
Industrialised Building System (IBS): Implementation Strategy from R&D Perspective

Workshop Results

Organised by the Construction Industry Development Board (CIDB) Malaysia, Construction Research Institute of Malaysia (CREAM), University Technology MARA Malaysia (UiTM) and University of Salford

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The Executive Summary

- Malaysian Construction Industry has been urged to use innovative construction technique and to shift from traditional practice of *brick and mortar systems* to Industrialised Building System (IBS) construction.
- The importance of IBS is highlighted under the *Strategic Thrust 5: Innovate through R&D to adopt a new construction method* in the Construction Industry Master Plan 2006-2015 (CIMP 2006-2015).
- This report is a compilation of outcome derived from the workshop entitled *Industrialised Building System (IBS): Implementation Strategy from R&D Perspective* which has been conducted on 29th July 2009 at Grand Seasons Hotel, Kuala Lumpur to identify existing government policies on IBS, understand current scenario on the uptake of IBS, determine main problems on the implementation of IBS, identify the contributing factors that could expedite the development on IBS and guide and recommend the way forward on R&D initiatives.
- The workshop highlights the issues of IBS incentives and tax mechanism, transformation of companies form conventional to IBS, IBS payment mechanism, training, supply chain, IBS Project Management, cultural issue on IBS, economic of scale for IBS components manufacturer and sustainability issue
- Recommendations derived form the workshop are to link IBS with sustainability issues and Malaysian Green Building Index (GBI) trough research, improve on IBS incentive system, to study in-depth on payment mechanism that suits IBS, to conduct more research on people issue, to find improvement in IBS supply chain management, to study tax mechanism including possibility to wave sales tax on IBS and to find way of providing more grant and soft loan for IBS manufacturers.
- This document will be proposed as a tool for policy makers and IBS promoters to path the way forward in establishing new policies on IBS, guiding their promotion programs and identifying the potential themes and titles for future Research & Development (R&D) in IBS. The output from this workshop will be discussed in the next IBS workshop scheduled on 2nd November 2009 and the final report will be submitted to CIDB and IBS Centre for their guidance and reference

1.0 Introduction

- 1.1 The Malaysian Construction Industry plays an important role in generating wealth to the country and development of social and economic infrastructures and buildings. The industry provides job opportunities for 800,000 people which represented 8% of total workforce [1]. Construction sector growth at 5.3% at 2007 and contribute 2.1% of total GDP for Malaysia [2]. The industry creates a multiplier effect to other industries, including manufacturing sector, financial and banking, agriculture, mining and professional services.
- 1.2 Estimation construction demand for Malaysian construction industry under 9th Malaysia Plan spanning from 2006-2010 is in region of RM 280 billion and in the average of RM 56 billion per year in the stipulated time frame. RM 120 billion demand comes from public spending, RM 140 billion from private sectors and another RM 20 billion under Private Finance Initiatives (PFI) [3].
- 1.3 However, the industry is under a constant pressure to improve its performance. According to Construction Industry Development Board (CIDB) Malaysia, 69% (552,000) out of total 800,000 of registered workers as in June 2007 is foreign workers [2]. Foreign workers are usually unskilled when they first arrived in Malaysia and this impacted the productivity and the quality of the construction industry. The social problems associated with foreign workers have further aggravates the situation. The local workforce and new graduates were reluctant to join the industry in the past due to the *3-D syndrome* (dirty, difficult, and dangerous) which has been long associated with construction industry.
- 1.4 The productivity level of Malaysian Construction Industry is worth RM 20,511, which an increase of 1.52% from the previous years. Nonetheless, this growth is relatively low when compared to other industry [4]. The death occurred by occupational accident in construction is one of the highest in the country which showed by 72 cases in 2008 and 95 cases in 2007. The rates were on-par with the number of cases in manufacturing industry, although manufacturing produced larger volume of works and higher number of occupational accident [5]. Issues of sustainability have been duly highlighted in the Construction Industry Master Plan (2005 – 2015) as being of significant importance for the Malaysian Construction Industry [1]. The Malaysian Green Building Index (GBI) has been developed recently to promote sustainability construction in built environment. The introduction of this rating system has provides a new challenges for the industry players particularly in building construction.

