

# Investigating the Relationship between Site Supervision and IBS Based Construction Projects

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**Abstract.** Successful delivery of construction of Industrialized Building System (IBS) projects needs an effective supervisor's that have a combination of strong technical, interpersonal, communication, and managerial skills. Unfortunately, a consistent finding is that there are many factors that affecting site supervision and most construction works are not delivered on time and consequently have a problem during installation of IBS. Therefore, the main aim of the study is to identify the factors affecting site supervision in improving IBS productivity. The study adopts a questionnaire survey approach to elicit information from the respondents, and out of the seventy questionnaires administered fifty-five were retrieved. The information and the data from the questionnaires were analyzed using the average index method. From the finding analysis, the main factors affecting site supervision is on-site construction process. While the main problem during installation of IBS is required planning on time delivery. It is recommended that the quality of IBS product or components should be enhanced to promote better site supervision

## 1. Introduction

Industrialized Building System (IBS) is one of technologies which can be categorized as an old in a developed country but yet considered as an emerging technology in developing countries such as the Asian region. Representatives of several prominent construction industries recommended the other construction sectors to extend the use of modern construction methods and information technology. Specifically, the use of mechanization in construction that leads to the production of IBS may help to ease the pressures of labour requirements while boosting quality and productivity [1]. IBS can be defined as a construction system which components are manufactured in a factory, on or off-site, positioned and assembled into structures with minimal additional site work [2]. In other words, IBS is a system that involves constructing buildings using pre-fabricated components. The manufacturing of the components is systematically done using machines, formwork, and other forms of mechanical equipment [3]. The components are manufactured offsite and once completed will be delivered to construction sites for assembly and erection. Since the first project of IBS in the year 1964 until today, IBS in Malaysia is not well accepted by the construction parties because of failure to adequately deal with risks. Failure to keep the cost within the budget is still common in Malaysia, and it is one of the reasons that limit the development of IBS [4]. Successful site management system for IBS construction had been categorized under five factors which include management (success integration, installed integration, caused delay, improvement), and workplace (site preparation, space, components keeping) [5]. IBS is admitted to be comparatively not new construction technique in Malaysia. Nevertheless, to ensure work on site is accomplished smoothly and without any risk, site supervision is required. In the IBS construction, improper site supervision will lead to problems on site, including incorrect assembly, leakage, and crack in the future. Moreover, it is essential for site supervisors of

IBS construction to understand the provisions that have been published to supervise sites adequately. Competent supervisors need a combination of strong technical, interpersonal, communication, and managerial skills. Successful delivery of construction of projects within the measurable tenets is driven by effective site supervision [6]. In many organizations, the efficiency of supervision is low even though the latest technology and trained workforce are made available. Also, it indicated that there is a lack of consideration in site supervision toward the improvement of IBS construction [7]. During the installation of IBS components, it is essential to have a good working collaboration, effective communication channel, and improvement in planning and scheduling of the project, risk management [4]. During IBS site management, delays are caused by late-arriving of IBS components at the construction site, erecting problems always occur without proper handling by the supervisor and installers, unskilled and inexperienced labour, insufficient plant and equipment, lack of teamwork and coordination, and weather problems [5]. Contractors are currently facing difficulties during installation at the site to comply with the design and manufacturing requirement [8]. This study aims to provide a general perspective of the factors that are affecting site supervision in improving IBS construction productivity. The specific objectives of this study are as follows:-

- a) To study the factors affecting site supervision in IBS construction.
- b) To identify the problems during installation of IBS.
- c) To analyse and suggest ways to enhance site supervision in improving IBS productivity.

