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# BARRIERS TO INDUSTRIALIZED BUILDING SYSTEM (IBS): THE CASE OF MALAYSIA

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**Abstract:**

The benefits of Industrialised Building System (IBS) as a modern method of construction are numerous and far reaching. Reduced construction time, better site management, reduced wastage are but a few of these benefits, that will ultimately produce better products for the customers. The Malaysian government has spared no effort to bring IBS to the drawing tables of all professionals involved in the built environment. The IBS Roadmap 2003 -2010 has been endorsed by the Cabinet of Ministers to be the blueprint document for the industrialisation of the Malaysian construction sector. Nevertheless, towards the last two years of the roadmap period, the effort to promote the usage of IBS as an alternative to conventional and labour intensive construction method has yet to make headway. Although members of the industry are open to the idea, a major portion of the industry stakeholders are indifferent, perhaps due to resistance towards change, insufficient information and lack of technology transfer methods to support feasibility of change to IBS. Thus, the paper reviews literatures conserving barriers on implementing IBS in Malaysia which requires attention from different parties. Then, the paper validates the barriers identified in the literatures through pilot study with the practitioners from the industry. The barriers highlighted from both literatures and pilot study are negative perception, readiness issues, cost and equipment, poor planning and regulations, poor knowledge and awareness issues. Finally, the paper proposes recommendations to improve IBS take up in Malaysia. IBS in Malaysia may requires serious marketing and re-branding efforts, restructuring in R&D focus, reorganizing training and awareness program and proper incentive for IT adoption.

***Keywords:*** *Barriers, Implementation, Industrialised Building System (IBS), Malaysia, Recommendations*

## 1. Introduction

Industrialised Building System (IBS) is not new to the construction industry. Only it has now reemerged worldwide into the 21st century as a plausible solution to improve construction image and performance. The method will enable cost saving and quality improvement through the reduction of labour intensity and construction standardisation.

Apart from this, it offers minimal wastage, less site materials, cleaner and neater environment, controlled quality, and lower total construction costs. Successful IBS implementations in the world are Sekisui Home (Japan), Living Solution (United Kingdom), Open House (Sweden) and Wenswonen (Netherlands) (Oostra & Joonson, 2007). The Malaysian government has spared no effort to bring IBS to the drawing tables of all professionals involved in the built environment. The IBS Roadmap 2003 -2010 has been endorsed by the Cabinet of Ministers to be the blueprint document for the industrialisation of the Malaysian construction sector (IBS Roadmap, 2003). Nevertheless, towards the last two years of the roadmap period, the effort to promote the usage of IBS as an alternative to conventional and labour intensive construction method has yet to make headway. This research intends to discuss the underlying barriers of IBS implementation in Malaysia which require attention from different parties. This will eventually add to the body of knowledge and provides fresh updates to previous studies and reports in this area by Hamid et al (2008), Hussein (2007), IBS Steering Committee (2006), IBS Roadmap Mid-Term Review (2007), Rahman & Omar (2006) and Thanoon et al (2003).

## 2. The Problem Statement

Early survey in 2003 reported in IBS Roadmap 2003-2010 (2003) and IBS Survey (2003) indicate that only 15% of overall construction projects in Malaysia used IBS. However recent study in 2006 published in IBS Roadmap Review shows that the percentages of completed projects using more than 70 % of IBS components in the construction project are in the range of 10%. Additionally, less than one – third of total construction projects using at least one IBS product in the year (IBS Roadmap Review, 2007). This percentage is lower than expected despite huge publicity campaign from the government. The actual projection for percentage of completed projects using IBS is in the range of 50 % in 2006 and 70% in year 2008 (IBS Roadmap, 2003). Despite well-documented benefits, the take-up so far, while reasonable, is not as high as the government anticipated at this stage. Relatively, the low labour cost in Malaysia is the root cause of the problem (IBS Roadmap Review, 2007). Although the members of the industry are open to the idea, a major portion of the industry stakeholders are indifferent, perhaps due to resistance towards change and insufficient information to support feasibility of change (Hamid et al, 2008). Thus, the problem of limited IBS take-up in Malaysia has triggered this paper to identify the barriers and seek ways forward.

