

## MEASURING THE PERFORMANCE OF INDUSTRIALISED BUILDING SYSTEM (IBS) CONSTRUCTION PROJECT TOWARDS ACHIEVING GREEN CONSTRUCTION IN MALAYSIA

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### ABSTRACT

The Malaysian government is committed to change significantly through embracing sustainable practices and meeting its target and obligations towards sustainable development. In respond to these desires, Industrial Building System (IBS) and their design procedures are considered as an opportunity to introduce sustainable features to the construction process and enhance construction sustainability into a more socially responsible, environmentally sustainable and economically viable to meet current demand of the construction market. This research mainly study the fundamental connotation of IBS that has the potential contributing to green construction and illuminates the significance and meaning of green construction principles based on IBS perspectives. The establishment of effective methods to evaluate the performance of different approaches in which IBS contributes to green construction is crucial for better understanding by construction organisation at present in deliberate whether returns have been attained on their investment in implementing IBS in construction project.

**Keywords: Green construction, Industrialised Building System, Performance measurement.**

### INTRODUCTION

The Malaysian construction industry plays an important role in generating wealth to the country and development of social and economic buildings and infrastructures. The construction industry has contributed 3% to 5% to the Gross Domestic Product (GDP) over the past 20 years, and has played a vital role in the country's development in supporting others sectors to expand (CIDB, 2015). Unfortunately, construction industry is a major consumer of non-renewable resources, a massive producer of waste, excessive resource consumption and the operation of buildings also contribute to carbon emissions through its life cycle (Hamid et al., 2011; Hussin et al., 2013; Aini et al., 2017). It has been generally recognised that degradation of environmental issues are critical in the construction industry (Shi et al., 2013). Thus, as a developing country which is shifting towards sustainable development

objectives, the national construction development is expected to change significantly through embracing sustainable practices.

## **Sustainable Development and Green Construction**

The need for sustainable development has gained significant impetus. International treaties such as the Kyoto Protocol Treaty, the Basel Convention, and the Rio Declaration have driven leading industrial countries to develop environmental regulations (Kang et al, 2013). Malaysia as a developing country which active participant to this global process has endeavored since 1970s, to introduce a variety of regulatory measures to balance the goals of social and economic development with minimum adverse impacts to environmental conditions (Foo 2013; Sharif et al., 2009).

In order to cope with these global challenges towards sustainable development, Kamar et al (2010) point out that Malaysian construction industry has been insisted to use innovative construction technique and to shift from traditional practice to Industrialised Building System (IBS) construction. Mohammad (2013) reviewed that the choice of using IBS in a sustainable commercial development is expected to enhance the quality of life and work for today and future generation. In line with government effort to reduce dependency on foreign labour and utilise green construction technologies, the adoption of innovation method in construction in the form of Industrialised Building System (IBS) is exhilarated (Hamid et al, 2011).

There are several aspects of IBS that has the potential of contributing to different aspects of sustainability and green construction (Mohammad, 2013; Yunus et al, 2011 and Kamar, et. al, 2010). Some of the major aspects are (i) Sustainability from Controlled Production Environment, (ii) IBS and Waste, (iii) IBS and Building Materials, (iv) IBS and Logistics, (v) IBS and Economic Sustainability. In a nutshell, green construction and sustainability provides a fresh challenge for the construction industry to practice sustainable development and at the same time providing highest quality of affordable building. IBS can be a potential solution to this. IBS promoters should see this as an ample opportunity to promote a greater use of IBS. Most importantly, this research will be conducted in this area to create new innovation in IBS and link IBS with other aspect green construction and sustainability issue (energy efficiency, indoor environmental quality and water efficiency) which could possible helping the industry to successfully addressing the sustainable development.