- 1.5 As in the conventional construction which is a common practice in Malaysia, reinforced concrete frame and brick, beam, column, wall and roof are cast in situ using timber framework while steel reinforcement is fabricated off-site. This method is labour intensive involving formwork fabrication, steel bending and concreting. It requires many wet trades on site such as skill carpenters, plasterers and brick workers. The process can hamper by quality issue, unfavorable site condition, skilled labour shortage and bad weather conditions.
- 1.6 To cope with these challenges, Malaysian Construction Industry has been urged to use innovative construction technique and to shift from traditional practice of *brick and mortar systems* to Industrialised Building System (IBS) construction. The importance of IBS was highlighted under the *Strategic Thrust 5: Innovate through R&D to adopt a new construction method* in the Construction Industry Master Plan 2006-2015 (CIMP 2006-2015) which has been published as means to chart the future direction of the Malaysian construction industry [1].
- 1.7 In general, Industrialised Building System (IBS) is the term to represent the prefabrication concept in Malaysia. The term was invented to shift from the typical paradigm of prefabricated systems. 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 [6].
- 1.8 IBS offers benefits to adopters in term of cost and time certainty, attaining better construction quality and productivity, reducing risk related to occupational safety and health, alleviating issue on skilled workers and dependency on manual foreign labour and achieving ultimate goal of reducing overall cost of construction.
- 1.9 In Finland, IBS (or offsite manufacturing as better known in EU) represented 70% of total building construction. It offers effective and rapid site assembly and improving the quality and productivity of construction [7]. Japanese housebuilding industry has been developed the most advance manufacturing techniques in construction. The automation and robotic applied in both manufacturing floor and onsite construction for better quality, minimum onsite duration and better value for customer [8]. Offsite manufacturing in German housebuilding industry has improved quality and provided a better value with considerable variety and flexibility in design. It also helped the developers to overcome strict standard of quality control imposed by local authorities [9].

2.0 The Problem Statement

- 2.1 Despite a well-documented benefits and strong support from the government, the take-up for IBS was not as high as first anticipated at this stage. Low labour cost in Malaysia could perhaps was the root cause of the problem. Although the members of the industry are open to the idea, a major portion of the industry stakeholders in the private sector are indifferent, perhaps due to resistance towards change and insufficient fund and information to support feasibility of change.
- 2.2 IBS Survey 2003 report stated that only 15 % of construction projects used IBS in Malaysia in the year 2003 [10]. IBS Mid Term Review in 2007 reported that approximately only 10% of the complete projects used IBS in the year 2006. Less than 35% of total construction projects (using at least one IBS product) in year 2006 had been reported in IBS Mid Term Review as compared to forecasting IBS project of 50 % in 2006 and 70% in year 2008 as projected by IBS Roadmap [11].
- 2.3 Among others, Research and Development (R&D) and innovation have been highlighted under IBS Roadmap 2003-2010, Construction Industry Master Plan (CIMP 2006-2010) and IBS Steering Committee as an important aspect of development to be ventured in order to produce new innovation in components and technology and to expedite greater use of IBS in Malaysia.

3.0 Literature Reviews

- 3.1 The literature reviews highlights information on IBS from selected literatures and documentations. It covers information on government policies regarding IBS, current scenario and main problems on IBS implementation. The summaries of literature reviews are as follows:

3.1.1 *Government Policies*

- The Construction Industry Master Plan 2006-2015 (CIMP 2006-2015) had been published in December 2006 as means to chart the future direction of the Malaysian Construction Industry. The effort to promote IBS is highlighted under *Strategic Thrust 5: Innovate through R&D to adopt a new construction method* [1].

