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The Implementation of Industrialised Building System (IBS) In Construction Project to Improve Sustainable Development in Putrajaya.

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Abstract

Industrialised Building System (IBS) can be defined in all aspects of construction either at the factory or at the site of the factory under strict quality control and minimum of wet activities site. However, Malaysia is still applying conventional methods which are often not sustainable especially in Putrajaya. Sustainable construction has become an increasing concern throughout the world over the past year. This study highlights the factors which are vital to improve sustainable development trough implementation of IBS. The quantitative research approach was adopted for this research by employing the survey method. The data analysis mainly focused on descriptive analysis. Based on the findings, the government should encourage contractors by creating awareness on the advantages of implementing the IBS system and the improvement it brings to sustainable development.

Keywords—Industrialised Building System (IBS), Sustainability Construction

I. INTRODUCTION

The Industrialised Building System (IBS) can be defined as all aspects of construction such as beams, walls, slabs, columns and stairs either at the factory or at the site of the factory, manufactured under strict quality control with a minimum of wet activities site. The manufacturing of these components is done systematically using machines, molds and other forms of mechanical equipment.

The implementation of the Industrialised Building Systems (IBS), whose components are constructed off-site, has the potential to promote the sustainability in construction. Although there has been a rapid development in the construction industry, most of the construction

work in Malaysia still utilises conventional methods which are often not sustainable especially in Putrajaya. However, sustainable construction has now become an increasing concern throughout the world over the past year (Kibert et al, 2007).

The implementation of sustainable construction will result in the creation and responsible maintenance of a healthy built environment and promote efficient use of resources. They should not focus solely on the economy but also on the benefits for companies and construction workers. (Hussein et al, 2008). To do this, all activities on the value chain of construction must be analyzed to determine their impact and contribution to sustainable development.

The production of construction components in a controlled environment reduces the numbers of workers involved, reduces construction time, increases the quality of buildings, reduces cost and enhances occupational health and safety (Blismas et al 2005). More importantly, it decreases construction waste. All these advantages provide opportunities for IBS to better contribute towards the agenda of creating sustainable building projects (Jaillon et al, 2009).

II. RESEARCH METHOD

This study was conducted in Putrajaya in order to achieve sustainability in construction by using the IBS system. The contractors of class G7 were involved in the research. Both qualitative and quantitative methods were employed in conducting the research. Questionnaires were distributed to 50 individuals working in different departments of a construction project. All data obtained were analyzed using the SPSS software. Descriptive analysis was employed to examine the data.

III. DATA ANALYSIS AND FINDINGS

A. **Demographic data**

There were 5 questions related to the demography of the respondents which were age, gender, position, years of experience and qualification. Only the respondents' age, years of experience and qualification are shown here.

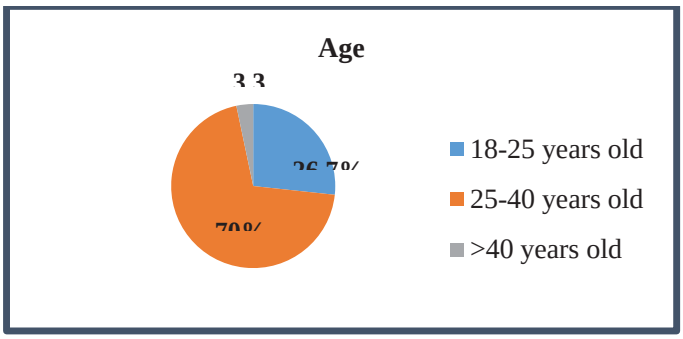

Fig. 1. Respondent's age

From the survey, most of the respondents' age was between 25 and 40 years old which accounts for 70% of the respondents as shown in Figure 1 while the rest of the respondents accounting for 26.7% and 3.3% were in the age group of 18 to 25 years old and above 40 years old respectively.

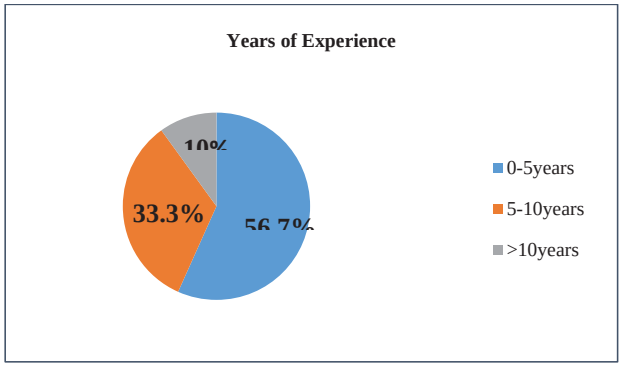

Fig. 2. Respondent's years of experience

In term of years of experience in the construction industry, the majority of the respondent (56.7%) had been in the industry between 1 to 5 years. Meanwhile, 33.3% had experiences between 5 to 10 years and the remaining 10% of the respondents had been working in this industry for more than 10 years as shown in Figure 2.

