

## **Issues in Industrialised Building System (IBS) Construction Project: A Case Study of Government School Building Project**

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**Abstract:** A lot of challenges are faced by the construction industry stakeholders in order to succeed in this field, especially due to the complexity, especially especially when global crisis or peripheral pressure environmentalist, environment, legal and social-politic occurs. The challenges of the construction industry are to ensure that the stakeholders are attainable and are able to sustain the anticipated growth. Industrialised Building System (IBS) can offer various benefits compared to conventional systems. IBS is a construction technique where the components are manufactured in a controlled environment, either on site or off site, transported, positioned and assembled into construction works. However, IBS implementations have had some shortfalls which highlight the need for an investigation. This study, therefore attempts to explore the issues in Industrialised Building System (IBS) construction project in a government school building projects in Malaysia. A case study was conducted as means to investigate a government secondary school building project located in penang. Analysis of data led to the establishment of five main issues: issues related to IBS; issues related to the site; issues related to construction workers; issues related to the local council and issues within project team. It was therefore, concluded that IBS construction works faces numerous challenges and these may come from various sources. These challenges definitely have an impact on project success thus, all conditions and situations should be well managed to avoid any risk and implication associated from these challenges towards ensuring success in projects.

**Key words:** Industrialised Building System (IBS), construction project, construction issues, delay, Malaysian case study

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### **INTRODUCTION**

The construction projects represent a unique set of activities consisting of various complex interdependent activities that need to be done to produce a unique product. The nature and characteristics of the construction activities typically introduces challenges is not encountered in other industries. These differences could be from numerous aspects such as work construction works are quite seasonal (James and Manoj, 2014); project-each project are quite customized (O'Brien, 1994); unique and have different complexity level (O'Brien, 1994; Parry, 2008; Olaturji, 2010) site-might involves various access problems (Muir, 2005)

process-may not be predictable (Takim and Akitonye, 2002) Automation-applications can be difficult (Mahbub, 2008; Balaguer and Abderrahim, 2008 ) unconditions-high chance for occurrence (Mead, 2007) costs-would vary depending on the conditions (Warsame, 2006) utilities and other resources-could be difficult to supply and manage technical innovations slower adoption rate success-highly depend upon the quality of people involved (Takim and Akitonye, 2002) weather and environmental conditions (Warsame, 2006; Vrijhoef and Koskela, 2005) and uncertainties (Bertelsen, 2004; Barrie and Paulson, 1992).

Now a days, constructions are becoming complicated in the aspect of management, application and execution.

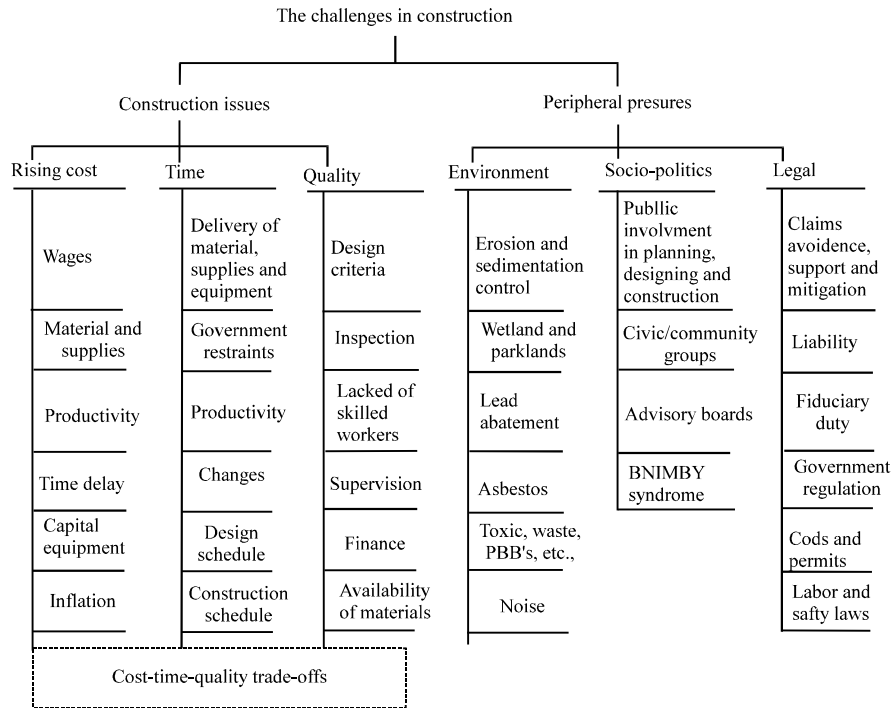


Fig. 1: The challenges of construction (Muir, 2005)

Abidin (2007) stated that construction is a complex process that involve many activities, myriads of individual, different entities, different part of the country with different skills and capabilities based on the changing environment. In other word a project being complex when it consist of many varied interrelated parts and each part can be operationalize in terms of differentiation and interdependency (Baccarini, 1996).

