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
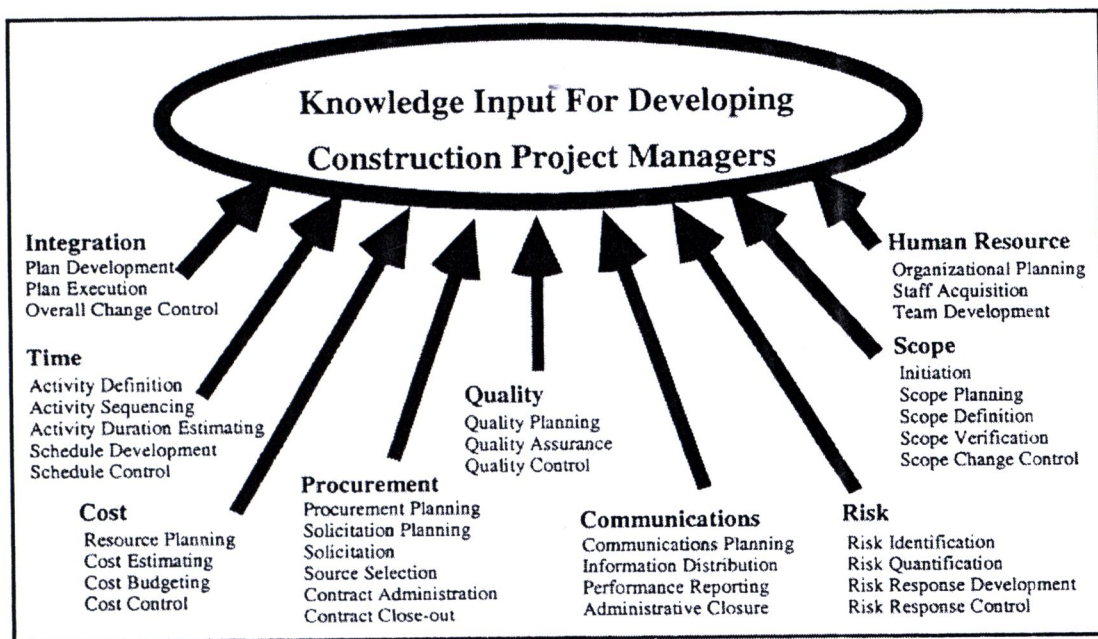9. Knowledge of Procurement Management

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

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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.
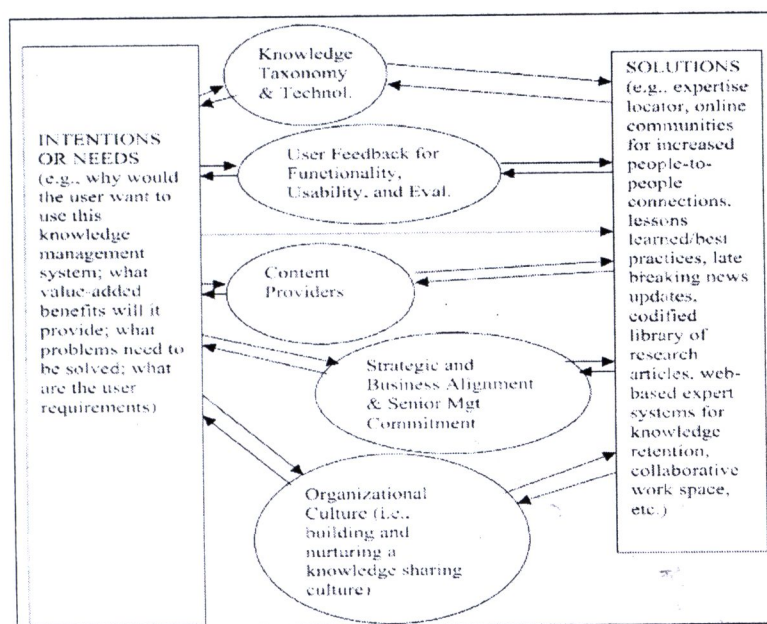

Figure 2.2 A generic knowledge management framework (Jay, 2003)

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