- Through the *2005 Budget*, the government had pledged to construct 100,000 units of affordable houses using IBS. In addition to this announcement back in 2004, all new government building projects were required then to have at least 50% of IBS content which had been calculated using *IBS Score Manual* developed by CIDB [11].
- The exemption of the construction levy (CIDB levy - 0.125 % of total cost of the project according to Article 520) on contractors that have used IBS in 50% of the building components has been commenced since 1st January 2007 [11].
- The new circular of *Surat Pekeliling Perbendaharaan Bil. 7 Tahun 2008* dated on October 2008 had emphasized on the full utilization of IBS in government's projects. Among the pressing matters raised in the circular were the use of IBS component in government projects must not be less than 70% and the inclusion of IBS as part of contract documents for all government's building works. As on February 2009, in approximate of 320 government's projects worth RM 9.43 billion had been identified to be carried out using the IBS [12].
- In the next 5 years from 2009, the government will established a new policy to reduce 50% of current 320,000 foreign workers registered in the sectors. CIDB has allocated RM 100 million to train skilled workers among locals on IBS and other methods to cope with the loss [12].

3.1.2 *Current Scenario*

- The availability of manual labours especially the abundant and cheap workers coming from neighbouring countries has sustained conventional practice and making IBS very unpopular. Three surveys have been conducted by CIDB which were IBS Survey 2003 (for all works including civil and infrastructure works), IBS Survey 2005 (architects and designer's perspectives) and IBS Roadmap Mid Term Review 2007 (only for building works).
- IBS Survey 2003 reported that only 15 % of total construction projects used IBS in Malaysia in the year 2003 [10].
- In IBS Survey 2005 which focused on architects and designer's views on IBS reported that the majority of the architects claimed to have relatively poor knowledge in IBS which result a lower uptake on IBS [13].

- IBS Mid Term Review in 2007 reported that in approximate, only 10% of the complete projects used IBS in the year 2006 (*estimation*). Less than 35% of total construction projects (using at least one IBS product) in year 2006 had been reported (*estimation*) as compared to forecasting of completed IBS project of 50 % in 2006 and 70% in year 2008 as projected by the IBS Roadmap [11].

3.1.3 Main Problem on IBS Implementation

- In 2006, IBS Steering Committee highlighted the shortcomings on IBS implementation which are as follows [11]:
 1. Poor Roadmap implementation
 2. High cost of IBS components
 3. Low standardisation of components and design solutions
 4. Poor human capital development on IBS
 5. No centralised R&D Centre for IBS
 6. No specialised resource centre for IBS
 7. Lack of certification and accreditation scheme on IBS
 8. Initiatives by too many parties as coordinator
- IBS Roadmap Mid Term Reviews reported the following problems on IBS implementation [11]:
 1. Lack of integration in the design stage
 2. Poor IBS knowledge
 3. Lack of support and understanding from construction professionals
 4. Misunderstanding and misinterpreting building regulations
- The Construction Research Institute of Malaysia (CREAM) has conducted a workshop with the captains of the industry in April 2007. Based on the workshop, the barriers to a greater IBS adoption were highlighted as follows [11]:
 1. IBS is not popular among design consultants
 2. Lack of knowledge among designers
 3. The need for mindset change
 4. *Chicken and egg* dilemma
 5. Lack of support and slow adoption from private sector
 6. Lack of push factor from responsible bodies
 7. Volume and economy of production in scale to IBS components

8. Monopoly of big boys, limiting opportunities to other contractors
9. Low IBS construction components available in the market
10. IBS require onsite specialised skills for assembly of components
11. Lack of special equipments and machineries
12. Lack of local R&D on technologies and testing of IBS components
13. Mismatch between readiness of industry with IBS targets
14. Insufficient capacity for contractors to secure project
15. Sustainability issue, government to lead during downturn

