AN INDUSTRIAL REPORT ON THE MALAYSIAN BUILDING INFORMATION MODELLING (BIM) TASKFORCE: ISSUES AND RECOMMENDATIONS

Ahmad Tarmizi Haron[1], Amanda J. Marshall-Ponting[2], Zahrizan Zakaria[1], Mohd Nasrun Mohd Nawi[3], Zuhairi Abd Hamid[4], and Kamarul Anuar Mohamad Kamar[5]

[1] *Faculty of Civil Engineering, Universiti Malaysia Pahang, 26300 Gambang Kuantan, Pahang, Malaysia.*
[2] *The School of Built Environment, The College of Science and Technology, The University of Salford, Greater Manchester, U.K.*
[3] *School of Technology Management and Logistic, Universiti Utara Malaysia (UUM), 06010 Sintok, Malaysia*
[4] *Construction Research Institute of Malaysia (CREAM),*
[5] *Lafarge's Regional Construction Development Laboratory (CDL) (Structural System), Lafarge Malaysia Berhad, Malaysia*

Abstract

The government of Malaysia has a vision to become a fully developed country by the year 2020, and the construction industry has a significant role to play in assisting the government to achieve this vision. In order to become an advanced country, the construction players in Malaysia need to be globally competitive, and encouraging innovation in the industry is a key aspect of this is and provides the rationale for the roundtable discussion workshop this paper describes. The main objectives of this roundtable discussion were to establish the Building Information Modelling (BIM) task force, provide a platform for industry experts to discuss BIM issues, share knowledge and information and work collaboratively, and to provide recommendations for policy makers for further enhancements of the construction industry. The exploratory roundtable discussion was used as the research method. This roundtable discussion demonstrated the lack of understanding of BIM by the construction industry in Malaysia and the importance of establishing a BIM task force to promote BIM and National BIM Guidelines in Malaysia. This paper also presents the draft organisational chart for the BIM Taskforce, concludes that Industrial Building System (IBS) should provide one of the directions for this task force to implement BIM and that the next step is to develop a case study to increase knowledge sharing activities amongst practitioners and academics.

Keywords: *Malaysian construction industry, Building Information Modelling (BIM), BIM Taskforce and National BIM Guidelines.*

INTRODUCTION

In a typical construction project, a lot of information has to be gathered and in many forms including drawings, contracts, reports, charts and worksheets. The project involves numerous parties (owner, architects, engineers, contractors), decisions and data, and a long set of processes starting with the initial idea and followed by a feasibility study, design, construction and operation and maintenance works (Waleed *et. al.,* 2003). Communication between members of the construction supply chain thus becoming crucial and can be difficult to be delivered due to the differences of background, references and goals. The challenges in communication requires extra effort to be put in and time consuming to deal with clarification of information, changing plans and sometimes re-working components that were installed according to misinterpretation of the documents. (Rashid, 2009; Nawi *et. al.,* 2009). Due to this, Waleed *et. al.,* (2003), consider construction to be a fragmented industry because of the lack of information sharing through its life cycle.

To overcome these challenges, many construction companies in Malaysia have invested in Information and Communication Technologies (ICTs) to handle all the information between parties in a construction project because they believed ICTs can process data and information with minimum delay and errors. Fischer and Kunz (2004) and Stewart *et. al.,* (2002) have argued that to have a real-time connection between work stakeholders and suppliers, ICTs could be an effective tool that improves the processing of data and communication and could improve the coordination and collaboration among parties in a construction project. As a result, Building Information Modelling (BIM) could provide a platform for sharing digital information among parties in a construction project in order to minimise the fragmentation issues (Rashid, 2009; Haron 2013; Hervas *et. al.,* 2007; Waleed *et. al.,* 2003). Haron (2013) defined BIM as *"an approach to building design and construction through modelling technology, with an associated set of processes and people to produce, communicate and analyse building information models*." In this regards BIM will act like a repository system of digital information for sharing within a construction project. Use of a single and integrated repository system of project information has been shown to reduce errors associated with inconsistent and uncoordinated project documents (Khanzode and Fisher, 2000). The other benefit associated with BIM is enhanced collaboration between project stakeholders which itself results in better design and drawing coordination, constructability conflict resolution, automated cost estimating and simulation of project planning (Atkin, 1999; Staub-French and Khanzode, 2007).

Realising the importance and the benefits gained through the utilisation of ICT in the construction industry, in 2008 the Construction Industry Board (CIDB) set up a team to promote ICT in construction industry in line with the Malaysian government's policy (CIDB, 2008). However, implementing and adopting ICTs can be complex and numerous issues need to be taken into account especially during the early stages. Yoke *et. al.,* (2002) found that the majority of Malaysian construction companies failed to utilise the full potential of the Internet due to an ICT adoption process that followed that of the successful companies without considering the contextual problems, strategies and needs. Yusuf and Othman (2008) added that a lack of training and limited availability of expert ICT users in the construction industry worsen the current situation. Hence, to avoid these pitfalls a thorough study need to be conducted to identify the right strategy for adopting ICT in the Malaysian construction industry. This paper discusses the benefits and the challenges of implementing BIM in construction projects. Additional, the importance of establishing a BIM Taskforce in Malaysia is also discussed and it concludes with some recommendations to the BIM Taskforce to progress further in the industry.

