22	27.00	32.33	32.33	13.00	13.00	237.71	0.0682	7
M	4.60	11.22	11.22	27.00	11.22	11.22	32.33	11.22	27.00	32.33	32.33	13.00	13.00	237.71	0.0682	7
Sum	4.33	11.67	11.67	25.67	11.67	11.67	31.00	11.67	25.67	31.00	31.00	17.00	17.00	3484.20		

λmax =	14.219
CI =	0.1016
RI =	1.56
CR =	**0.0651**

APPENDIX C

Table of Full Results in Cambodia

Table C.1 Contractors' perceptions in Cambodia for knowledge

Knowledge Area	Mean	Rank
Time management	0.2019	1
Cost management	0.1964	2
Quality management	0.0897	3
Safety management	0.0879	4
Labor management	0.0873	5
Risk management	0.0821	6
Material management	0.0774	7
Human resource management	0.0711	8
Subcontractor management	0.0418	9
Documental management	0.0416	10
Communication management	0.0376	11
Contract management	0.0334	12
Equipment management	0.0287	13

Table C.2 Consultants' perceptions in Cambodia for knowledge

Knowledge Area	Mean	Rank
Time management	0.2173	1
Quality management	0.1991	2
Safety management	0.1173	3
Cost management	0.1103	4
Contract management	0.0580	5
Risk management	0.0560	6
Documental management	0.0265	7
Material management	0.0259	8
Communication management	0.0257	9
Subcontractor management	0.0249	10
Human resource management	0.0249	11
Labor management	0.0249	12
Equipment management	0.0122	13

Table C.3 Owners' perceptions in Cambodia for knowledge

Knowledge Area	Mean	Rank
Quality management	0.1894	1
Time management	0.1400	2
Cost management	0.0892	3
Safety management	0.0883	4
Contract management	0.0645	5
Risk management	0.0443	6
Documental management	0.0291	7
Subcontractor management	0.0265	8
Communication management	0.0265	8
Human resource management	0.0211	10
Material management	0.0196	11
Labor management	0.0169	12
Equipment management	0.0138	13

Table C.4 Overall perception in Cambodia knowledge

Knowledge Area	Mean	Rank
Time management	0.1864	1
Quality management	0.1594	2
Cost management	0.1320	3
Safety management	0.0978	4
Risk management	0.0608	5
Contract management	0.0520	6
Labor management	0.0430	7
Material management	0.0410	8
Human resource management	0.0390	9
Documental management	0.0324	10
Subcontractor management	0.0311	11
Communication management	0.0299	12
Equipment management	0.0182	13

Table C.5 Contractors' perceptions in Cambodia for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	0	2	10	2	0	0.6000	Medium
Cost management	0	2	5	7	0	0.6714	High
Quality management	0	2	4	8	0	0.6857	High
Safety management	0	3	5	6	0	0.6429	High
Labor management	0	3	10	1	0	0.5714	Medium
Risk management	0	3	8	3	0	0.6000	Medium
Material management	0	4	8	2	0	0.5714	Medium
Human resource management	0	0	5	8	1	0.7429	High
Subcontractor management	0	4	9	1	0	0.5571	Medium
Documental management	0	1	6	7	0	0.6857	High
Communication management	0	3	4	6	1	0.6714	High
Contract management	0	4	7	3	0	0.5857	Medium
Equipment management	0	3	9	2	0	0.5857	Medium

Table C.6 Consultants' perceptions in Cambodia for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	4	5	3	0	0	0.3833	Low
Quality management	3	6	3	0	0	0.4000	Low
Safety management	4	6	2	0	0	0.3667	Low
Cost management	0	5	6	1	0	0.5333	Medium
Contract management	0	2	8	2	0	0.6000	Medium
Risk management	5	6	1	0	0	0.3333	Low
Documental management	0	1	11	0	0	0.5833	Medium
Material management	3	7	2	0	0	0.3833	Low
Communication management	0	4	7	1	0	0.5500	Medium
Subcontractor management	0	1	10	1	0	0.6000	Medium
Human resource management	0	3	6	3	0	0.6000	Medium
Labor management	2	8	2	0	0	0.4000	Low
Equipment management	0	3	7	2	0	0.5833	Medium