## 3. Research Methodology

This paper is a preliminary study to a PhD research on Industrialised Building System (IBS). This paper has been divided into four parts. The first part reviews the current state of IBS implementation in Malaysia. The second part investigates literatures conserving the barriers of IBS implementation in Malaysia. The third part is reporting the result on pilot study to validate barriers and the final part is recommendations and conclusion derives from evidence commencing both the literature reviews and the pilot study. First, the paper use literature review to investigate existing evidences conserving the barriers of IBS implementation in Malaysia. The literature review defined as a systematic survey

and interpretation of research findings in particular topic (Vogt, 1999). The aim of a literature review is to have a good grasp of the main published work concerning a particular topic or question in your field establishing the context of the topic or problem (Hart, 1998). It will group authors who draw similar conclusions and highlight gaps in research (Caulley, 1992). The sources of information are obtained from well known refereed journals, journal with original articles, books, conference proceedings and reports. However, the paper should deal with the potential pitfall of literature review as identified by Hart (1998) which are limited range, insufficient information and omission of recent work. Then, the paper applies unstructured interview and open discussion with construction practitioners to validate the barriers first identified in the literatures. The qualitative method in pilot study permits an informal setting that natural reflects the reality of what happen or 'phenomenon' in the real setting (Rudestam et al, 1992). This approach also allows the researcher and the participants to probe each argument in details and obtain rich and more complex data in term of tacit knowledge, perception and human experience in which can not be measured in quantitative approach which are the ability to understand people's meaning as identified by Easterby-Smith et al (2002). The authors imposed a careful selection process of the participants which has need a compulsory high degree of knowledge and direct practice in the area of IBS to construct some validity and robustness of the method. The authors also appointed an experience moderator (second supervisor of the PhD research) to monitor, lead the discussion and ensured that the participants are aware of the aims, objectives and methodology of the study.

## 4. IBS Definition

To date there has been no one commonly-accepted or agreed definition on Industrialised Building System (IBS). However, there are a few definitions by researchers who studied into this area previously emphasizing on the concept on pre-fabrication, off-site production, manufacturing and mass production of building components (Rahman & Omar, 2006; Lessing *et al.* 2005; Thanoon *et al,* 2003 and Warszawski, 1999). The paper selects workable definition of IBS which is 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 works (IBS Roadmap, 2003).

## 5. The Current State of IBS in Malaysia

IBS in Malaysia has begun in early 1960's when Ministry of Housing and Local Government of Malaysia visited several European countries and evaluate their housing development program (Thanoon *et. al.*, 2003). After their successful visit in 1964, the government had started first project on IBS aims to speed up the delivery time and built affordable and quality houses. About 22.7 acres of land along Jalan Pekeliling, Kuala Lumpur was dedicated to the project comprising seven blocks of 17 stories flat there are 3000 units of low-cost flat and 40 shops lot. This project was awarded to Gammon & Larsen Nielsen using Danish System of large panel of pre-fabricated system (IBS Survey, 2003). Today, the use of IBS as a method of construction in Malaysia is evolving. Many private companies in Malaysia have teamed up with foreign expert to offer pre-cast