BUILDING INFORMATION MODELLING (BIM): THE BENEFIT, THE CHALLENGES AND THE TASK FORCE

In August 2009, in the very first seminar of Building Information Modelling in Malaysia, the Director of Public Work Department Malaysia (PWD), Datuk Seri Prof Judin Abdul Karim, in the keynote speech, urged construction companies to adopt ICT and stressed on the importance of having an integrated software system and standardisation for obtaining effective workflow for the project development and implementation (Sani, 2009). Targeting first at improving efficiency, a BIM pilot project has also been delivered by PWD in 2010 on National Cancer Institute building in Putrajaya, Malaysia. The results of the pilot project will be used to determine if BIM can be applied in the 10th Malaysia Plan

development projects (New Strait Times, 2010). The keynote speech and the advertisement have opened up an early indicator of the government's commitment to implement BIM.

According to Eastman *et. al.,* (2011), BIM is defined as *"a modelling technology and associated set of processes to produce, communicate, and analyse building models"*. Meanwhile Smith (2009) defines BIM as *"a systems approach to the design, construction, ownership, management, operation, maintenance, use, and demolition or reuse of buildings"* and The BIM SmartMarket Report by McGraw-Hill (2008) defines BIM as *"the process of creating and using digital models for design, construction and/or operations of projects"*. Onuma (2008) believes that the most important part of BIM is not the software functionality, but collaboration in the design and planning process which speeds the process and clarifies design. The National Institute of Building Sciences (NIBS, 2007) states that *"BIM stands for new concepts and practices that are so greatly improved by innovative information technologies and business structures that they will dramatically reduce the multiple forms of waste and inefficiency in the building industry"*. Meanwhile, specifically to the Malaysian construction industry, Haron (2013) defined BIM as *"an approach to building design and construction through modelling technology, with an associated set of processes and people to produce, communicate and analyse building information models.* Based on several definitions, BIM can be conceptualised as a combination of three main components namely; process, technology and policy (Figure 1).

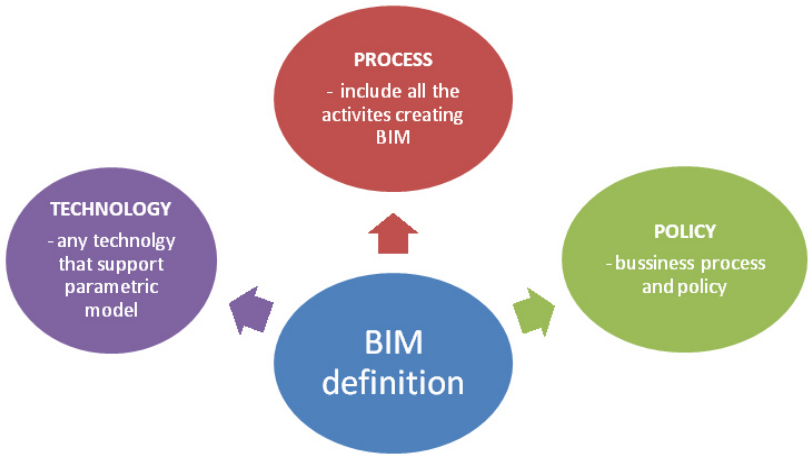

Figure 1. BIM definition components

The Benefits of BIM

Numerous construction projects have already demonstrated significant benefits from employing Building Information Modelling (BIM) technologies and processes. CRC Construction Innovation (2007) mentioned that one of the key benefits when implementing BIM is having information about the parts of a building in an integrated data environment. Having an integrated data environment acts as a central database of the construction project for all parties to refer to and that can avoid unnecessary data re-entry as the project develops. This environment promotes information collaboration activities resulting in;

- Increasing productivity: Kaner *et. al.,* (2008); Khanzode *et. al.*. (2008) and Staub-French and Fischer (2001) reported that utilisation of BIM can result in error free design documentation, shortened lead times and a reduction in Requests For Information (RFI) which lead to significant increases in construction project productivity;

- Smoothing of the coordination process: Visualization and simulation in BIM is a major advantage when utilizing BIM. Heesom and Mahdjoubi (2004) argued that 4D simulations can improve project planning due its capabilities to predict the potential problems at the construction stage. This capability allows considerable savings to be made on construction projects by identifying problems prior to construction and avoiding re-work during the project. Visualization and simulation in BIM can be utilized as a clash-detection tool to avoid re-work (Khanzode *et. al.,* 2000).

According to findings from Stanford University Centre for Integrated Facilities Engineering (CIFE) based on 32 major projects, using BIM allows the following benefits to be realised (Azhar *et. al.,* 2008):

- compared to traditional methods project time can be reduced by 7%;
- a good visualization tool can be used to detect clashes enabling the owner to save up to 10% of the contract value via clash detection activities;
- compared to traditional methods used to generate a cost estimate, utilisation of BIM can save up to 80% in time to generate a cost estimate.

In conclusion, the benefits from optimization of BIM includes cost reduction, risk reduction through automated clash detection, and increasing the quality of construction due to better management processes, the quality of the building itself or the construction period having access to complete information.