4.0 The Program

- 4.1 The Construction Industry Development Board (CIDB) Malaysia, Construction Research Institute of Malaysia (CREAM), University Technology MARA Malaysia (UiTM) and University of Salford have jointly organised a workshop entitled *Industrialised Building System (IBS): Implementation Strategy from R&D Perspective*
- 4.2 The workshop was conducted on the 29th July 2009 at the Grand Seasons Hotel, Kuala Lumpur. Workshop attendees were carefully selected from various government agencies, professional bodies and from Malaysian construction practitioners.
- 4.3 The workshop was also involved experts from academia including researchers from local IPTAs. The workshop was facilitated by Ir. Elias Ismail (CIDB Malaysia), Ir. Dr. Zuhairi Abd. Hamid (CREAM), Professor Charles Egbu and Dr. Mohamad Arif (Research Institute for the Build and Human Environment (BuHu), University of Salford, United Kingdom).
- 4.4 The objectives of the workshop are as follows:
 - To identify existing government policies on IBS
 - To understand the current scenario on the uptake of IBS in Malaysia
 - To determine main problems on the implementation of IBS from the perspective of manufacturers, contractors and suppliers
 - To identify the contributing factors that could expedite the development on IBS from manufacturers, contractors and suppliers
 - To guide and recommend the way forward on R&D initiatives undertaken by researchers at the University of Salford, United Kingdom

4.5 The workshop results and recommendations will be proposed as a guidance and reference for policy makers and IBS promoters to path the way forward in establishing new policies on IBS, guiding the promotion activities and identifying the potential themes and titles for future Research & Development (R&D) in IBS. The final report will be submitted to CIDB management and IBS Centre for the formulation of implementation strategy.

4.5 Attendees of the workshop are as follows:

Table 1: List of Attendees

Name	Organisation	Discipline
Ahmad Hazim Abdul Rahim	CREAM	Research Institute
Assoc. Prof. Dr. Baharuddin Abdul Rahman	Universiti Teknologi Malaysia	University
Assoc. Prof. Dr. Ahmad Fauzi Abdul Wahab	Universiti Teknologi Malaysia	University
Assoc. Prof. Dr. Fadzil Hassan	Universiti Teknologi MARA	University
Assoc. Prof. Dr. Mohamad Fadhil Mohammad	Universiti Teknologi MARA	University
Assoc. Prof. Dr. Roshana Takim	Universiti Teknologi MARA	University
Assoc. Prof. Dr. Zawiyah Ahmad	Universiti Teknologi MARA	University
Dr. Sr. Azlan Shah Ali	Universiti Malaya	University
En. Nuzul Azam	Universiti Putra Malaysia	University
Ir. Hooi Wing Chuen	Institution of Engineer Malaysia	Professional Body
Ir. Mohd Azhari Mohd Salleh	Public Work Department (PWD) Malaysia	Government Agency
Ir. Chuan Yeang Ming	Master Builders Association Malaysia (MBAM)	Professional Body
Ms. Faridah Muhammad Halil	Universiti Teknologi MARA	University
Mr. Alanore Chong	Master Builders Association Malaysia (MBAM)	Professional Body
Mr. G. Sudhakar	Zenbes Sdn. Bhd	Contractors

Mr. James Fung	Master Builders Association Malaysia (MBAM)	Professional Body
Ir. Kamal Pasha Mokhtar	Global Prefab Consultant Sdn. Bhd.	Consultant
Mr. Kow Choong Ming	Setia Precast Sdn. Bhd.	Contractor
Ms. Zaini Ahmad	Majlis Amanah Rakyat	Government Agency
Mr. Ong Chee Sam	Zenbes Sdn. Bhd	Contractor
Mr. Razali Zaman	PKNS Engineering Sdn. Bhd.	Contractor
Mr. Rofizlan Ahmad	IBS Centre, CIDB Malaysia	Government Agency
Mr. Sunderehsan Jayaram	LWC Precast	Manufacturer
Mr. Hashimi Albakri	REHDA Malaysia	Government Agency
Mr. Yusnizam Baharuddin	Eastern Pretech Sdn. Bhd.	Manufacturer
Mr. Zainal Abidin Abdullah	Global Globe Sdn. Bhd.	Contractor
Mr. Zulbahri Ismail	Universiti Teknologi MARA	University
Pn. Aminah Rahman	Ministry of Housing and Local Government	Government Agency
Pn. Norlina Awang	Public Work Department (PWD) Malaysia	Government Agency
Prof. Ir. Dr. Wan Hamidon Wan Badaruzzaman	UKM Perunding Sdn. Bhd.	Consultant
Wan Sri Hani Wan Mohamad	Universiti Putra Malaysia (UPM)	University
Mr. Quah Beng Teong	Master Builders Association Malaysia (MBAM)	Professional Body
Ms. Ani Saifuza Abd. Shukor	Universiti Teknologi MARA	University
Ms. Mahsuri Mat Deris	Malaysian Timber Industry Board	Government Agency
Assoc. Prof. Dr. Taksiah Majid	Universiti Sains Malaysia (USM)	University
Dr. Mohammed Arif	University of Salford	University
Khazali Alwi	Guild of Bumiputra Contractors Wibawa Berhad	Contractor
Zulkeflie Ismail	Universiti Islam Antarabangsa	University
Abdullah Chick	Guild of Bumiputra Contractors Wibawa Berhad	Contractor
Khairulnizam Alwi	Universiti Teknologi MARA	University