## 2. Methods

This section focuses on the method of study to be carried out to achieve the objective of this paper. Therefore, every measure is appropriate and relevant to the study's topic. Three approaches have been throughout this study to gather reliable and relevant data. The approaches are:

- a) Disseminating a questionnaire survey
- b) Computing the relative average index
- c) Reviewing the effective strategic formulation method

### 2.1 Data collection

This study's data collection involves acquiring information through a questionnaire survey because surveys involve a set of pre-formulated and written questions that the researchers would like to ask the respondents and record their answers. Surveys can be an efficient data collection tool when researchers know precisely the information that is needed and how to measure the variables of interest. Thus, all questions should be understandable, clear, and obtain no ambiguity. Before disseminating the questionnaire survey, a literature review was performed to outline an overview of the research topic. Moreover, the necessary information and additional references needed for research were gained from the literature review. The materials for the literature review include books, articles, magazines, internet, journals, newspaper, and others. Thus, the literature review guides the preparation of the survey questionnaire. Data validation occurs after the questionnaires had been collected. In the process of validation, the answer obtained from questionnaires will be checked for accuracy and suitability for this study purpose.

### 2.2 Sampling data

Handing out questionnaires is an approach to determine the current factors affecting site supervision in improving IBS construction productivity among IBS players in peninsular Malaysia. The target respondents for this study are contractors, suppliers/manufacturers, government officials, consultant firms, developers, and architectural firms for IBS construction. About 100 copies of the questionnaire were distributed to the targeted respondents. The method of distribution and collection of the questionnaire survey encompass the following:-

- a) *By hand distributions for selected respondents*
- b) By conforming through telephone calls and dispatching the questionnaire
- c) By mail and returned via mail through a stamped self-addressed envelope

### 2.3 Data analysis

After the process of collecting data, the information and data gathered through questionnaire were carried out using the relative average index (AI) method in relation to the objectives and scope of the study. The AI of each factor was computed using the following formula:

$$\text{Average Index (AI)} = \frac{\sum xiai}{\sum xi}$$

Where a = is a constant, weighting factor for i, x is the frequency of the respondent, and i is 1, 2, 3.....n. Then, the relative importance of each factor was interpreted based on the scale of five (5) categories as shown in Table 1.

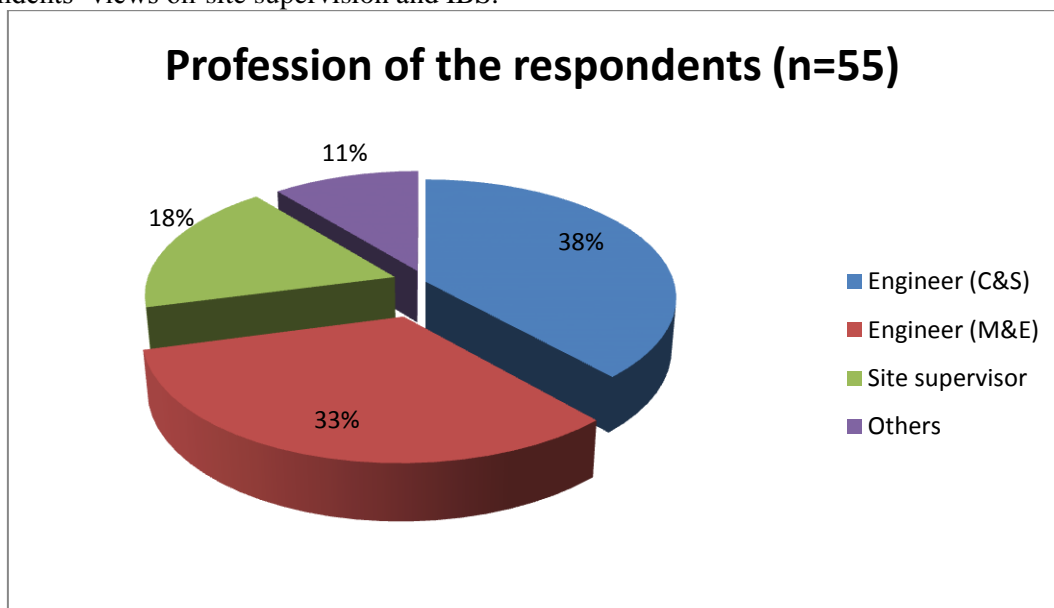
**Table 1.** Interpretation for the AI values