The Challenges

Despite the numerous benefits that have been gained from the utilisation of BIM, the uptake within Malaysia seems to be stagnant. Some organizations believe that productivity will suffer when implementing BIM because the technology is difficult to learn and the established workflow will be disturbed; designers believe that the owner and contractors will gain the most benefits when implementing BIM but that BIM will increase the risk (Haron, 2013). Legal issues also contribute to this scenario: the most prominent questions that need to be answered are; who owns the design; for data entry of the model, who will be responsible for the activities that ensure the data is accurate; and if there any inaccuracies in the model, who will be taking responsibility for them (Azhar *et. al.,* 2008).

Many organizations believe that implementing BIM will affect their established business processes according to Taylor and Levitt (2007). They argue that implementing Information Technology (IT) will reshape their business processes and during this process productivity will suffer (Olatunji, 2010). Ustinovicuius *et. al.,* (2007) added that reshaping the construction processes and business from being fragmented to collaborative in nature

will put the project outcomes and clients' expectations at risk. Fisher (2008) identified that the main hurdle that the Architect-Engineering-Construction (AEC) industry needs to overcome is the integration of BIM across the different phases and the different participants of a construction project.

In conclusion, there are three challenges when implementing BIM: legal issues (i.e. ownership, contracts, project delivery, etc.); technology (i.e. the level of user friendliness, inter-operability between software, cost, etc.); and issues related to the organization and its business structure and culture (i.e. productivity, level of acceptance intra and inter organization, knowledge sharing, etc.).

To ensure smooth implementation of BIM in Malaysia, the authority must address these issues accordingly.

The Needs of the Task Force

Many researchers, for example Eastman *et. al.,* (2011); Gilian and Kunz (2007); Tse, Wong, and Wong (2005), have discussed the potential of BIM at length and they believe that BIM has a capability as a collaborative tool in streamlining design and construction processes by providing a central repository of project data for all parties that can avoid unnecessary data re-entry as the project develops. However, in order to gain the benefits from implementing BIM, Succar (2010) emphasises the need to align both internal and external organisation processes, and without such alignment an organization or a project team will only benefit from a small subset of what BIM has to offer. Smith and Tardif (2009) and Eastman *et. al.,* (2011) identified that the implementation of BIM requires a strategic implementation approach to be successful as it is more of a business decision than a technical one. These arguments reveal the importance of implementing BIM with a proper strategy in order for the benefits to the construction industry in terms of managing risk, time, quality and cost to be successfully achieved.

The pace of BIM adoption and implementation is still slow because of concerns about the legal aspects, technology capability and user friendliness, and business structure. Thus, it is believed that establishing the task force will provide a good platform for industrial players to discuss BIM issues, share knowledge and information, work collaboratively, and provide recommendations to policy makers for further enhancement of the construction industry. Although the direction and scope of the task force are yet to be decided, a kickoff event is needed to identify and bring the industrial experts to come together.

MALAYSIAN CONSTRUCTION INDUSTRY: BACKGROUND

In Malaysia, the construction industry makes a significant contribution to the country. Over the past decade, this sector annually accounted for about 3-5% of the Gross Domestic Product (GDP) and provided employment for about 10% of the total labour force (CIDB, 2009). This shows the importance of projects in Malaysia's construction industry to its economy, and provides both great challenges and opportunities for various companies in the construction industry. In year 2009, to maintain the growth of the national economy, despite of economic crisis the government took firm measures and introduced government driven stimulus packages for the construction. For example, a second economic package for the

year 2009 with an additional budget amounting to RM60 billion (about 13 billion Euros) were allocated to keep the construction activities active (Market Watch Malaysia, 2010).This shows that the demand for construction is highly sensitive to developments in other sectors of the economy.

However, the government of Malaysia realized that the current construction industry needs to reform in order to be internationally competitive. In 2005 about 17.3% of government contract projects in Malaysia were considered sick due to delays of more than three months or complete project abandonment for a variety of reasons (Murali and Soon, 2007). This figure can tarnish the image of the construction industry in Malaysia; therefore, the government of Malaysia launched the Construction Industry Master Plan (CIMP) 2006-2015 to overcome the weaknesses of the current construction industry. The vision and the mission of CIMP are: *"The Malaysian construction industry shall be a world class, innovative and knowledgeable global solution provider;"* and *"To be a dynamic, productive and resilient enabling sector, supporting sustainable wealth creation and value creation, driven by technologically-pervasive, creative and cohesive construction community"* (CIMP, 2006).

In CIMP, there are seven strategic thrusts which are identified as follows:

1. Integrate the construction industry value chain to enhance productivity and efficiency;
2. Strengthen the construction industry's image;
3. Strive for the highest standard quality, occupational safety and health, and environmental practices;
4. Develop human resource capabilities and capacities in the construction industry;
5. Innovate through research and development and adopt new construction methods;
6. Leverage on information and communication technology in the construction industry;
7. Benefit from globalization including the export of construction products and services.

