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## Industrialized Building System Projects: A Survey of Construction Project Manager's Competencies in Malaysia

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### ABSTRACT

IBS is a construction system promoted by the Malaysian government in order to encourage the systematic construction process. Until now, the IBS construction project still consists of a conventional construction method. Due to the combination of these two methods, IBS project can be assumed as multi-complex task and project. Scholars agreed that the IBS construction process consolidated with many issues, which required management by qualified and experienced organization led by a competent construction project manager. A construction project manager is responsible for the success of the construction process which consist of initiation, planning, executing, monitoring and closing phase of a project. IBS construction projects are still inclusive of the conventional construction method. Thus, a competent construction project manager is important to integrate these two different methods and handle it as a holistic construction process. Literature review shows that specific competency is required to deal with the variety of methods used in the project. Furthermore, the construction project manager which posses required competency, may inspire the project team to success and win the confidence of the client. The purpose of this paper is to investigate initial information related to the competency of construction project managers in the context of the IBS construction projects in the Malaysian construction industry. Semi-structured interviews were conducted among the construction project managers which have experience in managing an IBS construction project. After conducting seven (7) interviews, the answers reach a saturated point. The finding reveals unanimously agreed that the construction project managers who managed IBS construction projects required specific competency as compared to the generic construction projects in terms of skills, knowledge and behavior. This paper will form a basis of the ongoing main research, with the aim is to develop a competency framework for a construction project manager in managing the construction process of the IBS construction project. It is hoped that the findings from this research will assist the construction project managers in their career development.

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## INTRODUCTION

The construction industry is unique compared to the other industries as it is a project oriented industry that produces unique projects. Each project involved a long duration starting with the initiation phase, design, procurement, construction and operation/ maintenance. Like other industries, construction industry market has also become competitive over the years, which urge the construction firms to complete the construction project with least time and high quality. It is no longer impossible to produce quality projects in a shorter time frame with the emergence of the Industrialized Building System (IBS).

IBS can be described as the construction technique that involved the using of prefabricated construction components that are manufactured in a controlled environment, transported, positioned and assembled with minimal additional site work (Hamid, *et al.*, 2008). The introduction of Industrialized Building System (IBS), adding to the variety of systems, technologies and methods to be implemented in the Malaysian construction industry. IBS is a construction system promoted by the Malaysian government in order to encourage the systematic construction process (Hamid *et al.*, 2008). According to Nadim & Goulding (2011), industrialization is a business strategy that transforms the traditional construction process into a manufacturing and assembly process in order to reduce cost, time, and improve the quality of the product. This is achieved through engaging

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people, embracing new technologies and translating clients' needs into building requirements through new contractual working relationships across the supply chain. The use of IBS will overcome the issues of repetitive part of the building but difficult, time consuming and costly labour at the site. At the same time, IBS also involve on-site casting using innovative and clean mould technologies such as steel, aluminium and plastic (CIDB, 2011). The application of IBS in the construction process is perceived to offer massive enhancement in productivity and quality of building construction amongst the numerous improvements evolving in the industry (Onyeizu *et al.*, 2011).

