Sustainable Construction in Malaysia: A Consultants' Perspective

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Abstract

The government of Malaysia recently introduced the National Green Technology Policy together with a proposed RM 1.5 billion (USD 500 million) Green Technology Financing Scheme to promote green and sustainable technologies. This policy is predicated on the belief that regulatory change is a key driver of innovation as local firms compete to develop new products that are more efficient, greener and safer. For the construction sector, the National Green Technology Policy complements the previous thrust to adopt Industrialised Building System (IBS) as a means to deliver high quality building and to reduce the reliance of the sector on migrant labour. The abundance of cheap low-skilled migrant labour has hindered investments in mechanisation and innovation. The current exemption levy for building with 50% IBS elements is 0.125% of construction cost. In order to encourage the construction industry to deliver high quality and environmentally sustainable housing, the government in 10th Malaysia Plan (2011 – 2015) stated to review tax incentives for the design of buildings that are built in a more sustainable manner. This study aims to investigate the influence of government policies toward the use of sustainable technologies and Industrialised Building System (IBS) in the Malaysian construction industry. Primary data has been collected by questionnaire survey of design consultants. The responses on how these policies affect design and construction decisions were analysed by employing descriptive and analytical methods. The findings of this study concluded that government policies play an important role in influencing the adoption of IBS in the construction industry. The most significant way of promoting the use of this innovated method is through incentives.

Keywords: Sustainable Technology, Industrialised Building System (IBS), Design Consultant, Government Policies, Malaysia

1. Introduction

Climate change is a great challenge to all countries. The world is experiencing the melting of polar ice, drying of Amazon rainforest, flooding of many coastal cities and increase of climate refugees. Being a member of the Intergovernmental Panel on Climate Change (IPCC), Malaysia voluntarily, aim to reduce the carbon emission up to 40% in terms of emission intensity of Gross Domestic Product (GDP) based on year 2005 level by year 2020.

One of the efforts initiated by the Malaysian government is the introduction of green and sustainable technologies (ST) which minimizes the degradation of the environment, promotes the use of renewable resources and conserves the use of energy and natural resources. The National Green Technology Policy launched on 24th July 2009 by the Prime

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Minister spurred demand for green industry as the priority in providing products and services. The policy is designed to minimise the problems of destruction of the environment and depletion of natural resources which have brought to climate change. As a result, green technology is expected to be a driver in accelerating the national economic growth and at the same time promote sustainable development (Kamarul *et al*, 2010).

One of the listed government initiatives in the policy emphasize on building aspect or the construction industry. It is because the built environment uses huge amount of non-degradable resources, produces wastes and emits around half of the carbon dioxide gas. Almost 40% of the world's consumption of materials converts to the built environment and about 30% of energy use is due to housing development (Kamarul *et al*, 2010). As a result, the construction industry has great challenge to deliver economic buildings that reduce the social and environmental negative impacts.

A supportive effort towards green technology has been made by the Work Ministry as the ministry had decided that Industrialised Building System (IBS) is adopted for building construction. Hence, the industry links IBS to the issue of climate change and claimed that IBS industry is able to contribute the sustainable development. Kamarul and Zuhairi (2011) suggested that the fundamental idea of IBS is to shift on-site to a more controlled environment.

Thus, sustainability can be achieved through the application of IBS by transforming the 4D – difficult, dirty, dangerous and dusty construction industry into a controlled production environment. Via this, IBS promotes minimisation of waste generation, effective usage of energy, efficient building materials, etc (Kamarul and Zuhairi, 2011). This can be achieved by the reduction of wastage in the construction industry due to prefabrication of building component. Various sizes of components can be produced in mass volume to suit the requirements of buildings. This reduces the number of trips of transportations.

Allocation of RM1.5 billion in the 10th Malaysia Plan (MP) to stimulate the use of green technologies demonstrates Malaysian government concerns the global climate change issue. With the environmental advantages offered by IBS, the government made compulsory of 70% IBS components in public building project. Tax incentives are offered to buildings that are built in a more sustainable manner. The paper aims to investigate the influence of government policies toward the use of sustainable technologies and IBS in the construction industry.

