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## Perspectives on issues and the application of the innovative procurement approaches for the Industrialised Building System (IBS)

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### ABSTRACT

Malaysia is making an aggressive effort of transformation to become a fully developed country. As one of the pillars for transformation, the construction industry has been undergoing a major reform with regard to the traditional method of construction. In recent years, the Industrialised Building System (IBS) has been promoted extensively with the government taking a lead with the practice. Studies showed that IBS has been able to expedite construction process, improve the time taken to accomplish a project, improve building quality, able to control cost and human resources, which in overall, raise occupational health and safety standard of construction. Despite, as most IBS projects were carried out under the traditional procurement method, the full benefits of IBS are somehow obscured. Several issues such as work delay, lack of communication and integration, lack of knowledge and increase in cost, which are synonymous to the traditional procurement method appear to outweigh the benefit of IBS. Hence, this research aims to suggest an alternative to the traditional procurement method with regard to IBS project implementation. The focus of this research has been on the challenges and innovative procurement methods most suited for IBS project. Two objectives were outlined: (1) to identify issues faced by client on current procurement method in IBS project; and (2) to identify the client's perspective on innovative procurement method most suited for IBS project. Data for this research was collected through semi-structured interviews with five respondents from five major developers having experience in IBS project implementation. The results from the thematic analysis revealed that apart from the common issues which ascend from the sequential nature of the traditional procurement method, design integration issue was opined to aggravate the situation. Unanimously, respondents agreed that partnering is the way forward for IBS project implementation in Malaysian construction industry. This research contributes by providing important pointers for the local construction industry to move forward with IBS project implementation.

## 1. Introduction

The construction sector is growing rapidly and has been subjected to numerous transformation program with regard to the traditional method of construction. In recent years, the Industrialised Building System (IBS) has been promoted extensively with the government taking a lead with the practice. IBS can be described as a method to construct a building by using prefabricated components. The components are manufactured systematically using machinery and mould in the factory and then transported and assembled on site (Rahim & Qureshi 2018).

The Malaysian government had pushed the concept of IBS through several policies such as IBS Strategic Plan, IBS Roadmap 2003-2010 and IBS Roadmap 2011-2015. Despite the efforts, the implementation of IBS in private project seemed low. Studies showed that the current traditional procurement method appear to be inadequate and had contributed to longer completion period, project delay, increasing the final cost of project and variation works. For this reason, an innovative procurement method appear to be the solution to address the current concern.

According to Construction Industry Development Board (CIDB), IBS has been introduced to solve issues of productivity. Studies showed that IBS has been able to expedite construction process, improve the time taken to accomplish a project, improve building quality, able to control cost and human resources, which in overall, raise occupational health and safety standard in construction. Though, there are many clients who do not satisfied with the completion time for traditionally procured IBS projects. This is attributed to the time needed for the design, where construction could only be commissioned after the completion of this stage.

Poor integration and communication between construction parties is the scenario that happens in the construction industry today (Mohd Fateh & Mohammad 2017). Cooperation among construction parties is one of the important aspects that will contribute to the success of IBS projects. The separation between construction players and work formed a silo condition which contributed to conflict and misunderstanding.

As most IBS projects were carried out under the traditional procurement method, the full benefits of IBS are somehow obscured.

Several issues such as work delay, lack of communication and integration, lack of knowledge and increase in cost, which are synonymous to the traditional procurement method appear to outweigh the benefit of IBS. Hence, this research aims to suggest an alternative to the traditional procurement method with regard to IBS project implementation. Two objectives were outlined: (1) to identify issues faced by client on current procurement method in IBS project; and (2) to identify the client's perspective on innovative procurement method most suited for IBS project.

This ensuing research reported in this paper is organised in four parts. The first part provide an introduction to IBS with issues concerning its implementation are emphasised. The second part then explained on the innovative procurement methods before the research methodology is explained. Next, the results from the data analysis are explained, followed by the discussions of the findings.