Azman Saubiran	University Teknologi MARA	University
Nor Zuwairi Zakwa	Guild of Bumiputra Contractors Wibawa Berhad	Contractor
Mohd Shukor Mohd Ali	Guild of Bumiputra Contractors Wibawa Berhad	Contractor
Shahrudin Shah	Universiti Sains Malaysia	University
Professor Charles Egbu	University of Salford	University
Ir. Dr. Zuhairi Abd. Hamid	CREAM	Research Institute
Mohd Khairolden Ghani	CREAM	Research Institute
Ms. Maria Zura Mohd. Zin	CREAM	Research Institute
Ir. Elias Ismail	CIDB Malaysia	Government Agency

5.0 Agenda

5.1 The agenda for the workshop below was followed:

- Registration
- Introduction and Presentation
- Discussion and Brainstorming – Multi-stakeholder’s groups
- Presentation (synthesis of output)
- Conclusion and Wrap-up Session

6.0 Workshop Results

6.1 The attendees are divided in multi-stakeholders group of 10. Five groups have been established. Workshop participants were asked to list all the factors and prioritise it in sequence of importance both to the industry and adopters. Each group has been given a specific area of discussion as follows:

- Group 1 - Identify problems on the implementation of IBS from the perspective of manufacturers, contractors and suppliers
- Group 2 - Identify contributing factor that could expedite the development on IBS from manufacturers, contractors and suppliers
- Group 3 - Proposed incentives to spin-off the activities in IBS supply chain

- Group 4 – To identify R&D initiatives on IBS
- Group 5 – To identify R&D initiatives on IBS

6.2 The results derived from the workshop are as follows:

Group 1: Problems on implementation of IBS

The problems and shortcomings for IBS implementation in Malaysia are as the followings:

High Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Lack of incentives • Lack of standard design • Lack of skill labour • Lack of training
Manufacturer	<ul style="list-style-type: none"> • Small volume demand • Lack of standard design • High capital expenditure • Lack of skill labour • Lack of training
Suppliers	<ul style="list-style-type: none"> • High capital expenditure
General	<ul style="list-style-type: none"> • Resistance from clients

High Impact to the industry and Low Impact to the adopters

General	<ul style="list-style-type: none"> • Poor understanding on IBS by professional and designers
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Low Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Security of payment • Cost to change to IBS is higher
Manufacturer	<ul style="list-style-type: none"> • Security of payment
Suppliers	<ul style="list-style-type: none"> • Security of payment

General	<ul style="list-style-type: none"> • Resistance from conventional contractor • To meet the design and manufacturing requirement
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Note:

- Lack of incentive is one the major issue which may hinder greater uptake on IBS
- Not enough active IBS component’s manufacturers in Malaysia
- Difficult to industry to attract new workers to join the workforce and re-train them with new IBS skills
- Less demand form the industry effecting the suppliers and their willingness to embrace in IBS market
- Change in construction method from conventional to IBS will effect the change in mode of payment. At this time, there is no security of payment designed for IBS
- People are reluctant to change their normal practice. Cost to change is too high
- Difficulties of supplier to cope with the demand of manufacturing and the design of construction

Group 2: Contributing factors which are critical to the success of IBS

The following are the contributing factors that can contribute to the success of IBS in Malaysia Construction Industry:

High Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Managing and coordinating efficiently • Consistently improve in quality • Maintain high productivity • The need of IBS support team • Use IBS to reduce overall cost • Use IBS to establish safer site condition
Manufacturer	<ul style="list-style-type: none"> • Managing and coordinating efficiently • Consistently improve in quality • Maintain high productivity • Generate new knowledge to penetrate global market • The need of IBS support team • Product high compliance to specification • Develop new IBS technologies
Suppliers	<ul style="list-style-type: none"> • Managing and coordinating efficiently

High Impact to the industry and Low Impact to the adopters

Contractor	<ul style="list-style-type: none">• Use IBS for better site cleanliness• Use IBS to minimise waste generation• Use IBS to cope with unpredictable weather condition• Use IBS to reduce labour
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Low Impact to the industry and High Impact to the adopters

General	<ul style="list-style-type: none">• Develop standard IBS specification
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Low Impact to the industry and Low Impact to the adopters

General	<ul style="list-style-type: none">• IBS as a solution for fragmented construction practice• IBS is used for solving problem in jointing and avoid leakage
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Note:

- The integration of design, manufacturing and construction are the element in IBS which can not be separated
- The IBS players can improve the economies of scale through better planning, policies and management
- The need for better machineries on site i.e. crane and also capable person to install IBS components
- People in the industry often associates IBS with jointing problem and leakage issue

Group 3: Proposed incentives to spin-off IBS implementation in Malaysia

The following are proposed incentive to spin-off IBS implementation in Malaysia Construction Industry:

High Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none">• Reduce service tax for hiring consultant• Improve salary scale for IBS workers• Exemption on IBS levy to be extended
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Manufacturer	<ul style="list-style-type: none"> • Waive tax for IBS product • Grant & soft loan for IBS manufacturer • Improve salary scale for IBS workers
General	<ul style="list-style-type: none"> • Monitor consultant to use standard scale of fees • Discount on client development fees • Subsidised professional training for consultant • Subsidised trade training for manufacturer and contractor

Low Impact to the industry and High Impact to the adopters

Contractor	<ul style="list-style-type: none"> • To increase CIDB levy for conventional construction adopters • Introduce better payment mechanism for IBS adopters • Free training for small contractor • Green lane for project approval • Soft Loan
Manufacturer	<ul style="list-style-type: none"> • Introduce better payment mechanism for IBS adopters • Soft Loan
Supplier	<ul style="list-style-type: none"> • Introduce better payment mechanism for IBS adopters

Note:

- Current incentives on IBS and tax waive on IBS components are insufficient
- Client's role on IBS should not be neglected. IBS developers should be given discount on the development fees if they use IBS
- Waive of IBS sales tax is important
- Resistance from consultants is one of the barriers for greater adoption. Incentives are needed for consultant engineers to use IBS
- Grant and soft loan are important for manufacturers to improve IBS products
- People are important to IBS. Incentive should be consider in training. Subsidised more for people training. In-house and with CIDB
- Easier financing for IBS adopter
- Re-think construction mechanism i.e. method of payment. Construction should re-look and benchmark with manufacturing industry

Group 4: R&D issues on IBS 1

The R&D themes and titles on IBS which is importance and need by the Malaysian Construction Industry are as follows:

High Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Transformation model from conventional to IBS • Risk Management • Cost-Benefit Analysis • Perception study on the use of IBS in SMEs • Cost comparison study on the use of IBS
Manufacturer	<ul style="list-style-type: none"> • Risk Management strategies • Cost-Benefit analysis • Perception study
Suppliers	<ul style="list-style-type: none"> • Risk Management strategies • Cost-Benefit analysis • Perception study
General	<ul style="list-style-type: none"> • Managing change and knowledge management in government agencies • Social aspect of IBS

High Impact to the industry and Low Impact to the adopters

Manufacturer	<ul style="list-style-type: none"> • Research on IBS Material • Research on load bearing wall • Research on green technologies in IBS
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Note:

- The urgent need of research on transformation of change from conventional to IBS, the success factors to facilitate the change and how to implement it
- Training and development of capacity building are critical to IBS
- IBS should be incorporate with people factors and sensitivity of local community and professionals whom involve directly or indirectly to the project
- Research on other materials other than pre-cast concrete is needed by the industry i.e. steel, timber and composite material
- Low-rise load bearing wall structure using all material is important area to be studied