2. SUSTAINABILITY IN MALAYSIA CONSTRUCTION INDUSTRY

Wet construction method has been adopted in the Malaysian construction industry. Activities carried out in the industry have been considered as one of the major contributors to the environmental pollution (Augenbroe *et al*, 1998). These activities not only consuming large portions of raw materials (Ding, 2005), but also creating wastes to the earth. As a result, the construction industry causes the depletion of non-degradable resources, destruction of landscape and creation of health and safety issue to the nation (Azapagic, 2004).

Environmental issue has started to gain wider attention by the construction industry players. The industry is currently shifting from its conventional approach with little regard on the ecological consequence to a development process with wider concern of the environmental agenda. The change is inevitably leading the industry towards 'green' or 'sustainable'. (Das Gandhi *et al,* 2006).

The concept of sustainable is not new. The philosophy of "Sustainable Development" was introduced in 1987 in Brundtland Report and since then, a lot of strategies and positive efforts had been prompted by many countries. Sustainable construction which plays a critical role of the philosophy is expected to contribute to the protection of environment. Figure 1 mimics the tree diagram of the concept of sustainability in construction. According to Nazirah (2005), sustainable construction concern about environmental protection, social well-being and economic prosperity. Activities carried out in the built environment and uses of natural resources exert an obvious impact to the environment. Builders help in protecting the environment by demanding less non-renewable natural resources and more recycled material in their productivity. Social well-being concerns with workers feelings which relate to security, satisfaction, safety and comfort (Lombardi, 2001) and their contributions of skills, health, knowledge and motivation (Parkin, 2000). Sustainability in construction leads to benefits in both micro and macro economy of the country.

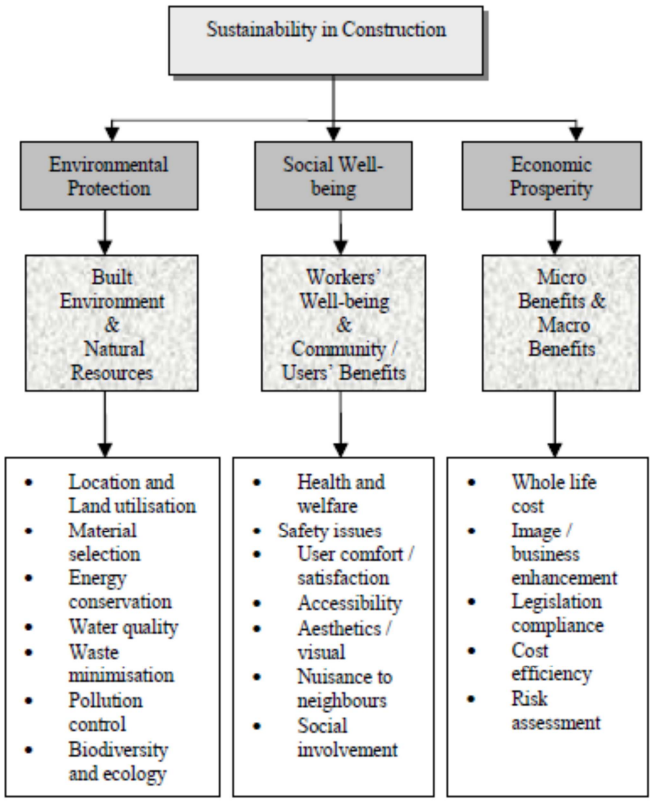

Figure 1: The diagram of sustainability in construction (Nazirah, 2005)

According to Ofori *et al* (2000), practitioners in the construction industry must be willing to change their attitudes and culture in adopting new ideas and approaches. Construction Industry Development Board (CIDB) plays a vital role in directing the Malaysian construction sector towards sustainability. Many efforts have been carried out in the area of waste minimization and management, environmental management plan and construction hazard

identification (CIDB, 2007). The subject of sustainability had been highlighted in the Construction Industry Master Plan (CIMP) 2005 -2015. Environmental practices as well as occupational safety and health are included in Strategic Thrust 3 of CIMP. The Malaysian Green Building Index (GBI) has been developed in year 2009 to promote sustainability in built environment. The introduction of the rating system provides a platform of assessment for sustainable construction and creates new challenges for the industry players.