With respect to the era of globalization, there is an urgent need for all stakeholders as well as industry players to be more innovative, continue to improve and update their skill and knowledge towards facing the future competitions in the open mathe construction industry. Construction trends have since moved towards an industrialized approach in an attempt to remain relevant with the global marketplace. Within the Malaysian construction industry, there has been a positive trend among the construction players, especially the contractors in increasing the level of technology application in the construction projects. One such example is the uptake of Industrialized Building System (IBS). Nevertheless while this practice is in alignment with the current government's policy which urges the industry to adopt relevant technology as well as integrated project delivery approaches towards improving future project value and productivity (Nawi *et al.*, 2014a; Ismail *et al.*, 2014), IBS adoption rates have not been up to a satisfactory level (Nawi *et al.*, 2014b; Hamid *et al.*, 2008; Thanoon *et al.*, 2003). IBS Roadmap (2003) had in

the past targeted for at least 50 and 70% IBS implementation on completed projects in Malaysian by years 2006 and 2008, respectively, however reports by IBS Roadmap (2003) showed the total opposite result where only approximately 10% of the completed projects used IBS. Among reasons for this predicament could perhaps be due to the cheap labour and too much reliance on foreign labour (Hamid *et al.*, 2008; Thanoon *et al.*, 2003).

Nevertheless, it is believed that the problems within the IBS adoption matter could lie beyond these issues and perhaps could come from other issues within the project workplace. This therefore highlights the need for an investigation on those workplace issues which will be conducted on an IBS Government school building project in Malaysia. Through a case study approach, this study will highlight the main issues observed in the studied project.

**The challenges of construction industry:** Adoption of a new technology and innovation approaches are difficult. Therefore, a lot of challenges are faced by the construction industry stakeholders in order to succeed in this industry. In general, the challenges of the construction industry are to ensure that the construction industry stakeholders attained and are able to sustain the anticipated growth. According to Barrie and Paulson (1992), challenges of the construction industry can be divided into two main categories as shows in Fig. 1.

Recently, one of the main challenges faced by the Malaysian construction industry is the lack of competency level of local contractors especially on industrialization or modern construction technique. The Master Builder Association of Malaysia survey indicated that despite a high percentage of contractors in the country, only approximately 12% are actually running construction business. It is vital to limit the number of contractors, raise standards of registration and pre-qualification of contractors to ensure quality delivery from only the capable and committed contractors-fewer but stronger players.

Furthermore, the collaboration between government agencies and private industry sectors are required to provide a quality construction industry-based training in order to meet the industry's needs especially for the up-skilling of the current local construction workforce. The government also urgently needs to train the local contractors and workers to replace Foreign workers towards reducing the number of foreign construction labour to 200,000 by 2015. It is as part of the Government's long term policy on reducing the reliance on foreign workers. Hence, this is the reason behind the idea of implementing Industrialized Building System (IBS) that had been claimed could offer various benefits compared to conventional systems.

**Industrialised Building System (IBS):** Industrialised Building System (IBS) is defined as a construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site work (CIDB, 2005, 2003; Hamid *et al.*, 2008). It consists of five main IBS groups identified namely:

- Pre-cast concrete framing, panel and box systems-pre-cast columns, beams, slabs, 3D components (balconies, staircases, toilets, etc.)
- Formwork systems-tunnel forms, EPS-based forms, beams and columns molding forms, permanent steel formworks, etc.
- Steel framing systems-steel beams and columns, portal frames, roof trusses, etc.
- Prefabricated timber framing systems-timber frames, roof trusses, etc.
- Block work systems-interlocking Concrete Masonry Units (CMU), lightweight concrete blocks, etc.