Table C.7 Owners' perceptions in Cambodia for competencies

	n1	n2	n3	n4	n5	Mean	Level
Quality management	2	6	2	0	0	0.4000	Low
Time management	3	4	3	0	0	0.4000	Low
Cost management	0	3	7	0	0	0.5400	Medium
Safety management	4	5	1	0	0	0.3400	Low
Contract management	0	3	6	1	0	0.5600	Medium
Risk management	1	9	0	0	0	0.3800	Low
Documental management	0	1	8	1	0	0.6000	Medium
Subcontractor management	1	8	1	0	0	0.4000	Low
Communication management	0	3	5	1	1	0.6000	Medium
Human resource management	3	5	2	0	0	0.3800	Low
Material management	3	5	2	0	0	0.3800	Low
Labor management	2	7	1	0	0	0.3800	Low
Equipment management	0	3	5	2	0	0.5800	Medium

Table C.8 Overall perception in Cambodia for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	7	11	16	2	0	0.4722	Medium
Quality management	5	14	9	8	0	0.5111	Medium
Cost management	0	10	18	8	0	0.5889	Medium
Safety management	8	14	8	6	0	0.4667	Medium
Risk management	6	18	9	3	0	0.4500	Medium
Contract management	0	9	21	6	0	0.5833	Medium
Labor management	4	18	13	1	0	0.4611	Medium
Material management	6	16	12	2	0	0.4556	Medium
Human resource management	3	8	13	11	1	0.5944	Medium
Documental management	0	3	25	8	0	0.6278	High
Subcontractor management	1	13	20	2	0	0.5278	Medium
Communication management	0	10	16	8	2	0.6111	High
Equipment management	0	11	12	9	1	0.5500	Medium

APPENDIX D

Table of Full Results in Lao PDR

Table D.1 Contractors' perceptions in Lao PDR for knowledge

Knowledge Area	Mean	Rank
Cost management	0.2304	1
Time management	0.1112	2
Quality management	0.1038	3
Risk management	0.0971	4
Material management	0.0809	5
Human resource management	0.0735	6
Labor management	0.0670	7
Contract management	0.0638	8
Safety management	0.0547	9
Subcontractor management	0.0391	10
Communication management	0.0306	11
Documental management	0.0251	12
Equipment management	0.0228	13

Table D.2 Consultants' perceptions in Lao PDR for knowledge

Knowledge Area	Mean	Rank
Time management	0.2150	1
Quality management	0.1688	2
Safety management	0.1260	3
Cost management	0.0779	4
Subcontractor management	0.0522	5
Contract management	0.0496	6
Risk management	0.0433	7
Documental management	0.0355	8
Communication management	0.0246	9
Labor management	0.0245	10
Material management	0.0237	11
Human resource management	0.0222	12
Equipment management	0.0118	13

Table D.3 Owners' perceptions in Lao PDR for knowledge

Knowledge Area	Mean	Rank
Time management	0.2684	1
Quality management	0.1734	2
Contract management	0.1328	3
Safety management	0.0925	4
Cost management	0.0880	5
Communication management	0.0479	6
Subcontractor management	0.0381	7
Documental management	0.0381	7
Material management	0.0302	9
Risk management	0.2880	10
Human resource management	0.0260	11
Equipment management	0.0179	12
Labor management	0.0179	13

Table D.4 Overall perceptions in Lao PDR for knowledge

Knowledge Area	Mean	Rank
Time management	0.1982	1
Quality management	0.1487	2
Cost management	0.1321	3
Safety management	0.0911	4
Contract management	0.0821	5
Risk management	0.0564	6
Material management	0.0449	7
Subcontractor management	0.0431	8
Human resource management	0.0406	9
Labor management	0.0365	10
Communication management	0.0343	11
Documental management	0.0329	12
Equipment management	0.0175	13