At present, several sustainable projects are initiated in Malaysia. The projects revolve energy saving housing that blends man-made and natural elements, community development which introduces eco-tourism to the world, zero energy office buildings that promote sustainable from the aspect of economic and social, etc. Nevertheless, the sustainability in the Malaysian construction industry is at its infancy stage (Nazirah, 2005) and a lot more efforts are required to increase the level of awareness among the industry players.

3. INDUSTRIALISED BUILDING SYSTEM (IBS) IN MALAYSIA

As part of the effort in promoting sustainable construction, the Malaysian construction industry has been urged to shift from the traditional wet method of construction to IBS method. The urge is highlighted in CIMP under Strategic Thrust 5 which relates to innovative construction method.

There are plethoras of definitions of IBS found in many literatures. Dietz (1971) for example, described IBS as total integration of all subsystem and components into overall process fully utilizing industrialized production, transportation and assemble techniques. Warszawski (1999) on the other hand, defined IBS as a set of interconnected elements that joint together to enable the designated performance of a building. Lew *et al* (2003) provided a simpler definition by describing it as a system in which concrete parts and components, pre-fabricated at site or in factory are assembled to form the structure with minimum in-situ construction process. All seem to have some common denominator - it is about pre-fabrication i.e. off-site production and mass production of standardised building components that are taken to site for assembly. IBS can be said to be an assembly industry. CIDB defines an IBS project as that which uses 70% IBS components (for government projects) or 50% IBS components for private sector project. IBS is a method of transferring the on-site production processes to the factories and while the on-site works are limited to the assembly of factory made parts and components only. It is about the assembling of pre-fabricated building parts or components (whether standardised or non-standardised).

The concept of IBS is not new as it was introduced since mid-60s. According to Din (1984), in 1964, the government has identified two pilot projects to try out the precast construction. The first project was in Kuala Lumpur to construct a 7 blocks of 17 storey flats and 4 blocks of 4 storey shop lots. This project comprised about 3,000 units of low cost flats and 40 units of shop lots. It is awarded to the Gammon / Larsen Nielson using the Danish system of large panel industrialised prefabricated system. The second pilot project was located in Penang with the construction of 6 blocks of 17 storey flats and 3 blocks of 18 storey flats. The project

consisted of 3,699 units of flats and 66 shops along Jalan Rifle range. It was awarded to Hochtief / Chee Seng using the French Estiot System.

While the sustainable technologies are still relatively new concept in Malaysia, IBS has its potential role in sustainable and green construction. The system components are mostly manufactured in the factory before delivering to the site. The productions take place in a controlled environment and this also helps in reducing construction waste in the site. Majority of IBS components have longer life span than the conventional building components. Ability to produce and assemble the components in large quantities reduces the number of trips of transporting to the site. Thus, waste produced by the transportation system is also lesser.

CIDB has been putting its effort in promoting the use of IBS in the construction industry. Despite the publication of the 2 roadmaps which documented the benefits of IBS, the adoption of IBS is still low especially in the private sector. Majority of the industry players feel reluctant to shift and the root cause is low labour cost (Kamarul *et al,* 2010). In order to increase the adoption of IBS in Malaysia, the Malaysian government had taken a number of initiatives.

During the 9th Malaysia plan period (2006-2010), the government pledged for the construction a total of 709,400 new houses. Special emphasis will be given to housing for the lower-income group where 38.2% of total new houses constructed will be for low-medium cost houses. These were built by utilising IBS in order to deliver the huge number of houses on time. As an incentive to private sectors, construction projects that adopt 50% or more IBS components in the building works are entitle to receive an exemption of construction levy. Generally, levy is imposed by CIDB at 0.125 % of total cost of the project. The new circular by the Ministry of Finance (MOF) emphasized on the full utilization of IBS for all government's projects. The circular emphasised that the use of IBS components in government projects should not be less than 70%. As in 2009, 320 government projects worth RM 9.43 billion have been identified to be carried out using the IBS (Bernama, 2009). Moreover, CIDB had allocated RM 100 million to train skilled workers in IBS (Bernama, 2009). Trained skilled workers play an important role in assembling the IBS components on site. By March 2011, there are 136 manufacturers registered with CIDB and 328 types of products are produced. There are a total of 671 IBS contractors in Malaysia and this builds up of merely 1% compared to 64698 contractors registered in 2009. It shows that only a very tiny portion of contractor firms adopted IBS method of construction.