## **2. Issues concerning the traditional procurement method and IBS project implementation**

According to Anuar et al. (2011), IBS is a mass-production of industrialised systems, using the innovative process of building construction with components produced in a controlled environment. Among the most outstanding IBS projects are Sekisui Home (Japan), Open House (Sweden), Wenswonen (Netherlands) and Living Solution (United Kingdom) (Rahim & Qureshi 2018).

IBS offers greater benefits over the traditional construction method. It applies less formwork on site (Rahim & Qureshi 2018; Anuar et al. 2011) and reduces waste which consequently reduce pollution to the environment. IBS also reduces the number of labour on site in lieu of IBS component installer. IBS therefore save time because prefabrication works are carried out off site and only requires installation on site. With the implementation of IBS, the project will be completed on time and unnecessary expenditures can be avoided (Din et al. 2012).

The traditional procurement is a method that separates the design responsibility from the construction work of a project. In Malaysia, many IBS project still adopt the traditional procurement strategy. The traditional procurement method of IBS is known as 'over the wall' syndrome (Obwegeser & Müller 2018). This suggests lack of communication among parties which leads to fragmentation.

A typical IBS project starts with the employment of design consultant team which include Architect, Structure Engineer, Quantity Surveyor and Mechanical and Electrical Engineer. Brief is then given where building requirements are pass to the design consultant team. Design team will prepare an outline design, preliminary estimation and feasibility study on the project costs. The detail design drawing and specification of the IBS components will be produced after the approval of client. Tender document for bidding is normally prepared at this stage by the quantity surveyor to facilitate the process.

The adoption of the traditional procurement method for IBS projects is not without any critiques. Researchers have been very critical in this particular aspect as the intended benefits of IBS seemed to be reduced. The review of the literature has managed to unearth issues concerning the application of the traditional procurement method in IBS project implementation which are described as follows:

### **2.1 Time consuming problem**

The traditional procurement method for IBS project is considered time consuming. This is because the manufacturing work of components can only be carried out after the design is completed. Besides, longer time is needed during the design stage as complexity increases with regard to

modern buildings (Rahmani et al. 2013). Others include design omission found in the design documents as well as the procedures to prepare and approved drawings. Discrepancies also regularly present between dimensions in different schemes which add up to the time needed to improve the design before component production could eventually take place.

### **2.2 Poor Integration and Communication**

The traditional procurement method for IBS project only allows the IBS pre-casters and contracting firm join in the project after the tender stage (Anuar et al. 2011). They only can accept the task that given by client irrecusably. They also are not familiar with the design team then the communication between each other will be less. Therefore, the client as the leader of the project should realize the importance of the relationship among parties to help in achieving the objective of the project.

### **2.3 Fragmentation**

Fragmentation arise due to the isolation of professionals and lack of cooperation between construction parties (Mohd Fateh & Mohammad 2017). This siloed operation may gives rise to conflict which lend a negative impact to the quality of the design process and design outcome.

### **2.4 Lack of knowledge**

The 'over the wall' syndrome (Mohd Fateh & Mohammad 2017; Ojoko et al. 2018) suggested that parties are only interested to transfer the risk to next parties as work completed. There is no knowledge sharing or learning process between the parties. Therefore, various mistakes occur due to the poor knowledge of IBS parties. For example, the most common problems that happen are an improper assembly of the components that normally involved the beam-to-column and column-to-base connections.

### **2.5 Issues of cost uncertainty**

As Ramanathan et al. (2002) and Odeyinka et al. (2012) had mentioned, cost certainty only present at the earlier stage of the construction process. Although a traditional lump sum tender may give the lowest tender price, it may not result in lowest overall construction cost. There will be surely uncertainty and changes in the market forces, interest and inflation rated affect the IBS design, document and tender because of the traditional method is a long term construction.

### **2.6 Effect of buildability**

Buildability improves building design, help to simplify the construction techniques, encourage more effective communication among construction parties and optimize the approach to construction management.