(CIMP, 2006)

Strategic thrust number six shows that the government of Malaysia realises that Information Communication Technology (ICT) can be used as a tool for changing the traditional approach and at the same time it can strengthen the construction industry's image. However, Gerald (2006) believed that ICT in Malaysia is not fully utilised to benefit the construction industry; even digital submission for approval by local authorities is still in an experimental stage meaning that there is a lot work to be done to promote the benefits from utilising ICT. Although a survey completed by Gaith *et. al.,* (2009) on ICT use in Malaysia revealed that the majority of Construction companies believed IT capable of integrating and sharing information among parties involved in a project, the pace of using IT as a tool for collaboration was still low. From a contractor's point of view, the use of IT is only to improve communication and to reduce the loss of information, a finding from a survey completed by Mui *et. al.,* (2002) on internet use in the Malaysian construction industry. This survey also found that most of the companies used the Internet and considered it an important tool, although the researchers believed that they did not fully

utilise the power of the Internet because they were only using the basic functions like e-mail.

Compared to other industries, Stewart and Mohamed (2003) revealed that the construction industry is still slow in terms of IT implementation due to the service or product characteristics offered by the industry. Steward and Mohamed (2003) added that fragmentation is one of the characteristics of the construction industry and it forms a barrier that prevents the strategic use of IT. Froese *et. al.,* (1997) believed that the main factor contributing to industry fragmentation is the volume of information that has been produced by many sources and at many levels, and the consequences of this scenario include problems like low productivity, cost and time overruns, and conflicts and disputes resulting in claims and time-consuming litigation. The major issue affecting the performance of the UK construction industry is the lack of integration across parties involved in the construction project according to Latham (1994). Various researchers, such as Mohamed (2003) and Alshawi and Faraj (2002) believed that in order to reduce delays, rework and communication breakdowns, collaboration and teamwork are crucial for enabling up to date information to be shared between parties in the construction project. Hence, BIM is recommended for promoting collaboration between parties in the construction industry, as mentioned by Rashid (2009); Haron. (2013); Waleed *et. al.,* (2003) and Hervas *et. al.,* (2007) is BIM.

THE METHODOLOGY

The Construction Research Institute of Malaysia (CREAM) in collaboration with Faculty of Civil Engineering and Earth Resources, University of Malaysia Pahang (UMP) organised an event entitled "IBS BIM: Mechanisation of Industrialised Building System (IBS) Through Building Information Modelling (BIM)" which was held on 17th November 2011 at Cyberview Resort and Spa, Cyberjaya, Selangor. At the event, the first author was involved as the chief coordinator, responsible for managing all activities for the one day event. The event consisted of three BIM case study presentations by the industrial practitioner, a BIM organisational readiness validation workshop and a roundtable discussion. The roundtable discussion was the main aim of the event, targeted at discussing the need for the BIM taskforce, and issues and recommendation associated with BIM implementation in Malaysia. This roundtable discussion was organised to bring together all experts with an interest and experience in implementing BIM and it was attended by 25 participants representing various organisations including private developers, government agencies, universities, contractors and consultants. Table 1 shows the background of the workshop participants:

Table 1: Background of the workshop participants.

No	Designation	Background	Experience (Years)
1	Head of Structural Department	Civil Engineering	>20
2	Senior Manager	Quantity Surveyor	11-15
3	Principal	Engineering	>20
4	Senior Architect	Architect	6-10
5	Principal	Planner & Scheduler	>20
6	Head of Architect	Architect	>20

7	Director	Civil Engineering	>20
8	Senior Manager	Architect	11-15
9	Assistant Director	Civil Engineering	11-15
10	Principal	Quantity Surveyor	>20
11	Senior Manager	Mechanical Engineering	11-15
12	Senior Manager	Architect	11-15
13	Principal	Architect	>20
14	Assistant Director	Engineering	>20
15	Principal	Civil Engineering	>20
16	Professor	Civil Engineering	>20
17	Lecturer	Civil Engineering	11-15
18	Senior Lecturer	Quantity Surveyor	11-15
19	Senior Lecturer	Buildings	11-15
20	Manager	Civil Engineering	11-15
21	Director Asset & FM	Quantity Surveyor	>20
22	Head of Development	Civil Engineer	>20
23	Assistant Vice President	Architect	16-20
24	Head of R&D Innovation	Architect	>20
25	Director	Computer Science	>20

The exploratory roundtable discussion was used as the research method. The advantages of this method are that participants are more objective and constructive in their arguments and instead of reporting the subjective impression of an individual interviewee, roundtable discussions identify the potential consensus about a subject as well as the range of opinions that led to that conclusion. In the process, data in a form of qualitative audio were captured by using Dictaphone during the roundtable discussion. After that, all audio were transcribed into written transcription before content analysis technique was used to determine the pattern of answer. As a result, four patterns has emerged and becoming the main discussion of the paper. They are all related to the BIM taskforce concerning the way forward, the strategy, the knowledge sharing and willingness of participants to share as can be referred to the next subchapter.

The ultimate objective in this discussion was to develop the BIM Taskforce in Malaysia in order to promote the implementation and utilisation of BIM in the Malaysian Construction Industry. However, before the BIM Taskforce was drafted, it was necessary to answer the following research questions:

- Research Question 1: What is BIM's status in Malaysia and what is the direction of the Task Force?
- Research Question 2: What is our strategy to make this happen?
- Research Question 3: What is the main issue in implementing BIM and what are the driving factors that can expedite the adoption of BIM?