solution to their project (IBS Survey, 2003). The current IBS systems used in Malaysia housing projects are large panel systems, metal form systems and modular system. The IBS system is largely used in Shah Alam, Wangsa Maju and Pandan area (Swee in Sarja, 1998). In large public and private buildings and infrastructure projects, pre-cast panel, steel frame and other IBS systems were used as hybrid construction technique to build national landmarks such as Bukit Jalil Sport Complex, Kuala Lumpur Convention Centre, Lightweight Railway Train (LRT) and Petronas Twin Towers. Nevertheless, the government of Malaysia still feels that the usage of IBS is still low despite potential advantages. From the survey conducted by CIDB of Malaysia in 2003, the usage level of IBS in local construction industry stands at only 15% (IBS Survey, 2003). On the other hand, the total registered IBS contractors in Malaysia stand for 895 companies in year 2007. Registered IBS manufacturer in Malaysia until 2007 is 138 producing 347 IBS products which are available in the market. The endorsement of IBS Roadmap 2003-2010 in Malaysia by the Malaysian Parliament on 29$^{th}$ October 2003 expressed the importance and urgency of IBS implementation in Malaysia. It is a systematic and coordinated blueprint of total industrialisation of construction industry towards achieving total industrialised industry and promoting open system by the year 2010. The roadmap is a comprehensive document that divided the IBS programme into the five main focus areas that reflect the inputs needed to drive the programme (Manpower, Materials, Management, Monetary, and Marketing) (IBS Roadmap, 2003). The new circular from the Treasury Department, Ministry of Finance Head Secretary, Tan Sri Dr. Wan Abdul Aziz Wan Abdullah dated on 31$^{st}$ October 2008 has emphasized on the full utilization of IBS for all government's projects in Malaysia. The used of IBS components in government projects must not be less than 70% and the inclusion of IBS component as part of contract documents for all building works.

## 6. The Barriers to IBS Implementation in Malaysia

Evidently the need for adopting IBS in Malaysia construction industry is immense and plausible due to strong encouragement from the government and systematic implementation plan in place. Notwithstanding this progress, a number of barriers were identified as being potential hurdles to the implementation:

### 6.1 Readiness

The paper has agreed and accepted that IBS is ideal conceptualization and simplifying construction work. However, the reality in the projects is far from practical idealism in Malaysia. The transformation is not green a good respond due to the unlikely construction readiness (Hamid *et al.* 2008). Superior construction technology requires highly skilled workers to replace foreign workers but contractors left with no other choice. Local workforce is reluctant to join the industry because of the issues of low wages combined with low emphasis on occupational safety and health. The current training program to produce new construction workforce is still not be able to cater vast demand of the market. As such, regardless of foreign worker policy, foreign labour to do manual job is still badly needed by the industry and it is available abundant in cheaper cost

(Construction Industry Master Plan, 2007). Moreover, specialized skills such as system integrator or assemblers need intensive training and apprenticeship which require more time and investment (Thanoon *et al.* 2003) (IBS Steering Committee, 2006) (Rahman & Omar, 2006). Contractors in Malaysia are also lack of past experience in IBS and their professional is lack of technical knowledge in this area (Hamid *et al.* 2008). Hamid *et al.* (2008) also observed lack of R&D, low IT adoption and limited technology availability have generally discourage IBS take up. It also appears that most innovative system and components or using innovative materials are based on imported technologies which are obviously more expensive and difficult to purchase by local contractor (IBS Roadmap Review, 2007).

### 6.2 Cost Issues

Many small contractors are reluctant to adopt IBS system and prefer to continue using the conventional method of construction. This is due to the fact that small contractors are already familiar with the conventional system and for them the technology suit well with small scale projects and therefore not willing to switch to mechanized based system. Furthermore small contractors lack financial backup and are not able to set up their own manufacturing plants as it involves very intensive capital investment. In this case, financial issues become the main obstacle for small contractors to move forward with the IBS system (Rahman & Omar, 2006). In the perspective of components' manufacture, IBS construction requires high initial investment capital for pre-casters to purchase new machinery, mould, importing foreign technology and wages of skilled workers for installation process (IBS Steering Committee, 2006) (Thanoon et al. 2003). IBS is also unattractive choice due to wide swing of housing demand, high interest rate and unsure economic condition (Thanoon et al. 2003). As a result, the industry viewed IBS as threats to their business and not as opportunities (IBS Roadmap Review, 2007). It appears that existing procurement and contracting system is not 'favorable' to both pre-caster and contractor which using IBS method.