Group 5: R&D Issues on IBS 2

The R&D themes and titles on IBS which is importance and need by the Malaysian Construction Industry are as follows:

High Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Culture of change in IBS acceptance and resistance • Green Building Index (GBI) • Whole Life Cycle costing for long run project • Issue of safety inspection of on IBS construction
Manufacturer	<ul style="list-style-type: none"> • Study on economic scale for IBS
Suppliers	<ul style="list-style-type: none"> • High capital expenditure
General	<ul style="list-style-type: none"> • Professional association- incentives, regulation to push on IBS • The impact on level of professionalism from the industries within time cost and quality • Incentives system • IBS subject to be embedded in IPTA's curriculum

High Impact to the industry and Low Impact to the adopters

Manufacturer	<ul style="list-style-type: none"> • The impact on term of trade offered by manufacturer to industry – payment term and deliveries
General	<ul style="list-style-type: none"> • Impact on level of professionalism from industry within time, cost and quality • Considering element of sustainability and architectural taken on-board in IBS

Low Impact to the industry and High Impact to the adopters

Contractors	<ul style="list-style-type: none"> • Profit margin comparable with conventional method and IBS method
General	<ul style="list-style-type: none"> • Total quality assessment

Low Impact to the industry and Low Impact to the adopters

General	<ul style="list-style-type: none">• Social impact in the use of IBS• Level of acceptance
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Note:

- Urgent needs to study the new incentive system for IBS adopter
- The research requires on achieving better rating using Green Building Index (GBI) using IBS
- The profit margin in construction is very low. Adopting IBS should have a good pull and push factors. Researches are needed
- IBS need create continues supply of components. Researches are needed in IBS supply chain
- The need for research on the continuity in IBS project which is the key for IBS adoption
- R&D need to study the perspective of professional and readiness of the industry to embrace in IBS

Wrap-up session (Professor Charles Egbu and Dr. Mohammad Arif)

Note:

- The need of R&D in social and sustainability i.e. the role of professional people (which often overlooked in the past in adopting IBS)
- Research need to look more on people aspect (how professional which has been trained in conventional construction to use IBS)
- Research on motivation and cultural issues on IBS are needed
- The importance of sustainability aspect to be linked with IBS. Look into IBS to address on sustainability issue (environmental, social and economic)
- The issue of foreign labour should be addressed by research on how to use the labour in a sustainability and optimal way yet not jeopardising sensitivity and social economic aspect of it.
- IBS should be seen as integrated and multi-disciplinary effort that brings various expertises in construction. The problem is that those people have a different view, philosophical and way of works. So, the researchers and promoters need to address this issue by understand the sensitivity of stakeholders in IBS supply chain
- The transformation from conventional to IBS requires time and technology improvement. It is a evolution rather than revolution of the industry

7.0 The Way Forward

1. The derived outputs from this workshop will be proposed to be a guidance and reference for policy makers and IBS promoters to path the way forward in establishing new policies on IBS, guiding the promotion programs and identifying the potential themes and titles for future Research & Development (R&D) in IBS. The conclusions and recommendations from this workshop will be discussed in the next IBS workshop scheduled on 2nd November 2009 to further enhance the results and looking for the formulation of implementation plan.
2. In the next workshop (2nd November 2009), the participants will be divided into their particular trade groups; contractor, manufacturer, supplier and government agency. Each specific group will discussed the results from the first workshop in details and will have to identify the Critical Success Factors (CSFs) to implement IBS for each trade. The final outcome will be submitted to the management of CIDB Malaysia, Ministry of Work Malaysia, members of Board of trustee CREAM, IBS Technical Committee and IBS Centre for guidance and future reference.