4. RESEARCH METHODOLOGY

Online questionnaire surveys were employed as a major tool for this research. The questionnaire surveys comprised of three major sections. The first section contains questions that defined the influences of Malaysian policy on the usage of sustainable technologies and industrialised building system (IBS) in Malaysia. The second section defines the positive and negative factors influencing the usage of sustainable technologies and IBS in Malaysia. The third section contains two questions on respondents' information, general suggestions and comments about the research topic.

4.1 Design and content of questionnaire

Table below depicts design and content of questionnaires based on the tackled and investigated issues.

Table 1: Design and content of questionnaires

Question(s) number(s) and type(s)	**Issues tackled/ investigated**
Question 1: Yes / No question	Determination of influence of Malaysian policy to sustainable technology and Industrialised building system (IBS)
Question 2: checklists/ multiple choice	The constraints for Malaysian construction to implement sustainable technology and Industrialised building system (IBS)
Question 3-4: checklists/ multiple choice	Factors influencing the usage of sustainable technologies and IBS in Malaysia
Question 5: checklists/ multiple choice	The influence of Malaysian policy to sustainable technology and Industrialised building system (IBS)
Question 6: checklists/ multiple choice	Factors discouraging the implementation of sustainable technologies and IBS in construction industry
Question 7: checklists/ multiple choice	The benefits of sustainable technology and IBS to country development in Malaysia
Question 8: checklists/ multiple choice	Classification of IBS reducing environment pollution
Question 9- 10: Open-ended (optional)	Respondent's information and general suggestion and comments about the topic

4.2 Data Collection

Respondents for this survey were selected from the list of registered architect under Board of Architect (Lembaga Arkitek Malaysia, LAM) in Malaysia. Architects were selected as respondents as they are generally leader of the consultant team in construction Malaysia. The sample for this study was selected using systematic sampling from the list available online on the Board of Architect Malaysia website. From the list of 1845 registered Architects in Malaysia, 50% of respondents from an existing population were selected to ensure significant responses and representative results. This online questionnaire allowed professional architect to respond to questions and give suggestions and comments according to his or her experiences.

This online questionnaire survey was prepared by a web-based survey tool. It comprised of 10 qualitative questions consisting of 8 compulsory questions and 2 optional or open-ended questions. Each of the closed-ended questions included an option 'Other' to allow respondents to give comments or suggestions in the actual questions about this topic.

5. DATA ANALYSIS, RESULTS AND DISCUSSION

5.1 Analysis of Data

A total of nine hundred and twenty two (922) questionnaire surveys were distributed to registered professional architects in Malaysia. Twenty eight (28) architects responded to the survey, making the response rate 3.04%. This low rate had been expected for an e mail questionnaire. On the other hand, the high percentage of invalid e mail addresses, which is 14.21% or 131 invalid e mails further corrode the response rate.

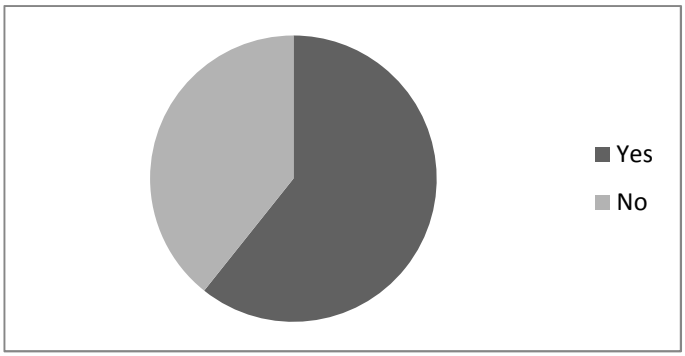

Figure 2: Can Malaysian government policies significantly influence usage of ST and IBS

Refer to Figure 2, out of 28 responses, 60.7% of respondents think the Malaysia government policies can significantly influence the usage of sustainable technologies, primarily Industrialised Building System (IBS) in Malaysia. 39.3% do not agree with the statement. Design consultants believe that government policies play important roles in promoting the usage of sustainable technology.