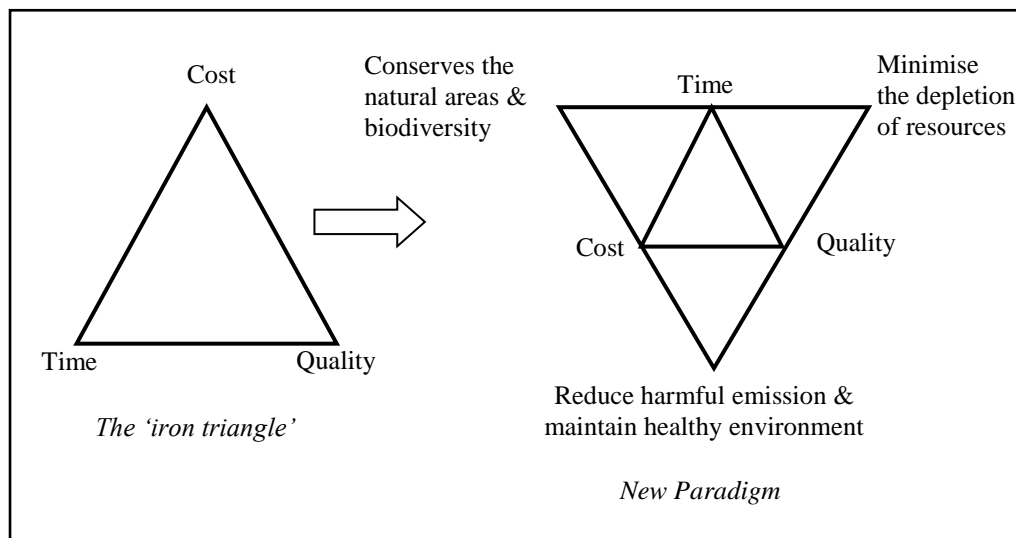
Further supported by Kamar et al. (2010), many of construction players and researchers stated that IBS will help the construction phase towards greater concentration on achieving a better construction which meets the client needs, potential solution in sustainable development and providing highest quality of affordable building. In addition, IBS has a potential usage to promote green construction and sustainability from controlled production environment, minimise waste generation, usage of energy efficient building material, promote effective logistics and encourage economic stability and sustainability (Mohammad, 2013)

However, the realisation of these benefits depends very much on the performance of IBS construction project throughout project development. Unfortunately, according to Hamid (2012), the implementation of sustainable green construction in Malaysia, have been slowed by the lack of research and innovation and also by the inability to evaluate and articulate green technology implementation costs and benefits. Thus, exploring the implementation of IBS construction project towards the enrichment of green construction and sustainability for all project in achieving sustainable development is likely to improve the implementation of IBS and enhance the

confidence of clients about their investment in IBS components, beneficial to the IBS manufactures and IBS contractors for a better construction industry performance by maximising project's value.

### Performance Measurement in Construction Project

In a time of globalisation and an increasingly competitive environment, measuring performance has become critical to business success. A considerable amount of literature has been dominated that time, cost and quality as the basic criteria of performance measurement in construction project, however, different ideas have emerged in the last decade (Zhiwei et al., 2014; Toor and Ogulana, 2010). In addition, Zhiwei et al. (2014), point out that once the construction meets the requirements of the project quality, time and cost, it will cause the resource waste and the environmental damage. This is where the green construction accentuates the efficient use of resources as the core and the environmental conservation as the priority principle in order to pursue the integrated construction method with the high efficiency, low consumption and environmental protection.



Picture 1 Conversion process of traditional construction method to sustainable construction (sources: Zhiwei et al., 2014; Hong, 2009; Huovila & Koskela, 1998)

As shown in picture 1 above, sustainable construction accentuates the efficient use of resources as the core and the environmental conservation as the priority principle in order to pursue the integrated construction method with (i) conserves the natural areas & biodiversity, (ii) minimise the depletion of resources and (iii) reduce harmful emission & maintain healthy environment.

Nevertheless, performance measurement criteria vary from project to project. Even though, much research done on this theme, there is no commonly agreed framework of performance measurement specifically on IBS project in Malaysia. Success factors are those which contribute to achieve success on a project meanwhile, success criteria are the measures by which the success or failure of a project will be judged. Factors constituting the success criteria are commonly referred to as the key performance indicators or KPIs (Cookies-Davies, cited in Toor and Ogulana, 2010).