8.0 Discussion & Recommendation

1. The integration of IBS components or modules into the building requires various parties and supply chain to cooperate closely. This requires very careful definition and management of interfaces between contractors and suppliers and a good communication channel. It has been suggested that by implementing integrated approach in design and construction, the fragmentation gaps could be minimised.
2. The incentives for IBS are not sufficient. IBS adoption requires more pull and push factors from the government. Due to the small profit margin, the change from conventional to IBS was not feasible, unless, more attractive incentive systems and benefits which can lure the conventionalist to IBS are in place. As we live in open and liberal market place, the decision to use IBS is commonly based on dollar and cent judgment. Any promotion efforts should be focused on the demand side of IBS as well as developing a capability in the supply side.
3. On the other hand, CIDB can increase the levy for conventionalist and this can force them to use IBS in the future. However, careful study should be done before we can propose this action to avoid to be labeled as impractical or naïve by the practitioners.

4. The manufacturers of IBS component require business continuity in producing component and ethos of continues improvement in product development. As such, a soft loan for manufacturers should be created or promoted in collaboration with other government agencies such as MIDA, SMIDEC etc.
5. The payment mechanism for IBS should be reviewed. The adopters require safer and more reliable payment mechanism and contracts. The construction industry should benchmark with other industry particularly in manufacturing and automotive to understand the mechanism that works for IBS construction.
6. IBS should not be seen as a threat to traditional methods. The failure of IBS to penetrate the market is due to a misconception that it will eventually replace the traditional sector, while it actually should work closely in tandem to promote best practice in construction. The sharing of best practice between the two approaches is essential for the continued successful development of both construction sectors
7. The research's trajectory should be move from technical research to tackling soft issues. Researches need to look more on people aspect i.e. how professional which has been trained in conventional construction to use IBS. IBS adopters should be able to manage and engage with multi-disciplinary organisations in IBS, thus, the project management capability and human capacity programs become more and more important in the future
8. IBS requires fresh thinking and 'blue ocean' strategy to capture new demand, create new market space and offer customers a leap in value. The blue ocean is an analogy to describe the wider, deeper potential of market space that is not yet explored.
9. IBS is not well accepted by the construction companies because of the failure to adequately deal with risks in the IBS projects. In order to reduce risks, a careful risk strategy is very important. Sub-contracting and establishment of IBS subsidiaries can reduce some risk based on contractual 'risk-transfer' solution. In addition, the contractor can attempt to own the prefabrication technology by devising a special relationship with one or more prefabrication subcontractor, such as project-based joint venture, vertical integration or even internalization.
10. Supply Chain Management (SCM) and partnering concept has not been fully understood by the industry. Currently, the cooperation between contractors, manufacturers and suppliers is weak in many cases. Improving the

procurement system and supply chain is the key to achieving IBS success for contracting companies. Partnering with suppliers and sub-contractors from the earliest project stages is vital to ensure efficient and timely delivery of components and services

11. IBS is seen as an expensive, risky and difficult solution for contractors who normally aim for a higher marginal profit by cutting operation costs. The transformation of company from the conventional system to IBS requires a tremendous focus on Critical Success Factors (CSFs) to achieve the transformation goal. More research should be done in the area of change management, Business Process Re-engineering (BPR), Benchmarking, occupational psychologist and identifying the success factor for IBS which can help contractors and other adopters to move to IBS.
12. Sustainability is the way forward both in research and policy. The introduction of Malaysian Green Building Index (GBI) developed by Association of Consulting Engineers Malaysia (ACEM) and Pertubuhan Arkitek Malaysia (PAM) is aims promote sustainability in the built environment and raise awareness among the industry players about environment issues. Building will be awarded GBI Malaysia's rating score based on six key criteria including energy efficiency, indoor environment quality, sustainable site planning, material and resources, water efficiency and innovation.
13. GBI provides a fresh challenge for the construction industry to practice sustainable development and at the same time providing highest quality of affordable building. IBS can be a potential solution to this. IBS promoters should see this as an ample opportunity to promote a greater use of IBS. Most importantly, more research should be conducted in this area to create new innovation in IBS and link IBS with sustainability issue which could possible helping the industry to successfully addressing GBI.

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event. We are hoping more workshops in this scale and focus shall be conducted in the future for the benefit of Malaysian Construction Industry and to expedite greater adoption of IBS in Malaysia.

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