### 6.3 Awareness and Knowledge

According to IBS Roadmap Review (2007) report, the adoption of IBS in Malaysia is a client driven. Client with a good knowledge and awareness of IBS benefit will surely encourage appointed designers to design building according to IBS. However, lack of awareness program to understand client needs and giving correct information on IBS has contributing to a lack of interest from the client and decision makers (Rahman & Omar, 2006). As a result, IBS is often misinterpreted as high risk process and not contributing to any benefit to the building owner. Lack of knowledge among the designers contributes to the project delays due to the extra time taken to produce details drawing. On the other hand, poor knowledge among the approving authorities has resulting misunderstanding and misinterpreting of IBS and its relation to the current building regulation. Familiarity with IBS will expedite design approval and it is vital to ensure

successful IBS project (Construction Industry Master Plan, 2007). The majority of the authorities nonetheless is not aware of IBS design and often takes more time than usual to process design approval. It is also observed by Chung & Kadir (2007) recently that most of local authorities in Malaysia are unlikely to change local building regulation to suit IBS as the amendment will consume a lot of time and cost. According to IBS Mid Term Review (2007), the enforcement of Modular Coordination trough the amendment of Uniform Building by Low (UBBL) is yet to be implemented due to poor knowledge and awareness on IBS and Modular Coordination (MC) concept among the policy makers.

### 6.4 Planning and Implementation

At presents, the pre-casters and contracting firm in Malaysia are involved after tender stage of the construction value chain. However, the paper observed that, IBS design needs to be addressed and plan form the design stage to be successful adopted trough the integration of pre-caster, designer and contracting firm (IBS Roadmap Review, 2007). As a result, a lot of IBS project in Malaysia is not cost effective as it is proposed to be an alternative design to traditional method. IBS application has to be incorporated during the design stage. The changing in design requires a lot of further adjustment will rise the initial time and cost. Moreover, IBS requires more coherent structure of process planning and control from start to end of the project in order to reach the goals and reduce defect and errors (Gibb, 2001) (Warszawski, 1999). The overall project should be planned in such way that as soon as the components are manufactured, it is possible to transport it to the construction site and assemble it. Any delays either on manufacturing floor or construction site has severe impact on staging requirement and production planning where components from several construction projects are scheduled for production at the same time. Although it is possible to pre-fabricate any kind of building design, but if the possibility of manufactured construction is taken into account at design stage itself, several issues relating to manufacturing, transportation, complex interfaces and final assembly can be resolved (Pan *et al*. 2008) (Hamid *et al.* 2008). There are cases, where building projects are awarded and constructed using IBS system but were carried out with many difficulties. The most common problems encountered are improper assembly of the components that normally involved the beam-to-column and column-to-base connections. These problems arise due to the fact that the parties involved in the construction underestimate the important of accuracy in setting out the alignment and leveling of the bases. Basically, accurate leveling and alignment of the bases are the two most important aspects for the successful rapid erection of pre- cast concrete components (Rahman & Omar, 2006)

### 6.5 Negative Perception

Rahman & Omar (2006) observed that the term IBS is often misinterpreted with negative image due to its past failures and unattractive architecture. These buildings are normally associated with pre-fabricated, mass construction method,

low quality buildings, leakages, abandoned projects, unpleasant architectural appearances and other drawbacks. Due to the poor architectural design, the old pre-fabricated buildings have given the public, bad impression about pre-cast concrete. Clients are often in doubt of using IBS because of fear of customer rejection. Even construction professionals are in doubt in IBS technology and relate IBS with a potential post-construction problem. In addition, it is always not popular among the designers as they found pre-fabrication has limiting their creativity in design process (Hamid *et al.* 2008). It is observed that lack of IBS branding and promotion taking place in the market as the end user are neither misinterpret nor unaware of this construction method. As a result, IBS is not creating enough pull factors to encourage developers to adopt IBS. In comparison, IBS development in Scandinavian and Japan provide higher customer focus and adopt mass-customization of to enrich customer option. In UK, IBS is well associate with sustainability and green construction. Better customer perception will create better understanding and demand and will definitely encourage developers to push for IBS adoption