AI range value	Interpretation
$1.00 \leq AI < 1.50$	Least Important
$1.50 \leq AI < 2.50$	Less Important
$2.50 \leq AI < 3.50$	Moderate Important
$3.50 \leq AI < 4.50$	Important
$4.50 \leq AI < 5.00$	Most Important

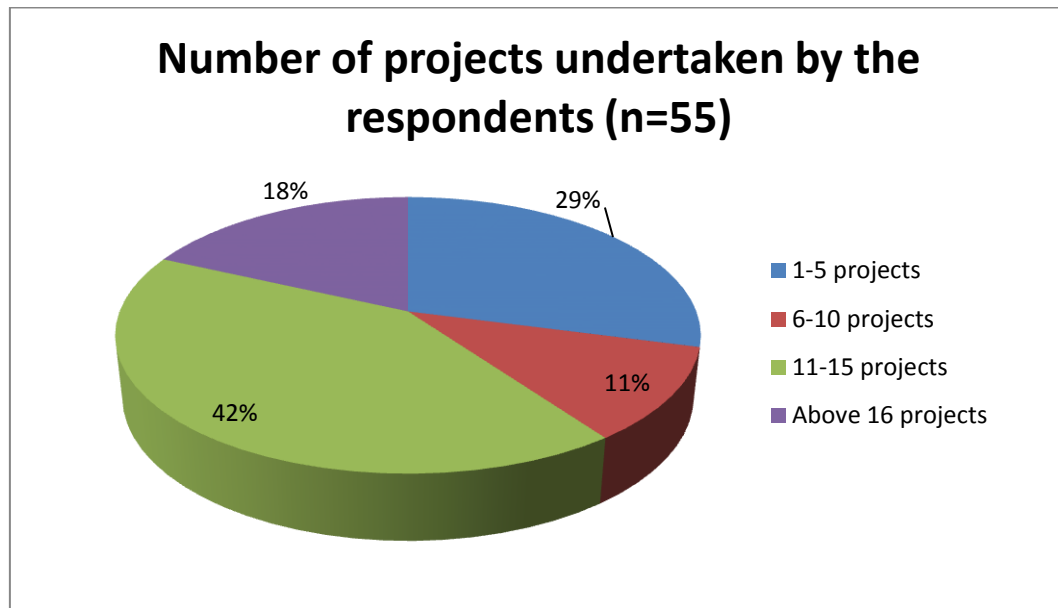
## 3. Result and discussion

### 3.1 Demographic of respondents

In total, data from fifty-five respondents were collected in this study. Figure 1 and 2 show the characteristics of the respondents. Figure 1 shows the distribution of the respondents' current profession. Figure 2 shows the distribution of the number of projects undertaken or engaged by the respondents. 29% of the respondents had undertaken 1-5 projects, 11% had undertaken 6-10 projects, 42% had undertaken 11-15 projects, while 18% had undertaken above 16 projects. The results show that the respondents have experience in IBS projects. The subsequent subsections present the respondents' views on-site supervision and IBS.



**Figure 1.** Profession of the respondents



**Figure 2.** Number of IBS projects undertaken by the respondents.

### 3.2 Factors affecting site supervision of IBS projects

Table 2 shows the AI value of each factor based on the collected data. Based on the importance scale that considers the effectiveness of the result, this study considers factors with AI values above 3.5 as important. Conversely, factors with AI values below 3.5 are considered as less important. Out of the fifteen factors, three factors have AI values below the 3.5 thresholds. Based on the list of factors, the researcher come out four (4) the most influential factors to discuss.