Table D.5 Contractors' perceptions in Lao PDR for competencies

	n1	n2	n3	n4	n5	Mean	Level
Cost management	0	1	7	1	0	0.6000	Medium
Time management	0	0	2	7	0	0.7556	High
Quality management	0	1	8	0	0	0.5778	Medium
Risk management	2	6	1	0	0	0.3778	Low
Material management	0	1	2	6	0	0.7111	High
Human resource management	0	2	3	4	0	0.6444	High
Labor management	0	2	6	1	0	0.5778	Medium
Contract management	0	3	5	1	0	0.5556	Medium
Safety management	1	7	0	0	0	0.3333	Low
Subcontractor management	0	2	7	0	0	0.5556	Medium
Communication management	0	3	6	0	0	0.5333	Medium
Documental management	0	2	6	1	0	0.5778	Medium
Equipment management	0	2	2	5	0	0.6667	High

Table D.6 Consultants' perceptions in Lao PDR for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	3	5	0	0	0	0.3250	Low
Quality management	1	1	6	0	0	0.5250	Medium
Safety management	1	6	1	0	0	0.4000	Low
Cost management	2	5	1	0	0	0.3750	Low
Subcontractor management	1	1	5	1	0	0.5500	Medium
Contract management	0	2	6	0	0	0.5500	Medium
Risk management	1	6	1	0	0	0.4000	Low
Documental management	2	6	0	0	0	0.3500	Low
Communication management	2	5	1	0	0	0.3750	Low
Labor management	0	3	4	1	0	0.5500	Medium
Material management	2	4	2	0	0	0.4000	Low
Human resource management	0	2	6	0	0	0.5500	Medium
Equipment management	0	2	5	1	0	0.5750	Medium

Table D.7 Owners' perceptions in Lao PDR for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	2	4	1	0	0	0.3714	Low
Quality management	1	2	4	0	0	0.4857	Medium
Contract management	0	1	5	1	0	0.6000	Medium
Safety management	2	4	1	0	0	0.3714	Low
Cost management	1	5	1	0	0	0.4000	Low
Communication management	0	3	4	0	0	0.5143	Medium
Subcontractor management	1	1	5	0	0	0.5143	Medium
Documental management	2	4	1	0	0	0.3714	Low
Material management	0	2	4	1	0	0.5714	Medium
Risk management	2	3	2	0	0	0.4000	Low
Human resource management	0	0	7	0	0	0.6000	Medium
Equipment management	0	2	5	0	0	0.5429	Medium
Labor management	2	1	4	0	0	0.4571	Medium

Table D.8 Overall perceptions in Lao PDR for competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	5	9	3	7	0	0.5000	Medium
Quality management	2	4	18	0	0	0.5333	Medium
Cost management	3	11	9	1	0	0.4667	Medium
Safety management	4	17	2	0	0	0.3667	Low
Contract management	0	6	16	2	0	0.5667	Medium
Risk management	5	15	4	0	0	0.3917	Low
Material management	2	7	8	7	0	0.5667	Medium
Subcontractor management	2	4	17	1	0	0.5417	Medium
Human resource management	0	4	16	4	0	0.6000	Medium
Labor management	2	6	14	2	0	0.5333	Medium
Communication management	2	11	11	0	0	0.4750	Medium
Documental management	4	12	7	1	0	0.4417	Medium
Equipment management	0	7	17	0	0	0.5417	Medium

APPENDIX E

Table of Full Results in THAILAND

Table E.1 Contractors' perceptions in Thailand for knowledge

Knowledge Area	Mean	Rank
Cost managment	0.1928	1
Time management	0.1807	2
Quality management	0.0916	3
Safety management	0.0763	4
Material management	0.0728	5
Labor management	0.0712	6
Risk management	0.0671	7
Human resource management	0.0668	8
Communication management	0.0406	9
Subcontractor management	0.0382	10
Documental management	0.0363	11
Equipment management	0.0342	12
Contract management	0.0313	13

