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To cite this article: A Mohsen *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **220** 012048

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# Determining factors for enhanced skilled worker requirements in IBS construction projects in Malaysia

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**Abstract.** Industrialized Building System (IBS) refers to prefabrication and offsite construction in Malaysia. The construction industry embraces IBS for better construction quality with reduced failure risks and cost effectiveness. This method is highly supported by the Malaysian government through Construction Industry Development Board (CIDB) Malaysia. However, IBS demands workforce that is skilled enough to produce and install construction components either on-site or off-site. The workers are deemed to be knowledgeable in handling materials, methods, and tools for constructing structures like houses, buildings, highways and roads. In fact, workers involved in construction projects are often found with low knowledge, skills, and accustomed to conventional methods instead of IBS. This research aimed at determining factors that may contribute enhancing skilled worker requirements for improving the implementation of IBS construction projects in Malaysia. The questionnaires were used to collect data from contractors involved in IBS construction projects in Malaysia. Statistical Package for the Social Science (SPSS) version 22.0 software was used to analyse the collected data. The results show that skilled labour with awareness of IBS implementation can handle and implement IBS projects properly. The results of this work revealed that the skilled workers also ensure the projects can be accomplished on time with better quality. The usage of foreign workforce can be minimized by encouraging local labours to participate in IBS as skilled workers, which enhances the market share of construction industry in Malaysian economy. This research provides valuable information regarding the importance of skilled workers and addresses the role of stakeholders in improving knowledge in IBS construction.

## 1.0 Introduction

In Malaysia, Industrialized Building System (IBS) is a technique, which was introduced to manufacture construction components either on-site or off-site. These prefabricated components are then assembled into one large structural component to build the project timely and efficiently. However, IBS has not been applied properly during the planning phase in construction projects. The reason being IBS is costly and complicated for construction companies as compared to their conventional methods [1, 2]. The implementation of IBS in the construction is expected to improve



over the time by great support from Malaysia Government. Furthermore, the Malaysian Government is uplifting the nation from middle income status to high income society, towards developed nation status by the year 2020 [3]. However, the practitioners at construction industry are still reluctant to employ IBS as their construction method. This is surprising as the researchers have encouraged the IBS usage due to various benefits. Warszawski [4] contended that by employing IBS methods, the manual labour on-site can be reduced, and construction speed can be increased along with achieving higher construction quality.

This research is aimed at determining factors that may contribute enhancing skilled worker requirements for improving the implementation of IBS construction projects in Malaysia. The findings may help the researchers to develop a systematic decision making guidelines to increase the knowledge of skill of workers in IBS application.

## **2.0 Literature Review: Industrialized Building System (IBS)**

IBS is a technique to improve construction deliverables by controlling the production of building components in a factory. These components are then transported and installed into a combined structure with minimal manual on-site labour [5]. Generally, IBS can be defined as a concept of mass production of quality building by using new building systems and factory produced building components [6].

In Malaysia, IBS is classified into five (5) categories: pre-cast concrete framing panel and boxy system, steel formwork systems, steel frame system, timber frame system, and block work system [6]. IBS employs techniques, products, components or building systems having prefabricated components for on-site installation. From the structural classification, there are five IBS main groups that are used in Malaysia as shown in following sub-section, which are mainly based on classification by CIBB with some modification to it.

### *2.1 IBS and Construction in Malaysia*

In fact, there exist various definitions of the Industrialized Building System (IBS) in Malaysia; hence, no agreed IBS definition exists since different researchers have defined it differently [7]. This has somehow led to misunderstanding and misinterpretation of IBS and existing building regulations in Malaysia [8]. Moreover, it often ends with delays in projects due to lack of knowledge of designs drawing using IBS [9]. It is important to note that IBS uses components to be assembled appropriately and it demands high precision in design and installation [8, 9, 11]. The government of Malaysia is trying to equip construction industry professionals with concepts associated with IBS and its assembling procedures [10]. In this effort, in early sixties, the Ministry of Housing and Local Government introduced IBS in Malaysia. Din [11] reported that, it was then that the two pilot projects using IBS concept were carried out in 1964 where the first pilot project was 7 blocks of 17 story flats and 4 blocks of 4 story flats which comprised of 3000 units of low-cost flats and 40 units of shop lots in Kuala Lumpur. The project implemented large panel system using the Danish System with IBS concept of construction.