### **2.7 Lack of early involvement**

Lack of contractor early involvement in the design stage would not give a cost-effective solution for IBS project. Construction clients should realize that the expertise of contractor is useful during the building design work. The expertise of contractor can indirectly bring effects in the design process. For example, it helps to prevent the redesign work and inefficiently built design and also enhancing project schedule (Wondimu et al. 2016).

### **2.8 Risk liability**

Under the traditional procurement, the client will take the more risk in the tender stage while the contractor takes risk in the construction

stage. It can seem that both parties take a risk at different construction stage. This will surely contribute a dispute-riddled environment and each party seeking to attribute liability to the other (Rahmani et al. 2013).

### 3. Innovative procurement approaches in IBS project

The traditional procurement method adopted for IBS project has caused several issues to construction clients. Therefore, there appears suggestions from researchers to implement the innovative procurement approaches for IBS project. According to (Obwegeser & Müller 2018), innovative management and procurement of IBS have not been fully realized by construction parties. An IBS project is requiring partnership and close relationship with the suppliers and contractors from the early stage of construction work as reported by Alias et al. (2014). This suggests that awareness to innovative procurement approaches in IBS project is important for change to take place. Review of the literature has managed to reveal innovative procurement approaches relevant for IBS project implementation which are discussed as follows:

#### 3.1 Partnering

Partnering is defined as a combination of two or more organizations in a long-term period to achieving specific project objectives by maximizing the effectiveness of each participant's resources (Wondimu et al. 2016). It is helps to improve the long-term performance of the individual organization. This innovative procurement approach envisages for a win-win situation between parties involve in the project.

#### 3.2 Integrated Project Delivery

An integrated project delivery aims to coordinate the construction parties, systems, business structures and practices into a construction process (AIA, 2007). The approach gives clients a single point of contact for both design and construction. Team members are requested to work together at every stage of construction either in a decision-making process or when problems occur during the design and construction stage. Through integrated project delivery, a better quality of IBS project will be completed since all the parties are involved in the same project and work towards achieving the same project goal.

#### 3.3 PPP/PFI

According to Takano (2017), public-private partnering (PPP) is described as a framework of accountability and a promise for value for money project. It aims to deliver infrastructure project at much lower cost. Financing the project through PPP could help to accelerate the project completion and in return, the private sector can get their profit once the project is completed. During construction, the private party will participate in the design, implementing the construction process and obtaining the necessary fund while the public sector is responsible to monitor the project to align with the project's objectives.

PFI is another part that under the PPP procurement approach. The PFI aimed to encourage the involvement of private party in delivering the public project. In Malaysia, PFI approach has been recognised as one of the most cost-effective method to procure a public infrastructure work.

#### 3.4 Separation of Procurement from Main Contract

Based on the report by Shaffii (2017), there is a proposed change in the public procurement approach through CITP. The change involves removing the burden of financial liquidity from the contractor and construction client would then be able to purchase the IBS components directly from the manufacturers and manages the payment themselves. This helps contractor to ease their financial obligation from having to

purchase the IBS components themselves while IBS suppliers would receive constant demand for the components.

## 4. Methodology

For this research, the interview method is selected to collect the data in order to achieve the objectives. The interview is a qualitative research method which exists in depth and detail, does not use predetermined categories of analysis, increases understanding of cases and situations, reduces generalizability and focuses more on researcher as his or her skills and competence are crucial to the research (Neuman 2014). Therefore, the respondents for this research are construction clients with prior knowledge and experience in managing IBS project.

This research has employed purposive sampling to identify the respondents for the interviews. Purposive sampling can be defined as 'judgement sampling' which place a value to specific experiences, behaviour and roles of respondents (Uribe & Manzur 2012). Respondents for this research area construction clients who have experienced IBS project before. This follows as they are the main party involves in the project and known to influence the procurement approach for a project.