Table E.2 Consultants' perceptions in Thailand for knowledge

Knowledge Area	Mean	Rank
Time management	0.2167	1
Quality management	0.1970	2
Cost managment	0.1150	3
Safety management	0.1121	4
Contract management	0.0654	5
Risk management	0.0588	6
Labor management	0.0381	7
Material management	0.0380	8
Documental management	0.0355	9
Human resource management	0.0354	10
Communication management	0.0353	11
Subcontractor management	0.0317	12
Equipment management	0.0210	13

Table E.3 Owners' perceptions in Thailand for knowledge

Knowledge Area	Mean	Rank
Quality management	0.2298	1
Time management	0.1737	2
Cost managment	0.1112	3
Safety management	0.0787	4
Contract management	0.0685	5
Labor management	0.0570	6
Subcontractor management	0.0548	7
Material management	0.0493	8
Communication management	0.0430	9
Risk management	0.0394	10
Documental management	0.0394	11
Human resource management	0.0280	12
Equipment management	0.0271	13

Table E.4 Overall perception in Thailand for knowledge

Knowledge Area	Mean	Rank
Time management	0.1904	1
Quality management	0.1728	2
Cost managment	0.1397	3
Safety management	0.0890	4
Labor management	0.0554	5
Risk management	0.0551	6
Contract management	0.0551	7
Material management	0.0534	8
Human resource management	0.0434	9
Subcontractor management	0.0416	10
Communication management	0.0396	11
Documental management	0.0371	12
Equipment management	0.0274	13

Table E.5 Contractors' perceptions in Thailand for competencies

	n1	n2	n3	n4	n5	Mean	Level
Cost management	0	0	3	6	3	0.8000	High
Time management	0	0	4	5	3	0.7833	High
Quality management	0	0	4	7	1	0.7500	High
Safety management	0	0	3	7	2	0.7833	High
Material management	0	3	3	6	0	0.6500	High
Labor management	0	0	3	9	0	0.7500	High
Risk management	1	3	6	2	0	0.5500	Medium
Human resource management	0	3	7	2	0	0.5833	Medium
Communication management	0	0	2	8	2	0.8000	High
Subcontractor management	0	3	6	3	0	0.6000	Medium
Documental management	0	3	3	6	0	0.6500	High
Equipment management	0	0	3	8	1	0.7667	High
Contract management	0	2	4	6	0	0.6667	High

Table E.6 Consultants' perceptions in Thailand for Competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	0	1	3	5	1	0.7200	High
Quality management	0	0	3	7	0	0.7400	High
Cost management	0	0	3	6	1	0.7600	High
Safety management	0	0	2	8	0	0.7600	High
Contract management	0	0	2	7	1	0.7800	High
Risk management	0	1	8	1	0	0.6000	Medium
Labor management	0	2	5	3	0	0.6200	High
Material management	0	3	5	2	0	0.5800	Medium
Documental management	1	3	5	1	0	0.5200	Medium
Human resource management	0	3	6	1	1	0.6600	High
Communication management	0	2	6	2	0	0.6000	Medium
Subcontractor management	0	4	5	1	0	0.5400	Medium
Equipment management	0	1	2	6	1	0.7400	High

Table E.7 Owners' perceptions in Thailand for Competencies

	n1	n2	n3	n4	n5	Mean	Level
Quality management	0	0	3	6	0	0.7333	High
Time management	0	0	2	6	1	0.7778	High
Cost management	0	0	3	5	1	0.7556	High
Safety management	0	0	2	7	0	0.7556	High
Contract management	0	1	3	5	0	0.6889	High
Labor management	0	2	6	1	0	0.5778	Medium
Subcontractor management	0	1	2	5	1	0.7333	High
Material management	0	2	5	2	0	0.6000	Medium
Communication management	0	3	5	1	0	0.5556	Medium
Risk management	0	1	7	1	0	0.6000	Medium
Documental management	0	0	3	4	2	0.7778	High
Human resource management	0	0	2	6	1	0.7778	High
Equipment management	0	2	3	4	0	0.6444	High