## **3.0 Methodology**

### *3.1 Research Design*

In this research, pilot study was carried out and final structure of questionnaires was sent to targeted respondents for determining the influencing factors for enhancing skilled worker requirements. Then, data was collected and analysed in order to achieve the set of objectives. A questionnaire survey was used for data collection. Additionally, only residential projects in Johor Bahru, Malaysia, which experienced challenges of implementation of IBS in construction projects, were chosen to participate in the survey. The findings have been concluded based on the ranking by using the mean.

### *3.2 Research Questionnaire Design*

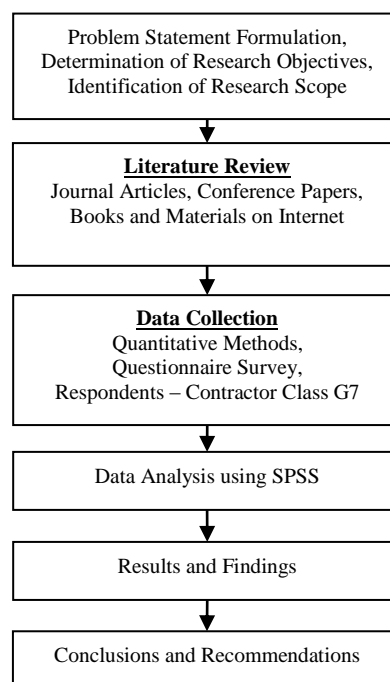
The data collection method used in this research was through questionnaire which is designed to collect and verify the information. However, this method also maintains few limitations as it is subjected to the willingness and cooperation of the target audience (the respondents) [14]. Thus, the questionnaires should be designed straight-forward and easy to fill and gather information that relates to the study objectives.

“Sampling is a practical way of studying people and their activities, thoughts, attitudes, abilities, relationships etc.” [15]. When dealing with people, it can be defined as a set of respondents (people) selected from a larger population for the purpose of a survey. The researcher has to determine the group of target population before conducting the research. Sampling unit is the elements which selected from the whole population. However, researcher must ensure that they select their target population according to their research objectives.

### 3.3 Data Collection

The research was conducted using literature review and questionnaire survey. The literature review is covered on enhancing skilled worker requirements in improving implementation of IBS in construction projects. All information on skilled worker requirements in improving implementation of IBS projects are gathered from journal articles, international conference papers, books, magazines, brochures, newsletter and information available from the internet. Furthermore, a survey using questionnaire was conducted to obtain information from engineers, site supervisor, managers and project engineers on IBS in construction projects.

This research takes a quantitative approach and was conducted in stages, as shown in figure 1. The first phase is the process to identify research issues, topic selection, problem statement and research objectives. Second phase is the literature review to find out the previous study that related to the use of skills worker requirements in improving implementation of IBS in construction projects and challenges of IBS implementation in construction projects. In the third phase, survey was conducted to collect data from respondents using questionnaires. The statistical analysis was conducted by SPSS, followed by results and findings. Lastly, the conclusion and recommendations were made based on findings of this study.



**Figure 1.** Research process.

## 4.0 Results and Discussion

### 4.1 Reliability of the Questionnaire Form

The pilot study was conducted to check the internal consistency of answers from engineers, site supervisors, managers and project engineers on IBS in construction projects. After a few revisions from the pilot study, the updated questionnaire form was disseminated to targeted respondents. 120 participants provided valid response in this study. Table 1 shows the result of the reliability of the questionnaire form.

**Table 1.** Reliability of the questionnaire form.

|  | <b>Cronbach's Alpha</b> | <b>Number of Items</b> |
|--|-------------------------|------------------------|
| Factors for enhancing skilled worker requirements          | 0.923                   | 11                     |
| Recommended ways for enhancing skilled worker Requirements | 0.879                   | 9                      |
| Overall reliability  | 0.955                   | 20                     |

This study used Cronbach's Alpha Coefficient to test the survey items' reliability. A coefficient value closer to value 1.0 is desired. In this study, the determined Cronbach's Alpha value were 0.923, and 0.879. It can be concluded that the questionnaire form which was developed for the data collection was well understood by the respondents and acceptable for the actual survey.

### 4.2 Influencing Factors for Enhancing Skilled Worker Requirements

Table 2 shows the means and standard deviations of the items. The mean score of all items was 3.07 over 3 (i.e. neutral point), which indicated that participants' agreement with the measured variables. The average standard deviation of 1.508 showed that the respondents were not significantly dispersed around their mean score.