With the advancement of technology and innovation, besides the five main types, various pre-fabricated materials have entered the market. These include gypsum, wood wool, polymer, fibre glass, glass and aluminum based IBS components.

Recognising the enormous benefits and potential of IBS, the government of Malaysia under the Ministry of Works through its agencies such as the CIDB and the Public Works Department have continually promoted the use of IBS (IBS Roadmap, 2003). In line with this effort, CIDB Malaysia formed the IBS steering committee to bring all IBS-related issues into a framework that could provide a guideline for feasibility of implementation of IBS (IBS Roadmap, 2003). The IBS steering committee and working groups have representatives from the government sector, developers, manufacturers, contractors, professional bodies, higher learning institutions, associations and other interested parties from the construction industry. As a result, the formation of the IBS Strategic Plan 1999 has produced a framework (involving multi disciplines of professional backgrounds) for full adoption of IBS industry wide.

Despite, the well-documented benefits and strong support from the Malaysian government, the take-up for IBS was not as high as anticipated. One of the main barriers to IBS implementation in the Malaysian construction industry is related to poor integration among stakeholders during the design stage and it is stated that it is more critical to address this issue as it directly relates to the aforementioned barriers to IBS implementation. This central issue can, specifically, affect the various stakeholders in the IBS value chain manufacturers, designers, local authorities, contractors, suppliers or clients. As construction becomes more innovative, competitive and complex, more participants were involved in IBS projects and thus a radical improvement in the procurement system and supply chain process is required for a more integrated practice, especially during the design phase of the construction life cycle process. The current IBS Malaysian project is based on the traditional design and construction process. This traditional design and construction process is however, unsuited to IBS construction and poses a substantial barrier to its adoption. Furthermore, the traditional design and construction process has been widely criticised for its fragmented approach to project delivery and its failure to form effective teams (Nawi *et al.*, 2012). If not tackled, this traditional design and construction process will lead to the unnecessary need for the redesign of plans and working drawings resulting in additional costs and time because of rework stemming from errors, quality issues and inefficiency of project delivery, poor performance and client dissatisfaction of product delivery.

## **MATERIALS AND METHODS**

This study used a detailed case study to investigate the issues in IBS construction project. A number of interviews were conducted with the officers from different

job functions (top level of management, operational and technical department). Case study is a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence (Saunders *et al.*, 2009). A case study is an approach to studying a social phenomenon through a thorough analysis of an individual case (Kummer, 2005). Yin (2013) defines a case study as a detailed analysis and description of the activities of an area under study.

**Case study description:** This study employs case study method on a “Government School Building Project” which is the secondary school in Penang. The school is considered the oldest Malay School in Malaysia and is situated at Jalan Sultan Azlan Shah, opposite of the main gate of University Sains Malaysia. It is connected from Georgetown to the Penang Bridge and there are three main landmark situated along this road which is Universiti Sains Malaysia an Army Camp and also a youth sport facility which is located beside the school. Currently it accommodates 500 pupils from the vicinity of Gelugor area.

Since, the building was built during pre-war era, the Ministry of Education of Malaysia decided to rebuild the pre-war school building while also sustaining the school’s functionality as well as conserve the historical building.

## RESULTS AND DISCUSSION

**Analysis and discussion of issues:** There are few issues that arose at the work place in the studied government school project. They were discussed there:

### Issues related to IBS

**Casting site:** The existing construction area at the Government school is comparatively small as compared to other new school projects in the mainland. Furthermore, the client would like the contractor to start the construction works without interrupting the school activities within the boundaries. Hence, the contractor had to make sure that phase 1 is completed before the phase 2 started.

The casting for IBS component had to be taken out outside of the construction boundaries thus the contractor had to find their own casting yard. Due to space limitations and high rental costs, the best option for the contractor was to place the casting site outside Penang Island. However, the long distance between the school and the casting site means that the contractor had to work on higher running cost to deliver pre-fabricated components to the site. More time was also incurred for component delivery purposes.

**Monetary issues:** IBS is a system which is efficient both in term of time and quality however, it is cost consuming and in most cases about 50% of the costs have to be covered in advance. In Malaysian law, contractors are only eligible to claim when the material are delivered to the site. This situation therefore burdens the contractor’s cash flow since they need to cope with the high initial cost of casting and delivering the IBS components.