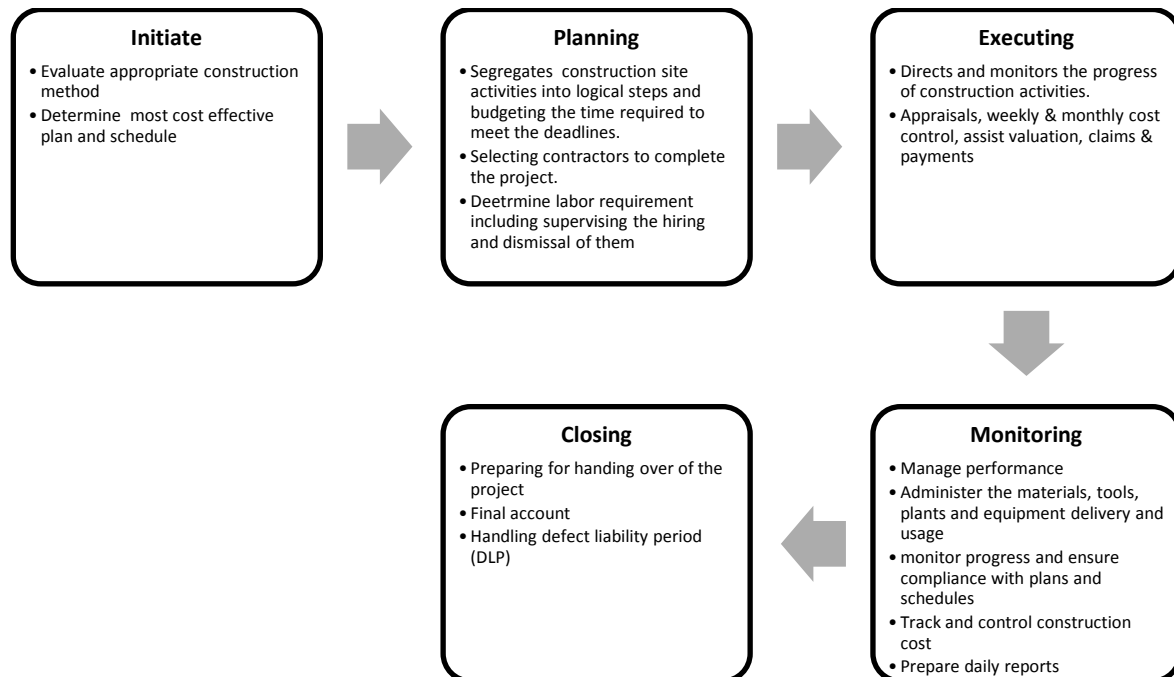
IBS is not a new technology adopted in our country. During the early sixties, Ministry of Housing and Local Government visited several European countries and assessed their building system, from there, the idea of IBS implementation was developed (Thanoon *et al.*, 2003). The first IBS pilot project in Malaysia started 50 years ago in the 1960s which situated at Jalan Pekeliling. Nearly 22.7 acres of land were developed in 17-storey flats (300 units of low cost flat and 40 shop lots). The second IBS project constructed at Jalan Rifle Range Penang in 1965 which consists of six blocks 17-storey flats and three blocks 18-storey flats (Kamar *et al.*, 2007, Thanoon *et al.*, 2003). IBS in Malaysia only became prominent in 1998; it began with an IBS Strategic Plan endorsed by the Cabinet of Ministers which plays a role as the blueprint for the total industrialization of the construction sector. Since then, the Construction Industry Development Board (CIDB) has been actively promoting the use of IBS in Malaysian Construction Industry (Mohamad *et al.*, 2009).

Since 2008, IBS has been made compulsory in a public building project, where 70% of components using in the construction must contain IBS (Hamid *et al.*, 2008). Nawi *et al.*, (2007) and Hamid *et al.*, (2008) mention that, although the IBS system improves the quality of projects, easier to control, reducing rectification work and lowering the total cost of construction, the trend of IBS usage in Malaysian construction projects are still below the national target. Consequently, it makes the IBS construction project consisting with a higher percentage of conventional construction methods (Kamar, *et al.*, 2010). As reported by IBS Centre CIDB (2007), the highest IBS score for the IBS project in the Klang Valley is 83 while the lowest is 21.5, average IBS score is 62. The percentage indicates that most of the IBS construction projects are still consolidating with the traditional construction method. Due to the combination of these two methods, IBS project can be assumed as multi-task and complex project. Moreover, the IBS construction process consolidated with many issues (Rahman & Omar, 2006), thus managing IBS project required a qualified and experienced organization led by a competent construction project manager to achieve successful deliveries (Clements & Gido, 2012; Kamar *et al.*, 2010). On the other hand, Müller & Turner (2007) stated that the competencies required by a construction project manager are varied according to project type and project phases (Skulmoski *et al.*, 2010). Accordingly, in addressing the knowledge gap in the construction level, this paper will present a semi-structured preliminary interview findings with regard to the competency required for a construction project manager in managing the construction process of IBS projects.