Table E.8 Overall perception in Thailand for Competencies

	n1	n2	n3	n4	n5	Mean	Level
Time management	0	1	9	16	5	0.7613	High
Quality management	0	0	10	20	1	0.7419	High
Cost managment	0	0	9	17	5	0.7742	High
Safety management	0	0	7	22	2	0.7677	High
Labor management	0	4	14	13	0	0.6581	High
Risk management	1	5	21	4	0	0.5806	Medium
Contract management	0	3	9	18	1	0.7097	High
Material management	0	8	13	10	0	0.6129	High
Human resource management	0	6	15	9	2	0.6645	High
Subcontractor management	0	8	13	9	1	0.6194	High
Communication management	0	5	13	11	2	0.6645	High
Documental management	1	6	11	11	2	0.6452	High
Equipment management	0	3	8	18	2	0.7226	High

APPENDIX F

Respondents' Expectations in Each Country

Table F.1 Respondents' Expectations in Cambodia

Knowledge Area of Project Manager		Percentage of Interviewed Respondents for Expectations		
		Contractors (14)	**Consultants (12)**	**Owners (10)**
Time Management	Providing new scheduling techniques	50%	92%	90%
	Providing new scheduling software	43%	100%	70%
Quality Management	Improving quality control system	43%	100%	100%
	Promoting quality improvement	36%	75%	80%
Cost Management	Providing new Estimating Software	57%	50%	30%
	Improving cost control system	36%	50%	50%
Safety Management	Improving safety strategy implementation	29%	100%	80%
	Upgrading Safety Risk Control	0%	100%	70%
Risk Management	Upgrading risk identification system	71%	67%	50%
	Improving risk control system	64%	50%	40%
Contract Management	Improving contract comprehension	7%	42%	70%
	Improving contract control system	36%	58%	60%
Labor Management	Strengthening labor selection	0%	50%	40%
	Upgrading labor control system	21%	50%	40%
	Providing labor development system	29%	42%	30%
Material Management	Developing material procurement planning	14%	58%	60%
	Providing new stock management software	57%	17%	0%
Human Resource Management	Improving staff recruitment system	7%	50%	40%
	Reinforcing staff control system	14%	58%	40%

Table F.1 Respondents' Expectations in Cambodia

	Setting up team development system	0%	25%	20%
Documental Management	Developing submittal planning	0%	42%	40%
	Improving submittal control system	21%	33%	20%
Subcontractor Management	Strengthening subcontractor selection	0%	42%	30%
	Improving subcontractor control	7%	83%	50%
Communication Management	Improving communcation language	7%	25%	30%
	Improving information distribution system	7%	33%	30%
Equipment Management	Setting up equipment planning	14%	42%	20%
	Improving equipment control system	21%	50%	40%

Table F.2 Respondents' Expectations in Lao PDR

Knowledge Area of Project Manager		**Percentage of Interviewed Respondents for Expectations**		
		Contractors (9)	**Consultants (8)**	**Owners (7)**
Time Management	Providing new scheduling techniques	56%	75%	71%
	Providing new scheduling software	44%	88%	86%
Quality Management	Improving quality control system	44%	75%	71%
	Promoting quality improvement	33%	100%	100%
Cost Management	Providing new Estimating Software	56%	50%	43%
	Improving cost control system	33%	38%	43%
Safety Management	Improving safety strategy implementation	44%	88%	100%
	Upgrading Safety Risk Control	11%	100%	70%