### Issues related to the site

**Site possession by contractor:** Since the contractor was required to construct the new building while at the same time allow for daily school activities to run as normal, the contractor did not had full authority of the whole site. Not only that some demolitions had to be done to make way for new building development, the contractor was also required to build temporary classroom for the student. These not only made the job more challenging but the contractor also had to postpone jobs that involve high noises (such as the ones using heavy machinery) during school examination periods. These would certainly delay the project as there would be many buffering periods between works and affect the fluidity of work processes. A good project planning and coordination would enable the project run smoother.

**Traffic management:** Jalan Sultan Azlan Shah is among the busiest road in Penang. Not only does it connects Georgetown to Penang Bridge, the three main landmark that is situated along this road (University Sains Malaysia, Army Camp and Youth Sport facilities) would certainly invite many people to use the road. Beyond that, there are also few housing scheme along this road which further contributes to the traffic congestion.

The contractor has no choice but to use this road to commute and transport the IBS component from their casting yard to the site. To make things worse, the transporter would need to make a U-turn before they could arrive to the construction site. Therefore, a good traffic management and coordination would be vital for the proper implementation and completion of the project.

**Issues related to construction workers:** A further condition that was set was to disallow workers quarters to be built within the construction area and again, this was due to the sharing nature of the site-the contractor had to share the site with the school. This therefore forced the contractor to provide accommodations for their workers outside the construction site. In Penan where accommodation is a big issue even for the locals, what about the workers that the contractor have to bring in?

**Issues related to the local authorities:** Based on the Malaysian regulations, requirements from the local authority must first be fulfilled before any physical construction activities could take place. Among the authorities that are involved are.

**JKR (Malaysian Public Works Department):** Based on a new instruction by JKR, the contractor has to build a single bus lay by in order to avoid traffic congestion during peak hours. This activity involved cutting down 3 trees and the need to divert the main water supply. Further to that, the contractor was also required to build a bus stop for the school children.

**TNB (Malaysian central electricity board):** Previously, the contractor was allowed to use the existing electrical supply within the school boundary. However, today, instead of allowing the contractor to tap from the existing supply, TNB requires them to build one new single chamber substation for supplying the electricity to the project. This will delay the project commencement date.

**Issues within project team:** There are two areas which raises conflict between the project team, they are.

**Between the client and the quantity surveyor:** The main conflict which arose between these two parties was the fact the client expects that all materials used in the project are of the best quality and the most recent in the market while the quantity surveyor has an obligation to adhere to specifications and amount agreed in the contract. It is a norm that everyone would prefer the best quality of products however; there are cost considerations that have to be considered. Good products comes at a price thus allocations should match what is expected.

**Between the contractor's project manager and finance manager:** The project requires roughly RM 1 Million per month. Therefore, to ensure fluidity of work progress, the finance manager has to make sure that the company's financial supply would not run dry. Even if the project runs smoothly and according to schedule, there is no guarantee that the project sponsor will pay them in time. This is because the sponsor's headquarters are in Putra Jaya (a city near Kuala Lumpur) and thus the Finance Manager has to ensure effective follow-up is made and that he/she maintains good contact with certain department in the Ministry of Education in order to ensure timely payments.

Failure to fulfil payments in time would cause problem for the project manager since the project gets delayed due to contractor's fiscal issues. This further leads to conflict between the project manager and the finance manager as blame-game could arise.

Therefore, it is important for the project manager to prepare department budgets in advance so as to ensure that the finance manager gets well informed on the allocations needed every month. This would then allow ample time for the finance manager to apply allocations from the ministry while the ministry would also have enough time to prepare the money for payments.

## CONCLUSION

This study did a case study on an Industrialized Building System (IBS) Government school building project in Malaysia. Case study findings established five main issues that arose in that project which were issues related to IBS, the site, the construction works, local authorities and within the project team. These therefore, establishes the fact that construction works are generally exposed to various challenges which could come from wide range of sources, be it from direct or indirect aspect of projects. Beyond that issues may also be made up by matters related to construction works such as workforce considerations, safety, time constraints and the changing nature of the work itself while non-construction issues could be in form of legal issues, government regulations, environmental concerns and socio-political pressures.

These challenges definitely pose an impact on project success which definitely require proper management of all associated conditions and situations to ensure that all risks are well catered for towards consequently limiting or eliminating its implication on the proper completion of projects.

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