### ***The importance of Construction Project Manager in Managing a project:***

Hassan (2005) mentions that a range of job titles has been used to describe the person performing the duties of construction project managers within the industry. A construction project manager is a business entity that facilitates the use of the construction management project delivery system on a construction project. According to Zwikael (2011), a manager who managed the construction project, is the person held accountable for the delivery of the project's outputs and for meeting the project's constraints. They may initiate, plan, execute, monitor and close a whole project or just part of the project. The term construction project manager is also used to identify individual practitioners that are part of the construction management organization. In the context of this research, construction project managers can be defined as a person (owner or salaried employees) of the construction company overseeing the construction management of a project. Sufficient competencies enable the construction project manager monitor and control the progress of the project smoothly. One of the important tasks of a successful construction project manager is to be able to handle unexpected situations effectively (Isa, 2007). This is why, a construction project manager must possess required competency in term of skills, knowledge and behavior (Crawford, 2000). The construction process consists of five project management process which are initiating, planning, executing, monitoring and closing and it deal with various participants (Osman, 2006). The main role of construction project manager is to coordinate the activities within the project management process with the various team members to ensure that they perform the right tasks at the proper time (Clements & Gido, 2012). A construction project manager must ensure that those who work on the project have the appropriate knowledge and resources, to accomplish their assigned responsibilities (Sutton, 2011). A construction project manager has a very important objective such as setting achievable and effective goals, monitoring and controlling the construction project, and ensuring the project's success within budget and time constraints. The generic activities of the construction project manager consist of administrating; advising; assisting; budgeting; checking; consulting; coordinating; documenting; estimating; evaluating; expediting; managing; planning; recording; reporting and scheduling (Shaker, 2007). Isa (2007) stated that the construction project manager roles started as early as in the initial stage, where the construction project manager required to

evaluate and determine appropriate construction methods and the most cost effective plan and schedule. The rest of the construction project manager's basic activities are summarized in Figure 1:



**Fig. 1:** Summary of construction project manager's roles (Adapted from Isa, 2007).

Crawford (2000) highlighted that, in order to perform satisfactorily, a construction project manager is expected to have specific knowledge and understanding of their roles. A Construction project manager has to combine the required technical knowledge and behaviors that may stimulate effective teamwork and communication to achieve successful outcomes (Dainty *et al.*, 2005). According to Cartwright & Yinger, (2007) and Ahsan (2011) a competency can be defined as a cluster of related knowledge, skills, and behaviors that affect a major part of one's job, correlates that individual needs to perform roles on the job. It can be measured against well-accepted standards and can be improved via training and development. When applied to project management, competence is the ability to perform activities within a project environment to expect and recognized standards. Yepes *et al.*, (2012) stated that nowadays, more challenges faced by the construction project manager as the magnitude of complexity of a construction project increase, thus, it hence the requirement of additional competencies. Ahsan (2011) and Crawford (2005) stated that, to be competent the construction project manager are required to satisfy the three dimensions of competency which are knowledge competence, performance competence and personal competence. On the other hand, Omran *et al.*, (2012) have outlined the concept of construction project manager competency which consists of personal characteristics (self-reflection; leadership / team management), attitudes (personal values; organization / project / events), knowledge competence (organizational context, scope, quality, risk, value, time, cost, materials and human resource management) and skills competence (project / event process, communication, leadership). Meanwhile, Fotwe & McCaffer, (2000) grouped the primary and secondary competency required by the construction project manager in delivering a project management activity into several clusters under knowledge and skills category. It includes technical, managerial, financial, legal, communication and general.