**Table 2.** Descriptive Statistics of Influencing Factors for Enhancing Skilled Worker Requirements.

| <b>Item Code</b> | <b>Item</b>  | <b>N</b> | <b>Mean</b> | <b>Std. Dev.</b> | <b>Ranking</b> |
|------------------|--|----------|-------------|------------------|----------------|
| Q1               | Provide workers / labours with sufficient skills on IBS usage.                               | 80       | 2.95        | 1.614            | 7              |
| Q2               | Participation of workers on IBS projects.  | 80       | 2.97        | 1.567            | 6              |
| Q3               | Provide sufficient training on IBS machines / tools used in IBS implementation.              | 80       | 3.14        | 1.524            | 2              |
| Q4               | Provide short courses to increase awareness while working time.                              | 80       | 3.33        | 1.240            | 1              |
| Q5               | Lesson learned from other developed countries that deal with and use IBS usage.              | 80       | 2.97        | 1.567            | 6              |
| Q6               | Implementation of various types of IBS elements such as (columns, slabs, stairs walls etc.). | 80       | 2.90        | 1.612            | 8              |
| Q7               | Observing other developed countries that deal with and use IBS projects.                     | 80       | 2.97        | 1.567            | 6              |
| Q8               | Good attention to OSHA policy for IBS usage.   | 80       | 3.09        | 1.528            | 4              |
| Q9               | Availability of work opportunities in IBS  | 80       | 3.33        | 1.240            | 1              |

|     |  |    |      |       |   |
|-----|--|----|------|-------|---|
|     | projects.  |    |      |       |   |
| Q10 | Bilingual skills and ability to work under pressure.                         | 80 | 3.03 | 1.567 | 5 |
| Q11 | Keep update to new technology for implementing IBS in construction projects. | 80 | 3.12 | 1.562 | 3 |

In table 2, the two most important factors for enhancing skilled worker requirements are “provide short courses to increase awareness while working time” and “availability of work opportunities in IBS projects”. Contrarily, “implementation of various types of IBS elements such as (columns, slabs, stairs walls, etc.)” have been identified as the less important for enhancing skilled worker requirements. Specific training should be provided to increase the workers’ ability in their daily activities. Improvement can be made by practicing and understanding the process involved for them to complete the assigned task.

Statistical analysis shows that the mean of the variables are between 2.90 and 3.33. In general, most of the respondents slightly agreed that by providing short courses to increase awareness while working time, availability of work opportunities in IBS projects, provide sufficient training on IBS machines / tools used in IBS, keep update to new technology for implementing IBS in construction projects, good attention to OSHA policy for IBS usage, and bilingual skills and ability to work under pressure as influencing factors for enhancing skills worker requirements.

On the other hand, most of the respondents were less concerned about the other factors; such as, participation of workers on IBS projects, lesson learned from other developed countries that deal with and use IBS, observing other developed countries that deal with and use IBS projects, provide workers / labours with sufficient skills on IBS usage, and implementation of various types of IBS elements such as (columns, slabs, stairs walls, etc.). Based on the research precast concrete framed building is ranked (1), (2) and (3) in the research by the respondents, while [7] found the precast concrete framed building has been ranked (4) which means that the skilled worker requirement for project has improved. Precast concrete systems are also known as hybrid system because it uses conventional method and precast slabs. With a proper implementation and appropriate legislations were adopted in the IBS application, this potential system able to improve sustainable deliverables in the construction industry [16]. Skilled workers with the understanding on the production and installation processes, including documentation works are mandatory to smooth the process of construction projects using IBS.

## 5.0 Conclusion

Industrialized Building Systems (IBS) is a construction process that utilizes pre-fabricated components or building systems. IBS has already benefited Malaysian construction industry even though it is still in the process of maturing itself. This study has been aimed to reveal to construction companies that while using IBS projects system in their contracts which factors affect the project regarding skilled and expert labour. The results show that skilled labour with awareness of IBS implementation can handle and implement IBS projects properly. The skilled workers also ensure the projects can be accomplished on time with better quality. The usage of foreign workforce can be minimized by encouraging local labours to participate in IBS as skilled workers, which enhances the market share of construction industry in Malaysian economy. This research provides valuable information regarding the importance of skilled workers and addresses the role of stakeholders in improving knowledge in IBS construction.

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### Acknowledgement

The authors would like to thank University of Tun Hussein Onn, Malaysia and the Ministry of Higher Education, Malaysia (FRGS vot. 1578) for their generous sponsorship of this research.