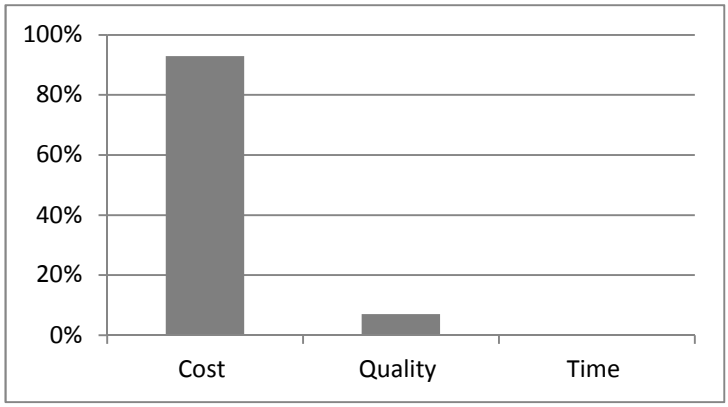

Figure 3: Constraint of implementing IBS in Malaysia

The government take IBS as a strategy to deliver high quality building and to reduce the reliance of migrant workers, the questionnaire requested the respondents to identify the factor that constraints implementation of IBS in Malaysia. 92.9% identify that cost is the constraint of implementing IBS, 7.1% show their worry in quality and none of the respondents take time as a constraint factor.

Incentives are employed as a preferred tool of policies in many areas (Ruth, 2004). The survey shown 42.9% of respondents think as long as incentive is given the usage of sustainable technology and IBS will increase. 28.5% think the incentive should be at least 0.2% of the total construction cost. Anyway, 14.3% of respondents believe that incentive doesn't encourage sustainable technology and IBS. Finally, 14.3% agrees, the usage will increase only upon the government enforcement but not incentive. Hence, a total of 71.4% of respondents agree that different level of incentives can encourage sustainable technology and IBS and 28.6% disagree that incentives works.

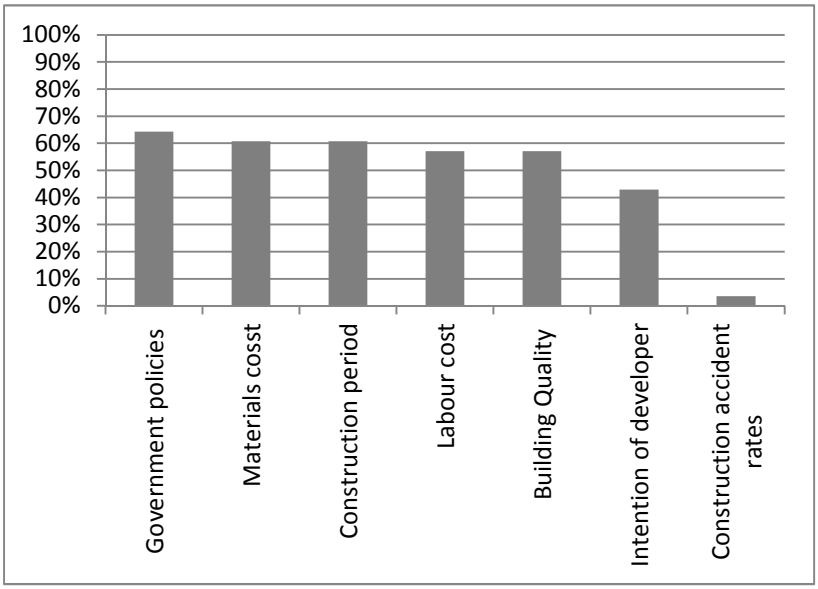

Figure 4: Factors significantly influence the usage of ST and IBS

As for the question on factors that can significantly influence the usage of sustainable technology and IBS in Malaysia, 64.3% of the respondents felt that government policies can bring significant influence. Among others, materials cost (60.7%), construction period (60.7%), labour cost (57.1%) and building quality (57.1%) are factors that supported by more than 50% respondents. 42.9% of respondents think intention of developer brings influence, and only 3.6% supported construction accident rates is the factor that significantly influence usage of sustainable technology and IBS. It is found that the government policies is the major factor influence the usage of ST and IBS, following by time, cost and quality.