#### ***The difference between construction process of IBS project and conventional project:***

Conventional construction is a common practice in Malaysia; it involves with the construction work being carried out on site. It consists of a reinforced concrete frame and brick, beam, column, wall, and roof, which are cast in situ using the timber framework while steel reinforcement is fabricated off-site. This method is labour intensive, involving formwork fabrication, steel bending and concreting. It requires many wet trades on-site, such as skill carpenters, plasterers, and brick workers. This process can be hampered by quality issues, unfavourable site conditions, a skilled labour shortage, bad weather conditions and material wastage (Lou & Kamar, 2012; Mian, 2006). Meanwhile, IBS construction process offers an alternative to the existing conventional building system. Prefabrication concept is the nucleus of IBS method. IBS process consists of five processes namely initial work, production, delivery, installation and closing (Ismail *et al.*, 2012). As explained by Mian (2006), the process started with the design of prefabricated components. The components will be

fabricated at the factory or manufacturing yard according to the specified dimensions and specifications. The IBS component is then transported to the construction site from the factory for installation purpose. Finally, the IBS components are installed and erected at the specified location by using sequencing method.

### Research Method:

The competence construction project manager is a factor in the successful delivery of a project; on the other hand, the construction project manager needs to have competence in those areas that have the most impact on successful outcomes (Crawford, 2005). However, limited research has been conducted on the competency requirement of the construction project manager in managing the construction process of IBS projects. To examine the required competency for the construction project manager who managed IBS construction projects, a semi-structured interviews were conducted. A total of seven (7) face to face interviews was conducted within the construction project managers who have experience in managing an IBS construction project. The interviews reached a saturated point after the seventh interview session. A semi-structured interview questionnaire began initially with sixteen (16) questions. The questions were divided into three (3) sections, section A- background of the interviewee; section B – the construction project manager's roles and section C – the construction project manager's competencies. A set of questionnaire was presented to each interviewee by email before the interview for better understanding and communication during the interview session. The results of the interviews were analyzed by using the content analysis method in the form of the matrix table in Microsoft Excel format. The data were then identified into themes and developed into a pattern.

### Findings and Discussion:

General information relating to the interviewees involved in this research was compared as summarized in Table 1.1. It shows that most of the construction project managers are given the designation as project managers at a construction site. The majority of them possesses a degree as their academic qualification and has more than 10 years working experience with a total number of construction projects handled more than 16 projects. This may be reflective of the long period of experience needed in order to attain a status of manager. However, most of the interviewee only experienced in managing 3 and fewer numbers of IBS construction projects, reflexing IBS method regarded as a non popular choice in the Malaysian construction industry. The table also indicates that the most popular IBS components used are precast concrete and steel framing system.

**Table 1.1:** Overview of the interviewees.

Interviewee	A	B	C	D	E	F	G
Designation	Project Manager	Project Manager	Project Manager	Project Engineer	Project Manager	Project Manager	Project Manager
Academic Qualification	Degree	Degree	Degree	Degree	Diploma	Degree	Diploma
Gender	Male	Male	Male	Male	Male	Male	Male
Years of experience	More than 10	5-9 years	More than 10 years	5-9 years	More than 10 years	More than 10 years	More than 10 years
No of construction project handled	10-15	6-9	16-20	1-5	16-20	16-20	16-20
No. of IBS project handled	6	6	3	1	2	3	2
IBS component used	Precast concrete, blockwork system, formwork system, steel framing.	Blockwork system, formwork system, steel framing system, Timber framing system	Blockwork system, formwork system, steel framing system	Precast concrete system, steel framing system	Precast concrete system, formwork system	Precast concrete system, steel framing system	Precast concrete system, formwork system

From the study, the majority of the interviewees agrees that, time is the most critical factor in managing the IBS projects compared to the conventional projects. In IBS construction process, managing time as per schedule is important to ensure the delivery of the components is within the estimated time. This is because; the plants and machinery are ready to receive the components. Any delay in delivery schedule will affect the utilization of plants and machinery, indirectly incurred cost. Simultaneously, the plant and machinery should be prepared to handle the component arrival and installation, failure to prepare the plant and machinery will result in the problems of double handling, storage and time delay which later will affect the cost. Other than the plant and machinery arrangements, ensuring the in-situ works are ready prior to the installation is crucial to ensure

immediate installation upon components arrival on site. Only one interviewee stated that planning as a critical factor in managing the IBS projects. According to interviewer E, having a good planning is essential as the construction project manager should be well versed about the sequence of construction activities. Furthermore, IBS project is not like conventional project, where changes can be made at a minimum cost. IBS projects are not flexible; thus it requires a good planning to ensure that the site and machine are ready and prepared to receive the components and installation.