**Table 2.** Factors affecting site supervision in IBS projects

Factors	Average index
Improper site layout	4.30
To meet design and manufacturer requirements	4.25
Poor quality of IBS product/components	4.09
Coordination among project participants	3.96
Interface problem between systems	3.85
Improper monitoring and feedback systems	3.84
Loss of management control	3.78
Insufficient training on-site levels	3.73
Climate conditions	3.71
Lack of knowledge in IBS construction	3.69
Conflict among project participants	3.62
Poor quality control	3.53
Lack of commitment to all project participants	3.18
Indecisiveness of project participants	3.07
Negative attitude among project participants	3.03

### 3.2.1 Site layout

Table 2 shows that improper site layout is the most factors that affect site supervision, which the main factors of that factor are on-site construction process. Since IBS is a construction system which components are manufactured in a factory, it may be a different problem on the site during site supervision. Thus, the installation of the components needs to be monitoring by the experienced and skilled person. Site layout refers to the arrangement of the site facilities, the tools and supporting utilities for optimum product flow [9, 10]. Hence, poor arrangement of the site can obstruct workflow, hinder proper supervision, increase multiple handling, and ultimately reduce productivity that results in project delays and failure. Unfortunately, site planning is often neglected, and the attitude of engineers has been that it will correct itself as the work progresses. Strategic arrangement of facilities, including workers accommodation, materials all has an influence on-site supervision [5, 9, 10] and in effect, affect construction site supervision. Consequently, respondents were recognized of these facts and ranked this factor as significant on factors affecting site supervision.

### 3.2.2 Design and manufacturer requirements

The other factor is to meet design and manufacturing requirements. Difficulties during the installation of IBS at the site are to comply with that factor. This classification is intended to meet a spatial necessity of the client's that is the spaces required for different capacities in the structure just as the particular compositional plan. In this occasion, the client's needs are vital that sometimes different to manufacturing requirements. Thus, it will be a problem on the site supervision to deal with both of that.

### 3.2.3. IBS product and components

On the other hand, poor quality of IBS product and components also would affect site supervision. This problem occurred due to a low exposure of IBS knowledge among the installers during the installation work of IBS components where the employees employ workers that do not possess sufficient knowledge of the installation process of IBS components. From the reading of the researcher, lack of experienced supervisors during the component production process may affect the quality of IBS product.

### 3.2.4. Coordination between project participants

Lastly, the other factors that point out in this research are on working collaboration, which is coordination among project participants. The coordination among the project participants and the dimension of responsibility are fundamental for any venture to be effective. Coordination and responsibility are relied upon to improve execution in various ways. Timely communication can produce a quick response to minimizing delays. The researcher identified that based on reading when selecting IBS as an option, it is necessary to understand the extensive coordination required before construction operations, for instances coordination of design, transportation, tracking, and installation to ensure successful site supervision. Moreover, with the expanded of coordination needed for the construction operations, the needs of effective communication becoming vital for the distribution of information respecting decisions, designs, schedules, and transportation requirements.

### 3.2.5. Least impacting factors

While prior studies suggest that these factors are affecting the success of site supervising in IBS projects, based on the result, most of the respondents agreed that these factors have the least amount of influence. The factors are: negative attitudes among project participants, the indecisiveness of project participants, and lack of commitment of all project participants' factors least affect the site supervision in IBS construction among the IBS players based on their experiences.

## 4. Conclusion

The main objective of this research is to list out the main factors of site supervision in IBS construction to improve the productivity of IBS. The success of a project invariably depends on the

level of supervision of the project or managerial skills. Project supervision somewhat can make or unmake a project. From the research, the successful delivery of projects within cost, time, and quality is hinged on the proper supervision of works. Thus, this makes IBS project supervision imperative to crucial construction activities. This study has identified key factors that affect site supervision in the IBS construction Industry, which is the challenge to IBS players is to identify the ways to reduce the occurrence of such factors on IBS projects. However, several factors count against the successful supervision of construction works. Lastly, the commitment to enhance site supervision in improving IBS productivity is required for all the IBS parties involved.

## 5. References

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