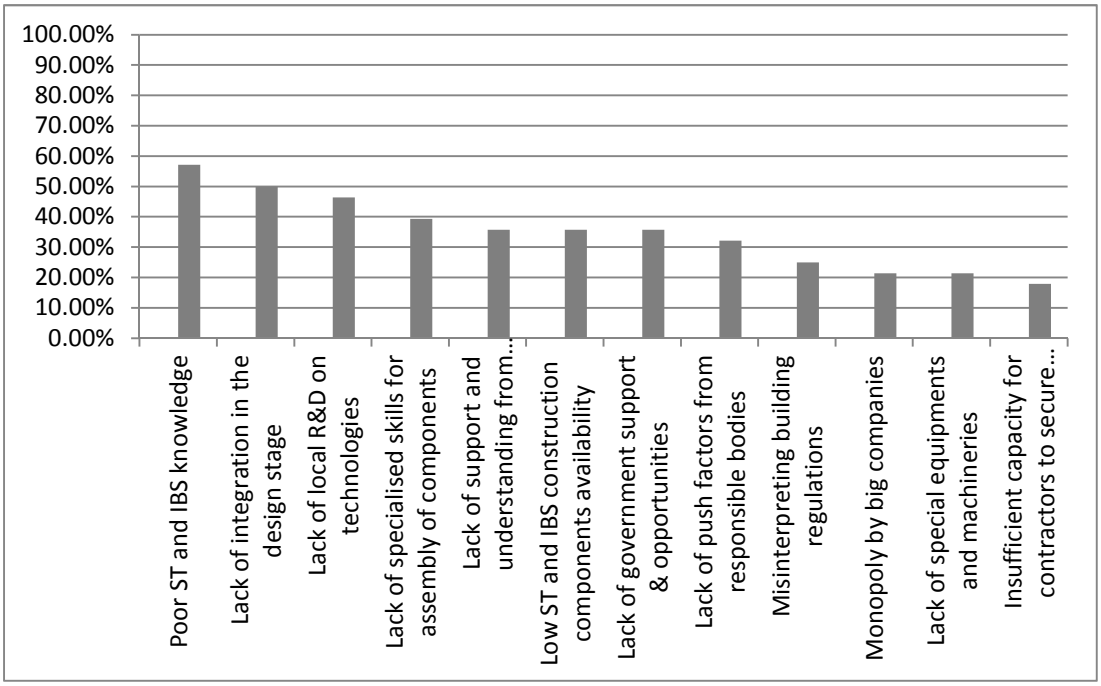

Figure 5: Factors discourage the design consultant from implementing ST and IBS

More than half of the respondents (57.1%) think poor sustainable and IBS knowledge is the main factor of not implementing sustainable technologies and IBS in Malaysia. 50% support lack of integration in the design stage will discourage the implementation. 46.4% think lack of local R&D on technologies leads to discouragement of implementation, 39.3% think the factor is lack of specialised skill for assembly of components. Other factors include lack of support and understanding from professional (35.7%), low sustainable technologies and IBS construction component availability (35.7%), lack of government support and opportunities (35.7%), lack of push factors from responsible bodies (32.1%), misunderstanding and misinterpreting of building regulations (25%). 21.4% think the factor is monopoly by big company, 17.9% support that lack of equipments and machineries is the factor, 17.9% think contractor do not have capacity to secure project.