## 9.0 Pilot study to Identify IBS Barriers in Malaysia

This paper aims to validate and cross-reference the barriers to IBS implementation with the practitioner's perspectives and point of view. Thus, the pilot study was conducted with representatives from using unstructured interview approach and open ended discussion in a workshop to the context related to IBS. This pilot study is organized in conjunction of Workshop on Aligning R&D Themes and Titles to the Requirement of Construction Industry held by Construction Industry Development Board (CIDB) Malaysia. It involves practitioners from private companies, Public Work Department of Malaysia, government agencies, IBS consultants and representatives from construction related professionals bodies. After a lengthy deliberation, the paper concludes that the factors contributing to the delays of IBS implementation and other issues related to IBS in Malaysia are as follows:

a. IBS is not popular among design consultants
b. Lack of knowledge among designers
c. The need for mindset change through promotion and education
d. The stakeholders face a chicken and egg dilemma
e. Lack of support and slow adoption from private sector
f. Proprietary systems make it hard to be adopted by designers
g. Poor quality products available in Malaysia
h. Joints are not standardized making it hard to design as the design will have to be fixed to a particular manufacturer
i. Lack of push factor for authorities and responsible government bodies by laws and regulations
j. The professionals in Malaysia is lack of technical knowledge about IBS components
k. Volume and economy of production in scale IBS components
l. Monopoly of big boys, limiting opportunities to other contractors

m. Low offsite manufacturing of construction components available in the market
n. Require onsite specialized skills for assembly and erection of components
o. Lack of special equipments and machinery which hampered work. Need more local R&D, support services, technologies and testing of IBS components
p. Mismatch between readiness of industries with IBS targets by the government
q. Lack of involvement from 'Bumiputera' contractors as an erectors or manufactures
r. Insufficient capacity building for contractors to secure project in construction
s. Sustainability of construction industry, government to lead during downturn.

## 10. Discussion

A comparison between data conserving the barriers in literatures and results from pilot study reveals the significant relation. Thus, the pilot interview validates findings which highlight negative perception, readiness issues, cost and equipment, poor planning and regulations, poor knowledge and awareness issues. For the purpose of this paper, the barriers identified in both the literatures and pilot study was classified into a fishbone diagram for further study. The purpose of the diagram is to clarify and analyses the barriers. An overview of barriers for Malaysian construction stakeholders to embrace in IBS is depicted in **Figure 1.**