Table F.2 Respondents' Expectations in Lao PDR

Contract Management	Improving contract comprehension	11%	50%	71%
	Improving contract control system	44%	63%	57%
Risk Management	Upgrading risk identification system	78%	75%	71%
	Improving risk control system	67%	50%	43%
Material Management	Developing material procurement planning	22%	63%	57%
	Providing new stock management software	56%	25%	0%
Subcontractor Management	Strengthening subcontractor selection	0%	38%	29%
	Improving subcontractor control	11%	63%	43%
Human Resource Management	Improving staff recruitment system	11%	50%	43%
	Reinforcing staff control system	22%	63%	57%
	Setting up team development system	0%	38%	14%
Labor Management	Strengthening labor selection	0%	50%	43%
	Upgrading labor control system	22%	75%	57%
	Providing labor development system	33%	38%	29%
Communication Management	Improving communication language	11%	25%	29%
	Improving information distribution system	11%	25%	43%
Documental Management	Developing submittal planning	0%	38%	43%
	Improving submittal control system	33%	50%	29%
Equipment Management	Setting up equipment planning	22%	38%	29%
	Improving equipment control system	22%	50%	43%

Table F.3 Respondents' Expectations in Thailand

Knowledge Area of Project Manager		**Percentage of Interviewed Respondents for Expectations**		
		Contractors (12)	**Consultants (10)**	**Owners (9)**
Time Management	Providing new scheduling techniques	50%	60%	56%
	Providing new scheduling software	33%	70%	67%
Quality Management	Improving quality control system	33%	60%	78%
	Promoting quality improvement	25%	60%	78%
Cost Management	Providing new Estimating Software	42%	40%	33%
	Improving cost control system	25%	30%	33%
Safety Management	Improving safety strategy implementation	33%	70%	78%
	Upgrading Safety Risk Control	8%	90%	78%
Labor Management	Strengthening labor selection	0%	40%	33%
	Upgrading labor control system	17%	60%	44%
	Providing labor development system	25%	30%	22%
Risk Management	Upgrading risk identification system	58%	60%	56%
	Improving risk control system	50%	40%	33%
Contract Management	Improving contract comprehension	8%	40%	63%
	Improving contract control system	33%	50%	44%
Material Management	Developing material procurement planning	17%	50%	44%
	Providing new stock management software	42%	20%	0%
Human Resource Management	Improving staff recruitment system	8%	40%	33%
	Reinforcing staff control system	17%	50%	44%

Table F.3 Respondents' Expectations in Thailand

	Setting up team development system	0%	30%	11%
Subcontractor Management	Strengthening subcontractor selection	0%	30%	22%
	Improving subcontractor control	8%	50%	33%
Communication Management	Improving communication language	8%	20%	22%
	Improving information distribution system	8%	20%	33%
Documental Management	Developing submittal planning	0%	30%	33%
	Improving submittal control system	25%	40%	22%
Equipment Management	Setting up equipment planning	17%	30%	22%
	Improving equipment control system	17%	40%	33%

APPENDIX G

Evidence of Competencies of Local Project Managers

Table G Evidence of competencies of each knowledge area

Knowledge Area of Project Manager		**Evidence of Competency**	**Percentage of competency of Interviewed Contractor**		
			Cambodia (14)	**Lao PDR (9)**	**Thailand (12)**
Cost Management	Estimating Software	*Spreadsheet*	100%	100%	100%
		Others (Timberline,..)	0%	0%	0%
	Cost Control	*S-Curve*	43%	33%	83%
		Cost Coding System	14%	11%	25%
Time Management	Schedule Technique	*Bar Chart*	100%	100%	100%
		CPM	0%	0%	25%
		Others (PERT, Line of Balance…)	0%	0%	0%
	Scheduling Software	*Spreadsheet*	7%	44%	0%
		M. Project	100%	56%	100%
		Others (Primavera,…)	0%	0%	0%
	Time Control	*CPM*	0%	0%	25%
		Delay Control	29%	33%	58%
Quality Management	Quality Control	*Quality Testing*	100%	100%	100%
		Quality Inspection	57%	56%	75%
		Quality Checklist	71%	67%	100%
	Quality Improvement	*Quality Problem Record*	64%	56%	67%
Contract Management	Contract Comprehension	*Full Requirement Identification*	57%	56%	75%
		Contract Risk Identification	29%	33%	50%
	Contract Control	*Contract Risk Reduction*	21%	22%	42%
		Contract Change Control	50%	44%	67%