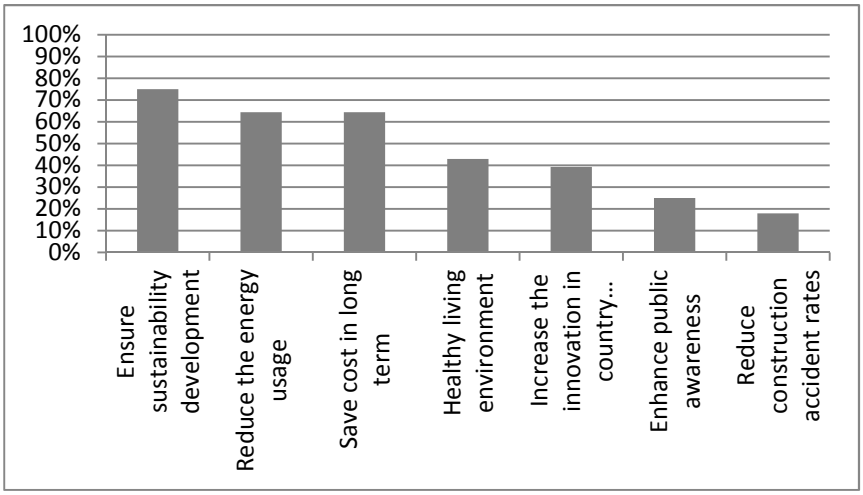

Figure 6: Benefits of ST and IBS

With reference to the above chart, three quarter of respondents agree that sustainable technology particularly IBS will ensure sustainability development. While 64.3% agree that sustainable technology and IBS will reduce energy usage. 64.3% responses they agree with long term cost saving and 42.9% think it can leads to healthy living environment. 39.3% believe this can increase innovation in country development and a quarter supports one of the benefits is enhance public awareness. Only 17.8% of architects think IBS can reduce construction accident rate.

When ask upon which classification of IBS can significantly reduce environment pollution, more than three quarter (85.7%) agree precast concrete framing, panel and box systems will reduce environment pollution. 57.1% think steel frame system can reduce environment pollution, 53.6% agree steel formwork systems can do the same thing. Half of the respondents support that prefabricated timber framing systems is useful in reduce pollution and finally only 42.9% agree block work systems is good in reduce pollution.

As for the optional questions that allow respondents to voice out their suggestions on increasing the usage of sustainable technologies and IBS, the answers were categorised into two categories.

i) Suggestions toward the government

ii) Suggestions toward the construction players

The suggestions toward the government were divided into two parts, the policies and the incentives.

As for policies, there were 3 suggestions to urge the government to make compulsory for all government projects to adopt sustainable design and technology. There is a proposal to have a scoring system as part of the development approvals. One suggestion wishes government to set up policies in collective manner, which this respondent thinks only a few departments championing the technology won't encourage the advancement of the technology. Another suggestion suggested anti-corruption in government project, and this will improve the implementation of government projects.

Total of five respondents wish more incentives can be given in order to gain momentum of the technology adoption. They suggested reducing taxes significantly on imported IBS materials, to provide subsidies to developers which use recyclable components or materials, to offset cost like reduced contribution costs, development charges and Improvement Service Fund (ISF), to subsidise the cost of applying for Green Building Index (GBI) certification. There is a proposal to request government to financially support selected contractors to perform sustainable technology and design. Lastly, there is also a suggestion to increase levy and tighten rules for employment of migrant workers, in order to reduce the migrant workers hence encourage sustainable technologies and IBS.

The suggestions to industry players are as follows.

All agencies or players have to coordinate and work together to achieve a common goal, which is to increase the usage of sustainable technologies and IBS. More engineers should be train to specialise in precast, IBS and jointing system. Industry players, including engineers and architects should do more research and development (R&D) in the local context instead of relying on imported technologies. The professionals need to have more knowledge on IBS costing and the characteristics of waste reduction. Finally, there are respondents who hope the suppliers can prepare more catalogues, manufacture more standard and customised IBS parts and offer IBS certified or GBI certified products.

6. CONCLUSIONS AND RECOMMANDATIONS

The study concludes that the architects as design consultants have the awareness that sustainable technology, particularly IBS will bring benefits to sustainable development, reduce energy usage and save cost in long term. They are also aware of the impact of different classification of IBS in reducing environment pollution.

Anyway, in Malaysia context, the main reasons of not using sustainable technologies and IBS include poor sustainable and IBS knowledge and lack of integration during the design stage.

As a conclusion, most respondents agreed that government policies are able to influence the usage of ST and IBS. Majority of them responded that incentives offered by the government encourage the usage of IBS in construction projects. Therefore, it is suggested that further financial aid by the government become the catalyst in promoting the adoption of sustainable technologies and IBS in the construction industry.

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