The construction project manager roles started with defining the scope of works, by identifying the IBS components used and managing the drawing conversion process. This is followed, by the establishment of the work program which associated with time planning for component delivery, plant and machinery arrangement, labour usage and activity sequencing. The critical part in the planning process is integrating the work program with the supplier (component and plant) and installer programs. For the execution process purposes, the construction project manager has to make sure the site, plant and machinery are prepared to receive the installation works. There are more works on integration and coordination management here such as coordination of IBS components and plants supplier and make sure the integration of their work. The construction project manager has to ensure that the technical coordination of dimensional interfacing between IBS components and also with other trades. On the monitoring part, the component sequencing, alignment, horizontality, verticality and jointing area should be closed monitor to ensure good quality achieved. The construction project manager has to make sure the progress is according to work program by controlling the schedule.

The interviewees have a consensus on the critical phase to manage in IBS construction process is the planning process. The planning by using the work program must be excellent because it will be the guideline not only by the main contractor, but also by the supplier and installer. Other than that the delivery schedule and plant and machinery arrangement are critical to ensure the success of the execution process. Findings from the interviews regarding the roles of construction project manager in managing the IBS construction process were summarised in Table 1.2.

**Table 1.2:** Construction project manager's roles.

Interviewee	A	B	C	D	E	F	G
Critical factor in managing IBS project	Time	Time	Time	Time	Planning	Time	Time
Roles of construction project manager in managing IBS construction process	<ul style="list-style-type: none"> <li>• Identification of IBS component</li> <li>• Convert drawings</li> <li>• Planning</li> <li>• Integration management</li> <li>• Works sequence</li> </ul>	<ul style="list-style-type: none"> <li>• Work program</li> <li>• Integration management</li> <li>• Final planning</li> <li>• Coordinate monitoring (technical)</li> </ul>	<ul style="list-style-type: none"> <li>• Define scope of work</li> <li>• Establish work program</li> <li>• Quality supervision at factory</li> <li>• Clarify the transportation issue</li> <li>• Control schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Define scope of work</li> <li>• Planning</li> <li>• Coordination management</li> <li>• Alignment monitoring</li> <li>• Defect rectification</li> </ul>	<ul style="list-style-type: none"> <li>• Define scope and design submission</li> <li>• Work program</li> <li>• Delivery planning</li> <li>• Preparing work to receive IBS components</li> <li>• Quality supervision</li> </ul>	<ul style="list-style-type: none"> <li>• Define the scope &amp; site planning</li> <li>• Sequencing and alignment</li> <li>• Utilization of plant and labor</li> <li>• Quality and progress control</li> </ul>	<ul style="list-style-type: none"> <li>• Drawing conversion</li> <li>• define scope of work</li> <li>• Time planning</li> <li>• Site preparation</li> <li>• Time delivery control</li> <li>• Jointing monitoring</li> </ul>
Critical phase to manage	Executing	Planning	Planning	Monitoring	Planning	Planning	Monitoring

Findings from interviews show that, the majority of the interviewee agreed that the construction project manager who manages IBS construction projects required additional competency on top of the competencies needed in managing conventional construction projects. Their reasons are IBS construction process are more on managing the plant and machinery, IBS supplier and installer. Further, managing IBS projects requires an understanding of the manufacturing, delivering and installation process. According to Crawford (2005), competency can be grouped into three categories;

- i. Knowledge and skills,
- ii. Performance and
- iii. Personal

#### ***i. Knowledge and Skills:***

The most critical additional competency required under the knowledge and skills category is technical knowledge. The construction project manager should have sound technical knowledge of the installation process, plant selection and quality of material. Other than that, the project management skill is vital in managing time, integrating conventional construction method with IBS construction method, managing resources and stakeholders. According to the interviewees, the delivery and the installation of IBS component

usually comes with issues to solve. Thus, a construction project manager should have a problem solving skills in handling the issues arise.