DISCUSSION

The roundtable discussion was chaired by the fifth author who is the Director of The Construction Research Institute of Malaysia (CREAM). To start the discussion, the director presented two important issues for the discussion; a proposal for a Building Information Modelling (BIM) taskforce for promoting BIM in Malaysia's Construction Industry and its direction and elements for a successful and sustainable working group.

BIM Taskforce: The Way Forward

The first topic for discussion was "What is the direction of this taskforce to promote BIM in Malaysia?" and "What does it look like?"

Lots of questions and comments arose amongst the participants towards this topic, some of which include;

- *"…in order to set up the taskforce committee, there is the need to set up the clear direction".*
- *"… not clear and specified".*
- *"…which area we focusing? Industrial Building System (IBS) or traditional construction method?"*
- *"…who will involve in this taskforce?"*
- *"…who will lead this taskforce and what is the function of this taskforce?"*

From the responses given by the participants on the direction and area of focus for the BIM task force, the chairperson suggested IBS as a platform to promote the implementation of BIM in Malaysia. This is because the ultimate target of IBS in Malaysia is achieving mechanization and currently IBS in Malaysia is in the reproduction stage. It is hoped that by implementing BIM, the transition stage from the reproduction stage into the mechanization stage will speed up. Along the way, the improvement of construction needs such as quality, time and cost will also be considered. The majority of the respondents agreed that IBS will be used as a platform to promote BIM in Malaysia because the majority of the government's construction projects in Malaysia are shifting from traditional construction methods to IBS. Therefore, the BIM task force can take this opportunity to promote BIM. Although the majority of participants agreed to use IBS as a direction for promoting BIM, there are some issues that should be taken into account: *"…how to embed the use of BIM in current situation," "…how about current condition of contract," "…lacking of literatures that relate BIM with mechanisation of the IBS construction system has also been pointed out as a critical problem to set the direction"* and *"…limiting BIM on mechanisation are also meant limiting the benefits that BIM technology could offer. Such benefits are BIM standardisation of information, management of knowledge and information, standardisation in terms of planning assessment, application assessment, and, etc."*

Although some of the participants agreed with the issues raised, they suggested that to tackle them there is a need to establish a proper BIM task force organisational structure, to identify the key people to be involved in the BIM task force and to agree its agenda, which must tackle the issues arising from the roundtable discussion. One of the participants suggested that participants who attended this discussion event should be elected as 'Protem'

steering committee members for the BIM task force, and CREAM as part of the government body will become the secretariat for BIM task force. The drafted BIM taskforce organisation chart is shown in Figure 2.

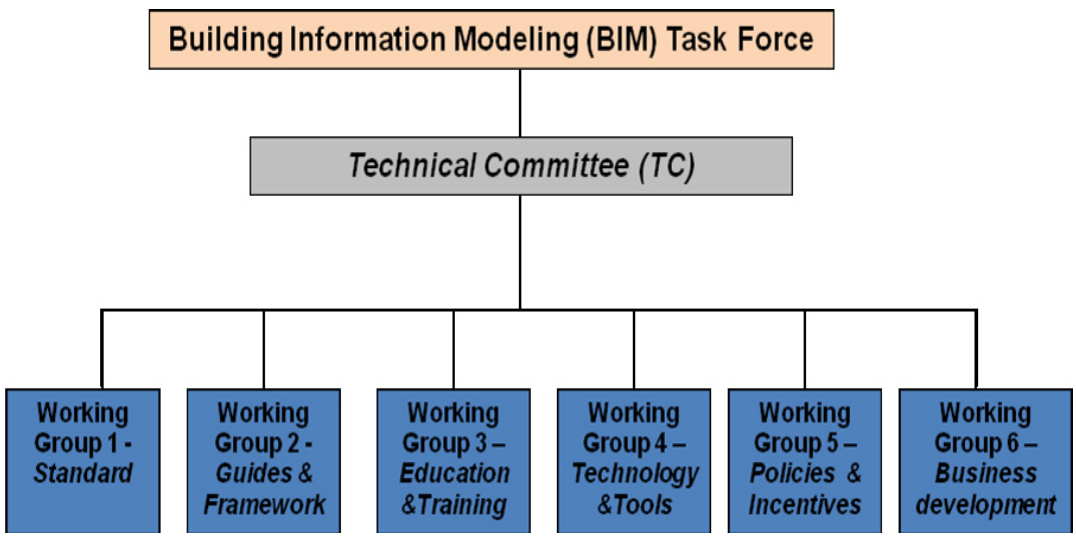

Figure 2. 'Protem' BIM Taskforce organisation chart

The Working Group will focus on its own niche area. It will present its findings to the other group to establish collective solutions for any issues arising, for example standards and guidelines, long life learning, technology, policies and business development.

BIM Taskforce: Strategy

One of the issues raised by the participants was the policy. There were lots of arguments about this, such, *"...how to change government policy?" "...how about private sector? Are they ready to change their business process?"* It was found that the participants had two different views, first to amend policy for the public sector and second to amend policy for private sector. The majority of participants believed that in Malaysia to change any policy, especially for the public or government sector, it is very difficult and time consuming compared to the private sector. The reason is because it involves procurement issues, circular, warranty issues, awards system design, and audit and these are believed to be very difficult tasks to tackle and resolve. However, respondents from the private sector argued that they believed that the use of BIM is viewed to be easy to fit in to every type of contract that could suit the business case.