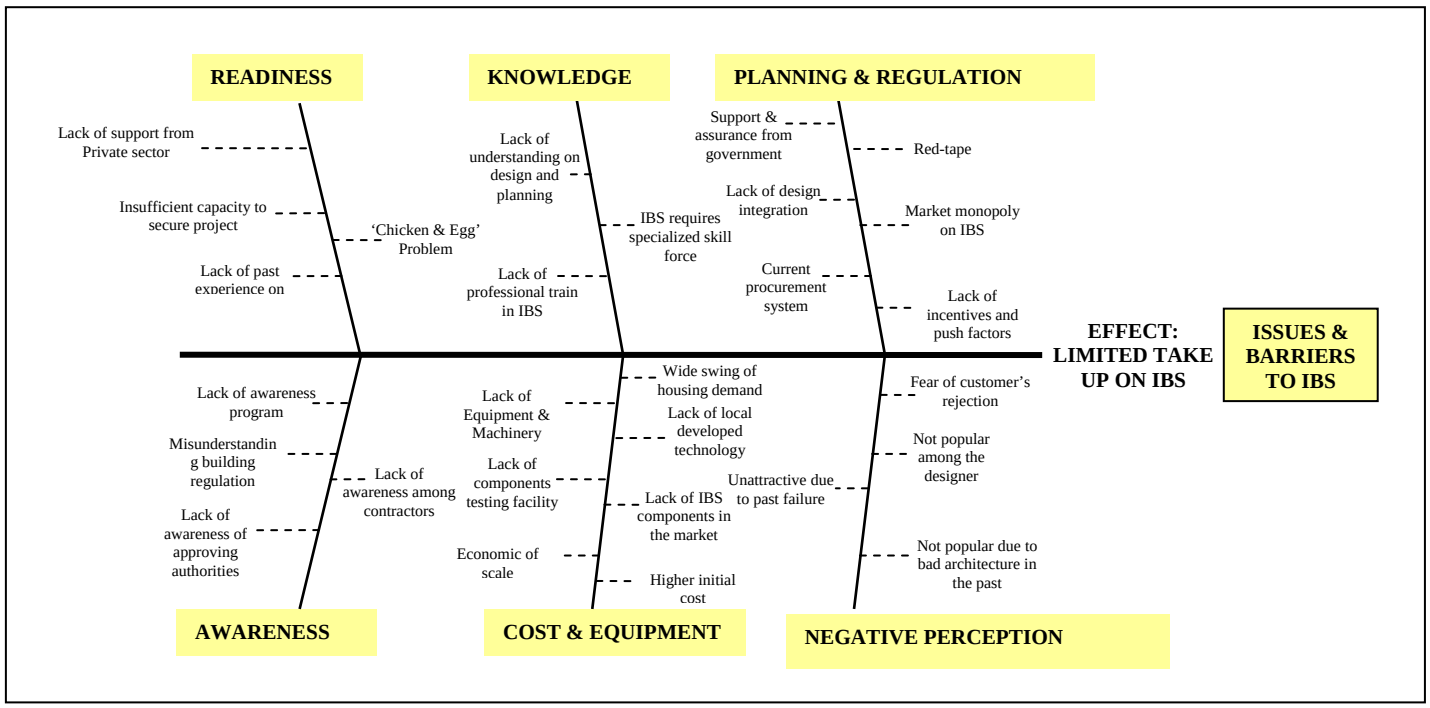


**Figure 1: Fishbone Analysis on IBS Implementation Barriers: the case of Malaysia**

## 10. Recommendation

The following are some of the recommendations proposed by the authors to increase IBS take up in Malaysia. More evidences need to established to support the paper and validate points and suggestions which has been highlighted in this study. The recommendations are listed as follows:

- **Reengineering the role of contractor -** IBS implementation requires contractors to be system integrator and process coordinator managing process from production line to site. The process demanded new skills and knowledge such as integration, planning, and monitoring. This is due to a huge risk of uncoordinated error and tolerance during the construction tenure of IBS project. Reengineering contractor roles from traditional practice to IBS is inevitable. The contractors need new organization set-up, strategic direction and procedure that 'favorable' to IBS. Professionals should be train in integration role between design and product production using relevant IT tools. In this case, the government agencies in Malaysia must provides relevant consultation and create special funding to encourage reengineering and change management initiative to suit IBS process. Although, IBS adoption is strongly related to clients and designers aspiration, there is not surprise if contractors can lead the role and influence overall IBS implementation in Malaysia.

- **Restructuring awareness programs –** Comprehensive awareness programs and showcases of best practices need to be established in order for IBS to be understood and widely used. Current awareness programs in Malaysia were ineffective and attract a lukewarm response from construction practitioners. The program only invites targeted audiences and in such way had failed to cover the vast majority of construction stakeholders. It is important for the new awareness program to run periodically and find way to educate all the stakeholders. Current activities for example, seminars, workshops, discussions, focus groups should be retained in the program. In addition, mass-media communication and site tour to real production facilities or project site to showcase best practices should be encouraged. The awareness program must also support two-way communication between the promotion agencies and the stakeholders. In such way, the program is a platform to understand stakeholder's perspectives on IBS and vice versa. Buildoffsite program in the UK for example promotes awareness program to educate and understand the client perspective, needs and issues related to construction. The program becomes a platform for clients and contractors to sit together and discussing on how IBS can give benefit to both parties other than one-way promotion program. The government trough relevant agencies in Malaysia must imitate the program and put effort to encourage two way communications and best practice sharing between promoters, clients and contractors.