Besides, this research had also applied the snowball sampling technique. Snowball sampling is a method that research respondent recruits other respondents to answer a research question (Bryman 2013). This method had been used because the population of the developer who implements IBS is "hidden" and "less". Though, the possibility of the respondent to involve in the research could not be guaranteed, the technique is able to increase the number of respondents to a saturation point where derivation of findings could be proposed.

## 5. Results and discussion

### 5.1 Demographic information

Five semi-structured interviews have been carried out. Table 1 shows the background of the respondents who have participated in the research. The respondents have been selected following their experience in handling IBS projects.

Despite the limited number of respondents interviewed, the experience that the respondents held in managing IBS projects are valued the most. In this instance, they have been able to provide an in-depth explanation on the issues they have experienced with the traditional procurement method while managing IBS projects. The experience that they held had also provide important points on the most suited procurement approach for managing IBS projects.

Table 1 Demographic information

Respondent	Designation	Experience (Year)
A	Senior Manager	10
B	Project Manager	12
C	Senior Site Engineer	10
D	Quantity Surveyor	9
E	Deputy Manager	7
F	Civil Engineer	8

### 5.2 Insights on issues experienced by the respondents on the traditional procurement method for IBS projects

Table 2 shows the issues the respondents experienced with regard to the traditional procurement method for IBS project. Respondents agreed that completion period (time-consuming problem) tended to be far-stretching than the anticipated period. Besides, poor integration, communication problem and lack of knowledge were the issue that happened frequently during the project period. Issue concerning lack

**Table 2** Issues on the application of the traditional procurement method for IBS projects

Issues	Respondents					
	A	B	C	D	E	F
Time Consuming Problem	√	√	√	√		√
Poor Integration and Communication	√	√	√		√	√
Lack of Knowledge	√		√	√		√
Issues of cost uncertainty				√		
Lack of Early Involvement	√		√			√
Design Issue		√				
Lack of Information			√			
Getting approval from the authorities					√	

of early involvement was pointed out by three respondents while only respondent D claimed that the company had faced cost uncertainty issue. Besides, there were also respondents who have pointed out additional issues that have occurred. In this instance, Respondent B mentioned that the company faced design issue, Respondent C stated that the company faced lack of information while respondent E has experienced the problem of getting approval from the relevant authority.

The results from the interviews suggests that most of the respondents believed that the design stage has been taking a longer time to complete. Based on their explanation, projects will only be converted to IBS design after the selection of contractor. Besides, the respondents also claimed that the design team was taking substantial amount of time to design a suitable IBS design due to the complexity of design in modern buildings. Apart from that, dimension errors which appeared within the same components in the develop schemes had also affect documentation which led towards a much longer period for approval. Respondents agreed that the issues mentioned have produced a ‘domino-effect’ which affected the whole sequence of works. The sequential nature of the traditional procurement method further exacerbates the already exasperated situation.

Respondents have also weighed in the issue of poor integration and communication in projects. Respondents mentioned a ‘trust gap’ between consultants and contractors especially when the contractors are only called in in the later stage of the project. With the myriad of parties involved, plus the many contractual relationship that existed, trust require time to develop. In the early stage, parties are frequently unknown to each other and focus has been to complete the individual tasks. As communication in the early stage was less, the tendency to deliver incorrect information was high. This eventually led to conflict which most of the respondents unanimously agreed to avoid.

Respondents also believed that contractors appointed for projects were less knowledgeable with the IBS method of construction. A respondent mentioned that in one of the projects, contractor was found having issue to understand the IBS design. The issue resulted to improper assembly of components, especially the critical connections between the beam-to-column and column-to-base connections. In other seemingly peculiar situation, respondents had also observed limited understanding of IBS among the appointed design team. Respondents reasoned that the siloed working arrangement might had contributed to the situation. The issue highlights the long-standing repercussion of fragmentation among parties in construction industry. It shows that the traditional procurement method imparts the ‘over the wall’ syndrome which placed constraints for knowledge sharing.