The second most prominent issue raised was the Condition of Contract for those who implement BIM in their project. The majority of the participants agreed that the current Condition of Contract needed to be revised because it does not include BIM as a part of the contract. Without modification of this consultants, architects and contractors claimed that implementing BIM will create a new role which develops the model, and they will demand new fees based on their new role. Participants raised the issue of ownership of a BIM design model, especially when the contract is terminated. In the current Condition of Contract there is no clause related to these issues. These arguments or concerns are aligned with similar

issues that Azhar *et. al.,* (2008) raise which most of the industry players who intend to implement BIM are expected to raise, i.e.; who has the ownership of the design? For data entry of the model who will be responsible for the activities that ensure the data is accurate? If the deliverables of 3D models are inaccurate, who will be taking responsibility for those issues?

To address these issues the steering committees of the BIM Taskforce have to develop a proper strategy plan or road map. One of the presenters suggested that the steering committees of the BIM Taskforce should convey to the related ministry how other countries have implemented BIM. They could use the United Kingdom, Australia and Singapore as examples how they pushed BIM into their construction industries. The UK for instance, is mandating BIM; Australia is supporting BIM and Singapore is assisting BIM. However, a comment was also made that BIM is still at an early stage within Malaysia's market and it is too early to adopt any particular approach.

For the moment, the participants suggested that working groups 2, 3 and 5 have a very critical role to study BIM in Malaysia's context to establish the right strategy or approach. They believed that BIM should be evaluated and the potential success rate must be determined as any organisation does not want to waste money and resources without any solid evidence.

BIM Taskforce: Knowledge Sharing and Willingness of Participants to Share: Are We Ready?

One of the elements of a successful and sustainable working group is knowledge sharing. It is known that some organisations are reluctant to share their thoughts through open discussion, but to ensure that this taskforce becomes successful and sustainable the key is willingness of its participants to share but it needs to be clear whether the taskforce is ready for this or not. The information should not only be limited to good experiences alone, but it should also identify bad experiences so that comprehensive lessons can be learnt thus expediting a thorough understanding of BIM. CREAM through the taskforce can be used as a point of dissemination of information related to BIM.

One participant from an established developer company responded to the willingness of sharing by commenting that the company is always open to sharing knowledge and information regarding BIM implementation. However, there are some sensitive issues that cannot be shared and must be respected by others. The participant has also offered to share as much information as possible regarding the use of BIM within current practice and the Idea House project was provided as an example of this. The project was developed by using both traditional 2D CAD and 3D BIM and engaging prefabricated construction.

The Department of Development and Property from one local university added that in the era of globalisation we cannot live in our silo alone if we are to eliminate the so called construction industry as a fragmented industry; knowledge sharing is one of the options or strategies to overcome the fragmentation problem.

Suggestions was made to conduct case studies on projects that have been completed using BIM and to explore the potential, identify the needs and the critical success factors in

implementing BIM and that these case studies can be used as a platform to promote knowledge sharing among practitioners and academics. Three projects were identified:

a) Idea House by Sime Darby;
b) Dewan Usahasama University Tun Hussein Onn Malaysia (UTHM);
c) National Cancer Institute by Malaysia Public Work Department (JKR).

CONCLUSIONS AND RECOMMENDATIONS

During the discussion the majority of the respondents agreed that Building Information Modelling (BIM) could be a good platform for collaboration among parties in construction projects. The respondents were aware that BIM not only promotes 3D modelling but that the most important part is the information that is shared. However, construction players in Malaysia regarded BIM as a new technology and the participants believed that to implement BIM without a proper plan and clear road map the construction industry will portray BIM as nothing other than another 3D software in the market. Therefore, to avoid this situation the BIM Taskforce will have to work to overturn this perception. The BIM Taskforce can study how other countries are implementing BIM in their construction industry, such as Singapore, Australia, Finland, the United Kingdom and the United States. Singapore, for example, has been promoting BIM since 1997 and has slowly enforced the requirements of BIM when submitting building plan approvals and fire safety certifications. And the BIM Guideline called "Integrated plan checking" has been completed. Hong Kong and Korea are very active in promoting BIM in their construction industries. Although Malaysia has a well planned road map and strategy, support from the government is vital and without this push the implementation of BIM in the Malaysian construction industry will be slow or stagnant. We can learn how the Governments of Singapore, the United States, Norway, Denmark and Finland enforced the use of BIM through government procurement and facility management processes, but in the end to ensure successful implementation of BIM in the Malaysian construction industry the BIM Taskforce needs strong collaboration and support from the government and key industry players. The BIM Taskforce must have a good coordination approach among the public and private sectors to ensure BIM development spreads across the country.

To gain strong support from the government and industry players the participants suggested some recommendations to enhance the effectiveness of the BIM Taskforce. One of the recommendations is related to the direction of BIM in Malaysia. Although the majority of the participants agreed that IBS will be used as a platform to promote BIM, it is agreed that the task force direction should not be limited to IBS alone but take a broader perspective. The participants understand why IBS needs to move up to the mechanisation stage, but a lack of knowledge and experience in that area can impede the speed in implementing BIM. Therefore, the participants suggested that Working Group 4 (Technology and Tools) will play their role to study and investigate the application of BIM towards mechanisation of IBS.