- **Restructuring IBS training program -** Comprehensive preliminary study should be conducted by the government to identify skill gaps in IBS sector in order to

create a comprehensive and systematic training program. The preliminary study will ensure the training fits the needs of IBS organization and accommodates current skill shortages in the market particularly on specialization skills such as design and installation based on information from real practice. In terms of design, the engineers must have competent knowledge in component analysis and IBS building design. In the construction field, the contractors and site engineers must have enough knowledge on the safe and accurate methods of erecting and assembling IBS components into a building structure. As such, training and professional development is vital to ensure successful IBS adoption in Malaysia.

- **Restructuring R&D focus on IBS -** The inadequacy of corroborative scientific research undertaken to substantiate the benefit of IBS system as mentioned in Thanoon *et al.* (2003) require a new approach to be taken on board. A long term and strategic approach of conducting research on IBS shall be established including strong involvement of universities, companies, organizations right from the onset of any IBS R&D projects. R&D themes should not be limited on developing hard issues e.g. jointing system, IBS material but also to undertake a comprehensive study on IBS solutions encompassing the entire value chain. These include the research on developing verification progress, IBS related software, vendor developing system, marketing system, building concept, IBS safety procedure, IBS whole life cycle costing, lean construction concept and developing financial model for IBS firm. Government should increase the allocation research grant through it agencies and provide more incentive i.e. tax reduction to encourage more R&D contribution in construction industry particularly on IBS.

- **Improving ICT adoption -** Industrialisation processes in construction method requires accurate and reliable information exchange. As compared to traditional method, Information Technology (IT) in IBS projects covers wide and extensive range of processes, for example in customer interfacing, design, production, monitoring and integration. Extensive use of modern IT tools supports the different IBS processes by enabling more accurate documents and hence good conditions for an effective production where errors are discovered early and problems in the manufacturing and assembly phases can be avoided (Lessing *et al.* 2005). Lessing *et al* (2005), Eichert & Kazi (2007), CIDB (2003), Hervas (2007) are suggested the utilization of IT in IBS projects to support integration, provide accurate data, help customers in selection process, distribution and logistic and cost comparison. Verweij & Voorbij (2007) suggested IT roles during IBS project in term of communication with customer, communication with all actors, quality control on product and process and performance measuring and re-use of experiences. IT is also vital for IBS in market analysis tools, intelligent component catalogues, assembly planning and monitoring tools and design and configuration tools as observed by Manubuild (2008). As such, government should encourage more positive policies and incentives on IT and provide financial facilities for contractors, designers and component's manufactures to improve IT capacity and capability in construction.

- **Paradigm shifting on IBS through rebranding -** IBS development in Scandinavian and Japan are well associated high customer focus and mass-customization. While in the UK, IBS promotes sustainability and green construction. This is the time for Malaysian construction industry to re-brand IBS construction. Current effort to brand IBS construction as cheap and fast construction solution is relatively poor strategy as it associated IBS with historical failure, poor workmanship and poor design to customers due to cost reduction mentality. The strategy now is rather to focus on customer pulls rather than technology push or cost reduction. The term IBS which carry the name of Industrialised Building System might be change to Intelligence Building Solutions which reflect more innovative and better image. In the era where customers are more educated in the issues of sustainability, carbon footprint and global warming, IBS should be branded as value for money solution with quality and environmental friendly solution. IBS designers should associate lifestyle aspects in IBS design where customers input is gathered and design is then generated based on their opinion. More showhouse must be developed to showcase the building components and highlights its feature as a holistic sustainable building of future of dwellings. This will attract not only attract new buyers and set-up new market ranges but also improves the overall image of construction industry