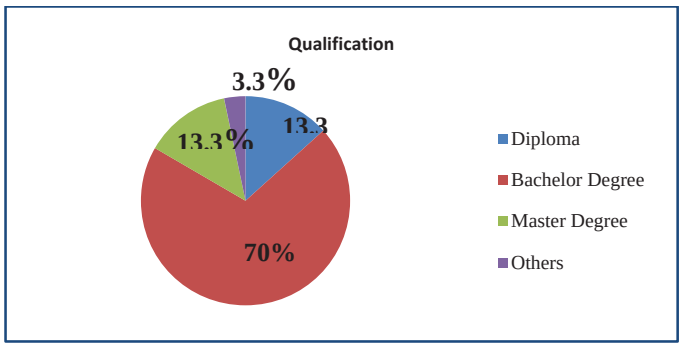

Fig. 3. Respondent's qualification

From the survey conducted, 70% of the respondents were degree holders, while the rest 13.3% had a Diploma and a Master's Degree. Another 3.3% were those with SPM or a PhD qualification. Figure 3 depicts the percentage of the respondents' qualifications.

B. **Identifiying the sustainable elements that need to be improved.**

This section discusses the sustainable elements that can be improved.

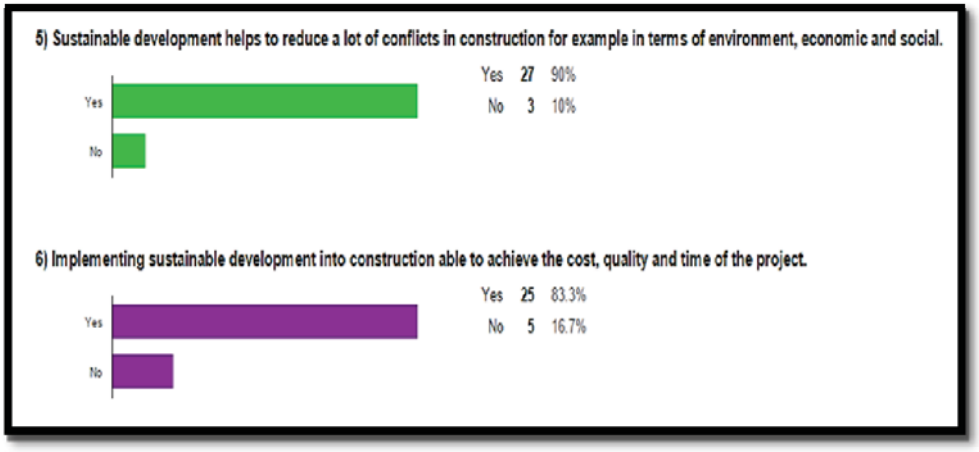

Fig. 4. *Sustainable development reduces a lot of conflict and cost, while improving time and quality*

Based on the figure depicted in Figure 4, 90% of respondents answered "Yes" for agreeing that sustainable development helps to reduce conflicts in construction while 10% answered "No". 83.3% respondents answered "Yes" for agreeing that implementing sustainable development into construction would help to achieve cost effectiveness, good quality and saves time for the project while 16.7% answered "No".

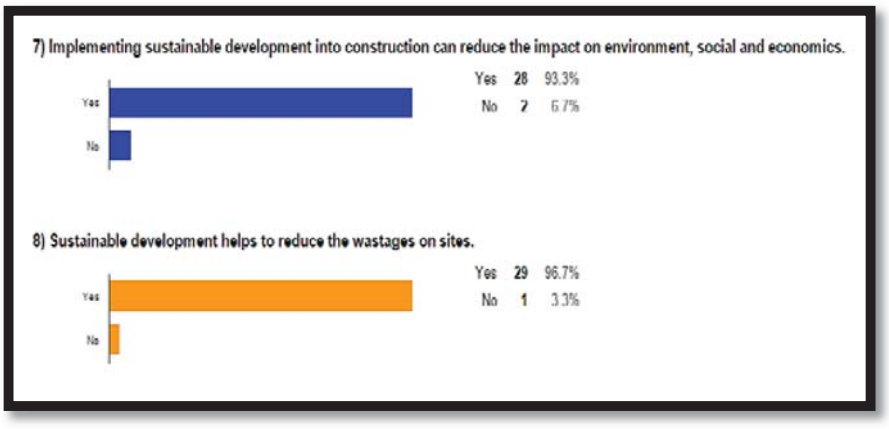

Fig. 5. Sustainable development reduced the impact on environment, social, economic and wastages at sites.