However, having the direction alone is insufficient to promote BIM. Therefore, there needs to be a clear rationale for the use of BIM and its impacts to improve current practice need to be identified; it is therefore recommended that case studies are conducted. The participation of lecturers and research students are also highlighted in assisting with the

development of the case studies. The findings from the case studies will be used to formulate the direction of the BIM Taskforce, and the direction needs to be documented and agreed upon by the entire task force membership.

Before drafting the strategic plan, a thorough study needs to be carried out especially on the critical success factors and current status of BIM in Malaysia. From that study the BIM Taskforce can establish how it can draft a strategic plan before presenting it to the government, because the government, as a client, needs to be convinced and it was suggested that all the experiences that the participants had with BIM should be captured and presented to the client.

The BIM Taskforce was encouraged to develop the BIM guidelines and standards in Malaysia's context because the lack of these was identified as a weakness for BIM implementation. The Working group under area 2 (Guidelines and Framework) should investigate and study International guidelines and standards, potentially using the United Kingdom, United States of America, Australia and Singapore's guidelines as references. It will be important to establish whether any of these standards can be adapted to suit the needs of local usage or whether the standards will need to be tailor-made to suit local culture.

The participants responded to say that in order for this strategic plan to have an impact on the nation the involvement of the government is a necessity because without this the BIM agenda will stall. Therefore, four additional members were identified and proposed to be invited to join the BIM Taskforce and represent the following organisations:

a) Ministry of Housing and Local Government;
b) Economy Planning Unit (EPU);
c) 1Malaysia House Program (PR1MA);
d) Ministry of Works.

These additional members can strengthen the image of the BIM Taskforce and they can directly convey to the government the importance of implementing BIM in Malaysia's construction industry.

Finally, to promote knowledge sharing among the practitioners and the academics, it was suggested that the BIM Taskforce should develop a database to gather all research findings related to BIM and IBS. The Construction Research Institute of Malaysia (CREAM) has a close connection with local university and can collect all related research. All the findings of various researchers can be shared within the BIM Taskforce and the industry. In conclusion this roundtable discussion was successfully conducted and a lot of information and many suggestions and ideas have been collected and stored. The participants agreed that the next roundtable discussion will be hosted by Sime Darby which would combine an industrial visit to the Idea House project and CREAM has agreed to carry out secretariat roles.

REFERENCES

Alshawi, M., and Faraj, I. (2002) Integrated construction environments: Technology and Implementation. *Construction Innovation, 2, pp. 33-51.*

Atkin, B. L. (1999). Refocusing project delivery systems on adding value. *Information Technology in Construction, 4, 803-212.*

Azhar, S., Hein, M., and Sketo, B. (2008). "Building Information Modeling (BIM): Benefits, Risks and Challenges". *Proceedings of the 44th ASC Annual Conference*, Auburn, Alabama, April 2-5, 200

CIDB. (2009). Construction Industry Review 1980-2009(Q1). Construction Industry Development Board Malaysia. Kuala Lumpur, Malaysia

CIMP (2007) Construction Industry Master Plan 2006 – 2015 (CIMP 2006 – 2015), Construction Industry Development Board Malaysia (CIDB), December 2007, Kuala Lumpur

CRC Construction Innovation. (2007). Adopting BIM for Facilities Management: Solutions for Managing the Sydney Opera House. Cooperative Research Centre for Construction Innovation, Brisbane, Australia.

Eastman, C., Teicholz, P., Sacks, R., and Liston, K.,(2011). 2nd Edition BIM Handbook: A Guide to Building Information Modelling for Owner, Managers, Designers, Engineers, and Contractors. John Wiley and Sons, Inc. New Jersey

Froese, T., Rankin, J. and Yu, K. (1997). Project Management Applications, Models and Computer Assisted Construction Planning In Total Project Systems. *Journal of Construction Information Technology, Vol. 5 No. 1, pp. 39-62.*

Gaith, F. H., Khalim, A. R. and Ismail, A (2009). Usage of Information Technology in Construction Firms; Malaysian Construction Industry. *European Journal of Scientific Research Vol.28 No.3 (2009), pp.412-421*

Gerald, Sundaraj (2006). The Way Forward: Construction Industry Master Plan 2006-2015. *The Ingenieur, Board of Engineers Malaysia . Issue Sept – Nov 2006.*

Haron A. T (2013). Organisational Readiness to Implement Building Information Modelling: A Framework for Design Consultant. *PhD Thesis. University of Salford*.

Heesom, D., & Mahdjoubi, L. 2004. Trends of 4D CAD appliions for construction planning. *Construction Management and Economics, 22, pp. 171-182.*

Hervas *et. al.,* (2007), as stated in Kazi, S., (2007), Open Building Manufacturing – Core Concept and Industrial Requirement, Manubuild Consortium.