Table G Evidence of competencies of each knowledge area

Material Management	Material Procurement	*Material Delivery Scheduling*	50%	44%	58%
		Purchase Order Preparation	64%	56%	83%
	Material Storage	*Proper Location*	79%	78%	83%
		Reliable Security System	86%	78%	92%
	Stock Management Software	*Manuals*	100%	100%	67%
		Spreadsheet	0%	0%	33%
		Others(Commercial Software,…)	0%	0%	0%
Labor Management	Labor Selection	*Formal Skill Test Action*	0%	0%	0%
		Formal Interview Conduction	0%	0%	0%
	Labor Control	*Work Quality Control*	64%	56%	67%
		Labor Variation Control	43%	44%	50%
		Labor Safety Control	64%	67%	75%
		Conflict Control	71%	78%	75%
	Labor Development	*Skill-Enhancement Training*	0%	0%	0%
		Development Training	0%	0%	0%
Equipment Management	Equipment Planning	*Right Equipment Identification*	64%	67%	83%
		Proper Location Determination	79%	78%	83%
	Equipment Control	*Equipment Safety Control*	36%	33%	42%
		Noise Impact Control	0%	0%	0%
		Maintenance Program	43%	44%	50%
Safety Management	Safety Strategy Implementation	*Protective Equipment Action*	79%	67%	100%
		Safety Sign Implementation	100%	89%	100%
		Safety Inspection	50%	44%	67%
		Safety Meeting Conduction	43%	44%	58%

Table G Evidence of competencies of each knowledge area

		Safety Training Program	0%	0%	0%
	Safety Risk Control	*Accident Investigation*	57%	56%	58%
		Accident Recording	36%	33%	42%
Subcontractor Management	Subcontractor Selection	*Quotation Consideration*	100%	100%	100%
		Experienced Labor Consideration	21%	22%	25%
		Past Project Information	50%	56%	50%
		Adequacy *of Good Equipment*	50%	44%	75%
		Past Safety Performance	14%	11%	17%
	Subcontractor Control	*Subcontractor Coordinating*	71%	67%	75%
		Subcontractor Scheduling	71%	67%	75%
		Work Quality Control	57%	56%	67%
Documental Management	Standard Document	*Needed Document Identification*	71%	67%	83%
	Submittal Planning	*Needed Submittal Determination*	64%	56%	75%
		Submittal Scheduling	50%	33%	50%
	Submittal Control	*Late Submittal Control*	50%	33%	50%
Communication Management	Communication Language	*English Speaking*	93%	89%	92%
	Information Distribution	*Meeting*	100%	100%	100%
		Electronic Mail	100%	100%	100%
Human Resource Management	Staff Recruitment	*Formal Test Action*	0%	0%	0%
		Formal Interview Conduction	100%	100%	100%
	Staff Control	*Organizational Chart Establishment*	93%	67%	100%
		Staff Reporting Action	36%	33%	50%
	Team Development	*Skill-Enhancement Training*	0%	0%	25%
		Development Training	0%	0%	25%

Table G Evidence of competencies of each knowledge area

Risk Management	Risk Identification	*Project Risk Determination*	21%	22%	33%
		Risk Source Determination	14%	11%	25%
	Risk Control	*High Project Risk Control*	21%	22%	25%
		Risk Reduction Measure	14%	11%	25%

BIOGRAPHY

Sereyraseth Hang was born on February 13, 1986 in Phnom Penh, the capital city of Cambodia, where he mostly spent his time for academic study from primary school until educational institution. He succeeded in obtaining a Bachelor Degree from Institute of Technology of Cambodia (ITC) in a major of Rural Engineering in 2008. He was promptly awarded AUN/SEED-Net JICA scholarship which formally admitted him to pursue his Master Degree in a field of Infrastructure Civil Engineering, Chulalongkorn University, Thailand.