Figure 5 shows that 93.3% respondents answered “Yes” for agreeing that implementing sustainable development into construction can reduce the impact on environmental, social and economic factors while only 6.7% disagreed by answering “No”. 96.7% respondents answered “Yes” as they agreed that sustainable development helps to reduce the wastages on construction sites while 3.3% disagreed by answering “No”.

C. **Relating Sustainability with Industrialised Building System (IBS).**

TABLE I. RELATION BETWEEN SUSTAINABLE ELEMENTS WITH IBS

Relation Between Sustainable Element With IBS System	Mean Score
IBS system minimizes environmental hazard waste.	4.17
Able to reduce the construction time which leads to improve the economics of the project.	4.07
IBS system reduce the disturbance to environment	4.07
Efficiency waste management which help to improve the project economic.	4.03
IBS improves Health & Safety which promotes manageable construction site.	4.03
IBS system improves sustainable element. (Environment, economic and social)	3.93
IBS system improves a good material selection for the building by using renewable materials.	3.83
IBS system improves in social which provide a better working platform and changes the lifestyle, standards and condition.	3.80
IBS reduces foreign labours which will offer more working opportunity to the local.	3.77
IBS system can improve the economic by reducing the cost of the project	3.70

After the sustainable elements had been identified, those factors are then related to IBS. The mean score was tabulated in Table I IBS helped to minimize environmental hazard waste achieved the highest score meanwhile IBS can improve the economy by reducing cost of projects.

TABLE II. RELIABILITY STATISTICS TO PROVE THE RELEVANT OF RELATION BETWEEN SUSTAINABLE ELEMENTS WITH IBS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.984	.986	10

Suggestions on implementing the IBS in construction project to improve sustainable development are tabulated in Table III.

TABLE III. SUGGESTIONS ON IMPLEMENTATION OF IBS IN CONSTRUCTION PROJECT TO IMPROVE SUSTAINABLE DEVELOPMENT.

Suggestions On Implementation Of IBS In Construction Project To Improve Sustainable Development.	Mean Score
IBS system produces less pollutant on the construction site.	4.1
IBS is flexible with different environment and climate	4
It produces more environmental friendly by using IBS system in improving sustainable development	3.93
Produces better quality of materials and finishes by using IBS	3.93
Able to save maintenance cost by using IBS system and it reduces the use of natural resources.	3.9
IBS contributes to sustainable construction in environmental, economic and social	3.8
Implementing IBS system helps to protect the natural resources and reduce negative impact on environment.	3.8
IBS system improves experience and skilled workers for younger generations.	3.77
IBS system provides long-term opportunities for employees and improves the quality of life in local communities.	3.63
IBS system improves in new design which makes attentions to local traditional and cultural aspects.	3.57

Due to the IBS system producing less pollutants at construction sites, it was given the highest rank suggesting that it will improve new designs which gives attention to local traditions and cultural aspects.

Those elements from the Table III are considered relevant and Cronbach's alpha was used to prove the consistency of the questions outlined. The Cronbach's alpha obtained 0.984 which is higher than 0.65. This proved that these questions are reliable. The result is shown in Table IV.

TABLE IV. RELIABILITY STATISTICS TO PROVE THE RELEVANT OF SUGGESTIONS ON IMPLEMENTATION OF IBS IN CONSTRUCTION PROJECT TO IMPROVE SUSTAINABLE DEVELOPMENT

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.984	0.985	10

IV. CONCLUSION AND RECOMMENDATION

A. **Conclusion**

This study highlights the suggestions on the implementation of the IBS system to improve the sustainable development of constructions. The results derived from the descriptive analysis prove to be consistent. There were 10 elements identified as related to sustainable elements with IBS. To validate these factors, Cronbach's alpha was used to assess the reliability and these factors are considered reliable. The Cronbach's alpha obtained 0.984 which is higher than 0.65.

B. **Recommendation**

- *Enforcement by the Government*
  The government should play an important role in implementing the IBS system among the contractors. Since Putrajaya is fully under the control of the central government, hence, the government should encourage the contractors to implement the IBS system in every construction project.

- *Role of the Private Sector Contractors in the Need to Implement the IBS System*
  Moreover, not only the government sectors, private sector contractors need to be widely exposed to the IBS system and urged to implement it in every construction project.
- *Continual Improvement in the IBS for A More Flexible Design*
  The IBS needs to always update its current design in order to produce a more flexible design. Respondents' feedback also emphasizes the notion of having flexible designs.
- *Need to Provide Special IBS Course for Contractors*
  It is important to provide a special course for the contractors about IBS and its benefits. The contractors need to gain in-depth knowledge about IBS before implementing it.

- *Use of More Renewable Materials in IBS*

The materials used in constructions will be optimized if renewable materials can be used. Thus, it will save the limited natural resources for our future generations.

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