### ii. Performance:

Performance, on the other hand is the ability to perform the activities within an occupational area to the level of performance in employment (Crawford, 2005). Thus, the interviewee agreed that the critical activity to perform in ensuring the success of the IBS construction process is the planning process.

### iii. Personal:

On the other hand, the critical personality of construction project manager required to possess is good communications. By having good communication, all the necessary information will be delivered effectively to the stakeholders such as supplier and installer. Leadership is stated as an important by the interviewee in managing and controlling the stakeholders and direct them to seriously completing their work. Other than that, teamwork, decision making, self-confidence and honesty and integrity are amongst the personality that considered important to acquire by the construction project manager in managing IBS construction process.

Finally, the interviewees were on the same opinion that the most critical competency that the construction project manager should possess is under knowledge and skills category. According to the interviewee, the construction project manager must have adequate technical knowledge of IBS process, project management knowledge and communication skills in order to ensure the success of the construction process. Table 1.3 summarizes the competencies identified during the interviews.

**Table 1.3:** Construction project manager's competencies.

Interviewee	A	B	C	D	E	F	G
Additional competency required in managing IBS project	<b>KNOWLEDGE &amp; SKILLS</b>						
	<ul style="list-style-type: none"> <li>• Planning skill</li> <li>• Technical knowledge</li> <li>• Project management skill</li> </ul>	<ul style="list-style-type: none"> <li>• Communication skills</li> <li>• Problem solving skill</li> <li>• Coordination skills</li> </ul>	<ul style="list-style-type: none"> <li>• Project Management skill.</li> <li>• Leadership skill</li> <li>• Problem solving skills</li> </ul>	<ul style="list-style-type: none"> <li>• Technical knowledge</li> <li>• Leadership skills</li> <li>• Problem solving skills</li> </ul>	<ul style="list-style-type: none"> <li>• Coordination skills</li> <li>• Technical knowledge</li> <li>• Integration skills</li> </ul>	<ul style="list-style-type: none"> <li>• Technical knowledge</li> <li>• Leadership skill</li> <li>• Coordination skills</li> </ul>	<ul style="list-style-type: none"> <li>• Problem solving</li> <li>• Project management skill</li> <li>• Coordination skills</li> </ul>
	<b>PERFORMANCE</b>						
	Planning	Planning	Monitoring	Execution	Planning	Planning	Implementation
	<b>PERSONAL</b>						
	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Honesty and integrity</li> <li>• Good communication</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Good communication</li> <li>• Self confidence</li> </ul>	<ul style="list-style-type: none"> <li>• Team building</li> <li>• Decision making</li> <li>• Good communication</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Decision making</li> <li>• Energy and toughness</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Teamwork</li> <li>• Positive attitude</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Good communication</li> </ul>	<ul style="list-style-type: none"> <li>• Good communication</li> <li>• Teamwork</li> </ul>
The most critical competency	Behaviour	Knowledge & skills	Knowledge & skills	Knowledge & skills	Performance	Knowledge & skills	Knowledge & skills

### Conclusion:

This paper was aimed at providing insight on the requirement of additional competency for construction project manager in managing the construction process of IBS project. It began with the identification of construction project manager's roles followed by the competencies required. The survey established that the construction project manager who managed IBS projects required additional competency on top of the competency needed in managing conventional construction project. The most important competency is under knowledge and skills category which consists of technical knowledge, project management skill and problem solving skill. It is anticipated that the findings of this research may develop an awareness and self-assessment of construction project manager practice and opportunities for professional development that enhance their competence.

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