The traditional procurement method only let the contractor to involve at a later stage. Respondents mentioned that time was wasted while waiting for contractors to start with a project. In contrast, if the

contractor can involve early in the pre-tender stage, they may be able to give advice to client in preparing a cost-effective solution for IBS project. The expertise of contractor can indirectly bring effects in the design process. For example, it helps to prevent the redesign and improve the scheduling for the project.

The data collection through interviews has managed to unearth issue concerning design. This is an issue which attract attention as the literature seemed to be lacking in this aspect. Some respondents provided an instance where the connections between IBS panels were below par. This despite the IBS panels were produced in a strict concordance to the drawings. The respondents commented that the design issue has appeared due to poor communication and coordination between consultants and contractors. Limitation of time has compounded the issue further where the inability to coordinate design and drawings had caused the production of unsuitable IBS design.

The findings also suggest that information which should accompany the drawings is somewhat lacking. Respondents mentioned that the conversion of the conventional building design to IBS had altered important information causing frequent information lost in the process. A respondent provided a relevant instance where a critical information about the dimension of components were missing. This consequently forced the design team to make assumption which was happened to be wrong. The same mistake also arose in the measurement where re-measurement was required to be carried out. The example given by respondents imply that fragmentation, which is the character of the traditional procurement method often lead to information breakdown. This prove having a detrimental effect to the project.

Another issue considered perplexing involves getting an approval from the authority. In the case of IBS project adopting the traditional procurement method, respondents commented having to go to many different stages in getting the approval. Some respondents mentioned that the authority that they met were unfamiliar with the technologies behind IBS. They were often queried about using pre-fabricated concrete components and steel for constructing houses. The information gathered from the respondents suggests the need for the local authority to be familiar with the IBS technologies so as not to affect the progress of the project.

### 5.3 Insights on the most suited procurement approach for IBS project

Having mentioned issues connected to the traditional procurement method for IBS project, respondents agreed that partnering is the most suited procurement approach for IBS project. Respondents have weighed the integrated project delivery in second followed by the separation of procurement from the main contract. Regarding PPP and PFI, surprisingly, none of the respondents have agreed to it. Respondents mentioned that PPP and PFI could only be considered should the government is involved in a project.

Partnering is a procurement concept where partners work together to construct IBS project. The approach able to accelerate learning and help to distribute skills and knowledge. Through this, parties with better experience and knowledge tend to bring improvement to the project quality. They also share risk and resources for the success of the project. As there is a greater understanding between partners, any potential mistakes could be reduced thus helping to achieve a win-win situation.

The integrated project delivery approach aims to coordinate all construction parties, systems, business structures and practices into a construction process. Respondents were in the opinion that if this

approach can be implemented in IBS project, a cooperative team will be formed. As previously mentioned, the integrated project delivery approach will create a chance to embed the constructability principles during the design stage of IBS project. This gives chance for parties to share their expertise in preparing an effective design. Hence, it will provide the opportunity for strong pre-construction planning, resolving design-related issues and improving cost control.

Separation of procurement from main contract is an approach that help to remove the contractor's burden of financial liquidity. In this approach, contractor will on be appointed to install the IBS components. Project promoter can directly procure the IBS components from the suppliers and manage the payment themselves. This approach brings benefit to all parties as it reduces the cost to the contractor and increase demand certainty for IBS suppliers. It will also generate competitiveness amongst IBS manufacturers to bid for the contract. Besides, the client can directly negotiate the price with the supplier to prevent any potential mark up of prices via main contractors. There is only one respondent who support the approach indicating unfamiliarity with it.

## 6. Conclusion and recommendations

Based on the findings, it shows that the industry is still facing issue when adopting IBS through traditional procurement method. Where there is a change of technology or industrialisation in the industry, new and appropriate project procurement is needed. This is to endure it can cater efficiently towards innovative activities. As every project is unique and dynamic in term of processes, risk exposure and responsibilities between all parties therefore the necessity of having a standard form of contract for IBS.

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