Consequently, a comprehensive review of Key Performance Indicators (KPIs) in measuring the success of IBS construction project is essential. Cox et al. (cited in

Toor and Ogulana, 2010) observe that the KPIs are helpful to compare the actual and estimated performance in terms of effectiveness, efficiency and quality of both workmanship and product. However, it seems difficult as every project has certain unique features and limitations. Thus, generalising the nomenclature of KPIs for all kinds of projects looks fairly impractical because different type of project carried out from different contexts (Toor and Ogulana, 2010). Therefore, regardless of these limitations, it is important to comprehend the perception of KPIs on IBS projects based on Malaysian context.

Nevertheless, performance measurement criteria vary from project to project. Even though, much research done on this theme, there is limited framework of performance measurement for green construction specifically on environmental performance in Malaysia. The proposed model can effectively quantify the environmental performance of the construction process and can be used as an on-site environmental management tool for green construction operations. In addition, this research mainly illustrates the significance of green construction performance measurement in order to provide a model for project stakeholder and researchers. Hence, the deficiency of effective methods to evaluate the performance of green construction implementation towards achieving sustainable development lead to many construction organisation at present have no way knowing whether returns have been attained on their investment in implementing green construction. Therefore, this study attempts to fulfill this gap.

## **Research Methodology**

The nature of this research was exploratory and tried to identify the major issues by examining the viewpoints of experts in the construction industry. The mix method research strategy would be used in this study. Therefore, this research will be divided into three main phases:

### ***Phase 1: Literature review and Preliminary Questionnaire Survey***

This phase aims to get an overview of the study by referring to the past studies done by other researchers relating to this research. The literature search is focused in identifying the level of consideration given to green construction and sustainability issues in current implementation of IBS construction project in Malaysia. Furthermore, this search will extend to explore the drivers and barriers of green construction through IBS perspectives in Malaysia.

A literature review seeks to describe, summarise, evaluate, clarify or integrate the content of information. Completing a literature review is usually a significant intellectual achievement in its own right, requiring the analysis and synthesis of previous work in such a manner that new understandings of that work are uncovered, and the way is opened for new research. Most of the reading materials are published journal, articles, text book and other relevant reading material. On the other hand, the preliminary Questionnaire survey will carried out as a pilot study to clarify the issues with various stakeholder that involved in IBS construction project and also to refine the theoretical framework and validate the variables gained from literature reviews.

### ***Phase 2: Semi-structured interview and case studies***

The semi structured interview is important to explain the case studies and comparison studies to validate various aspects of the performance measurement frameworks because it permits an informal setting of data collection that reflects the reality of what is happening in the real settings. This approach also allows the researcher to

probe each argument in details and obtain rich and more complex data in term of tacit knowledge, perception and human experience which may not be measured using a quantitative approach. The aim of case study is to determine the implementation of IBS in construction project in achieving green construction and sustainability in construction development in Malaysian construction industry.

### ***Phase 3: Final Questionnaire Survey and Interview with expertise in IBS***

The final data collection method is the final questionnaire survey. Final questionnaire survey is undertaken as the most appropriate manner in which to gain the views of a large number of stakeholders involved in construction project. The aim of the questionnaire survey and expert interview are to develop and validate the framework for better understanding that enable an evaluation of different approach in which IBS contributes to green construction and sustainability in construction project in Malaysia

## **CONCLUSION**

The present conventional methods of construction often associated with many unprofessional practices. The adoption of IBS promises to elevate every level of the industry to a new height and image of professionalism. In addition, IBS has a potential usage to promote green construction and sustainability from controlled production environment, minimise waste generation, usage of energy efficient building material, promote effective logistics and encourage economic stability and sustainability. The development of this research enables the improvement of IBS construction project in the future in refining construction practices and modernise the construction industry towards achieving sustainable development.

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