Kaner, I., Sacks, R., Kassian, W. and Quitt, T. (2008). Case studies of BIM adoption for precast concrete design By mid-sized structural engineering firms. *ITcon Vol. 13, 303-323.*

Khanzode, A., and Fisher, M. (2000). Potential savings from standardized electronic information exchange: A case study for the steel structure of a medical office building. *CIFE Technical Report, No 121*. Palo Alto, CA: Stanford University.

Khanzode, A.; Fischer, Martin; and Reed, Dean (2008). Benefits and Lessons Learned of Implementing Building Virtual Design and Construction (VDC) Technologies for Coordination of Mechanical, Electrical, and Plumbing (MEP) Systems on a Large Healthcare Project. *ITcon, ITcon Vol. 13, Special Issue Case studies of BIM use , pg. 324-342.*

Latham, M. (1994), Constructing the Team, HMSO, London Market Watch (2010). Malaysian-German Chamber of Commerce – The Construction Sector.

McGraw-Hill Construction, Building Information Modeling Trends SmartMarket Report, New York, 2008 Mohamed, S. (2003). Web-based technology in support of construction supplies chain networks. *Work Study*, *Vol. 52 No. 1, pp. 13-20*

Mui, L. Y., Abdul Aziz, A. R., Ni, A. C., Yee, W. C., and Lay, W. S (2002). A Survey Of Internet Usage In The Malaysian Construction Industry. *ITcon Vol. 7, 259-269.*

Murali, S and Soon, Y. W (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management 25 (2007) 517–526.*

National Institute of Building Sciences (NIBS). (2007). United States National Building Information Modelling Standard, Version 1 – Part 1: Overview, principles, and methodologies

Nawi, M.N.M., Lee, A., Kamar, K.A.M. and Hamid, Z.A. (2012) Critical Success Factors for Improving Team Integration in IBS Construction Projects: The Malaysian Case, *Malaysia Construction Research Journal (MCRJ)*, vol. 10.

Nawi M.N.M., Kamar, K. A.M., Abdullah M.R., Haron, A.T., Lee, A., and Arif, M. (2009), Enhancement of Constructability Concept: An Experience in Offsite Malaysia Construction Industry, *Proceeding in Changing Roles; New Roles, New Challenges*, Netherlands

Onuma, Kimon (2008). "White Paper:BIMStorm LAX."(http://www.onuma.com/)

Olatunji, O.A., Sher, W.D., Ning Gu and Ogunsemi, D.R. (2010). Building Information Modelling Processes: Benefits for Construction Industry. *Proceeding 18th CIB World Building Congress*. May 2010 Salford.

Peansupap, V., & Walker, D. H. T. (2005). Factors Enabling Information and Communication Technology Diffusion and Actual Implementation in Construction Organizations. *IT Con, Vol. 10, 193 – 218.*

Premkumar, G., & Potter, M. (1995). Adaptation of Computer Aided Software Engineering (CASE) Technology: An innovation adaptation perspective. Data Base Advances

Rashid, K.A. (2009). Introduction to SPP 7/2008 and JKR's Approach to Implement IBS in JKR Projects. *Seminar on Implementation Plan for IBS Projects in JKR*, Hotel Regency, Kuala Lumpur.

Revit. (2008). White Paper: The Five Fallacies of BIM

Sani R (2010) Modelling for Better Building. New Strait Times. Article in press, 16th August 2010.

Smith D.K and Tardiff M. (2009) Building Information Modeling:A Strategic Implementation Guide for Architects, Engineers, Constructors and Real Estate Asset Managers. John Wiley & Sons, Inc. New Jersey

Staub-French, S., & Khanzode, A. (2007). 3D and 4D modeling for design and construction coordination: Issues and lessons learned. *ITCon, Vol. 12, 381-407.*

Staub-French, S. and Fischer, M. (2001). Industrial Case Study of Electronic Design, Cost, and ScheduleIntegration. *Technical Report #122*, Center for Integrated Facility Engineering, Stanford University.

Staub-French, S., & Khanzode, A. (2007). 3D and 4D modeling for design and construction coordination: Issues and lessons learned. *ITCon, 12, 381-407.*

Steward, R.A. and Mohamed, S. (2003). Integrated Information Resources: Impediments and Coping Strategies in Construction, The Australian Centre for Construction Innovation, University of New South Wales, Sydney.

Succar, B. (2010.) Building information modelling framework: A research and delivery foundation for industry stakeholders. *Automation in Construction, Volume 18, Issue 3, Pages 357-375.*

Taylor, J.E., & Levitt, R. (2007). Innovation alignment and project network dynamics: An integrative model for change. *Project Management Journal, 38, pp. 22-35.*

The Star (2009). Construction Companies Urged to Adopt ICT. Article in press, retrieved online from http://biz.thestar.com.my/news/story.asp?file=/2009/8/20/business/20090820082547&sec=business on 12th November 2011

Ustinovichius, L., Shevchenko, G., Kochin, D., and Simonaviciene, R. (2007). Classification of the Investment Risk in Construction. *International Journal of Strategic Property Management 8(5), 209 – 216.*

Waleed, A.M.T., Lee Wah Peng, M.R.A. Kadir, Mohd. SalehJaafar and Mohd.SapuanSalit (2003). The essential characteristics of industrialized building system. *International Conference on Industrialised Building Systems, Kuala Lumpur, Malaysia, pp.283-295*