## 12. Conclusion

The paper discussed barriers underlying IBS implementation in Malaysia. IBS in Malaysia has been introduced to cope with a growing demand of affordable housing, solving issues associated with foreign workers and improving image, quality and productivity of construction related services. The usage of IBS in Malaysia has begun since early 1960's in a low cost housing scheme and today IBS has evolved and used in hybrid construction to build national landmark. Despite its plausible advantages and systematic implementation plan established trough IBS Roadmap, numbers of barriers was identified as being potential hurdles to the implementation. The barriers include negative perception, readiness issues, cost and equipment, poor planning and regulations, poor knowledge and awareness issues. The paper uses a fishbone analysis to map-up the barriers conserving IBS implementation in Malaysia. In general the barriers have hindrance the construction practitioners in Malaysia to adopt IBS as construction method. The paper proposed recommendations to improve IBS take up and ensure successful roadmap implementation. It includes reengineering the role of contractor, paradigm shift on IBS through rebranding efforts, improving ICT adoption, restructuring R&D focus, restructuring IBS training program, restructuring awareness programs and reengineering contractor's role. With the present conventional methods of construction, the industry is always 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. The authors observed that IBS should be branded as value for money solution with quality, whole life cycle costing and environmental friendly to change customer's perception of past failure and bad architecture which strongly associated with IBS. The term IBS in

Malaysia could perhaps be changed from Industrialised Building System to Intelligence Building Solution which reflects innovativeness and better image. In 2008, IBS Centre has been established in Kuala Lumpur by the government to play the role as promoter of IBS in Malaysia trough activities such as consultancy, verification and certification of IBS product, training, R&D and showcasing IBS product which is excellent effort for future development of IBS. It is also important for Malaysia through the government agencies to benchmark IBS development with other countries such as Japan, Sweden and Singapore which have been successful in IBS implementation. It is hoping that the research will provide great path for further research and data collection regarding on IBS issues in Malaysia.

## 11. Further Research and Relation to PhD study

The paper is a preliminary research to develop understanding prior conducting a regional benchmarking study between contractors in Malaysia and UK. The paper aims to have a good grasp of the main published work concerning a particular topic or question in the field establishing the context of the topic or problem. The recommendations which have been proposed in this paper will be used as criteria for benchmarking study. The objectives of benchmarking are to identify process and functionality gaps. At the end of the PhD research, the study will has to propose recommendations to improve IBS readiness in Malaysia. The benchmarking process is depicted **Figure 2**.

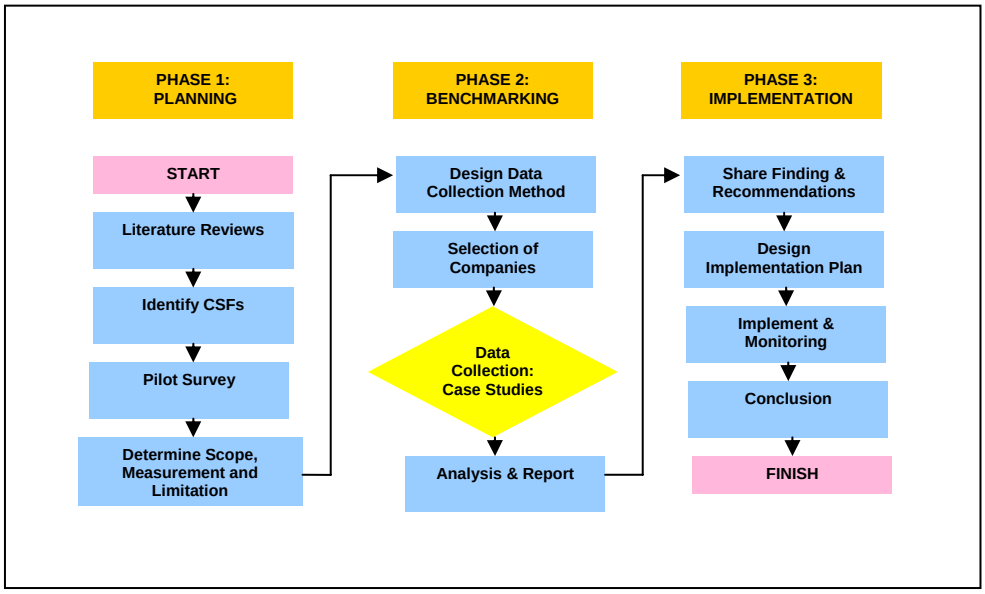


**Figure 2: The Benchmarking Model**

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