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# An Exploratory Study on the Potential of Implementing Building Information Modelling (BIM) in Malaysian Construction Industry: Lesson Learnt from Singapore and Hong Kong Construction Industry

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ABSTRACT

For a decade, construction industry can be considered as a fragmented industry because of lacking of sharing information through its life cycle and with other parties. Information Technology (IT) can be a tool for integrating and collaborating among parties in the construction projects, and Building Information Modelling (BIM) is one of the platforms that can be used to promote the collaboration between parties in the construction projects. Basically, BIM will act like a respiratory system with full of information to share with for construction projects. Even though there are lots of benefits can be gained by utilisation of BIM, it is a difficult task to convince the construction companies to embrace and implementing it due to some reasons. Since there is a sort of understanding of BIM by the construction companies in Malaysia. This paper is intended to review the strategy and action plan from Singapore and Hong Kong in adopting and implement BIM, which could be used in supporting the implementation of BIM in Malaysian Construction Industry. Therefore, this paper reviews the strategy and action plan from Singapore and Hong Kong in adopting and implement BIM, which could be used in supporting the implementation of BIM in Malaysian Construction Industry. Malaysia could learn from these countries because they can be classified as a new comer in implementing BIM compared to other's countries such as the United States of America, United Kingdom, Finland, Denmark, Australia and Norway, which are more advanced in implementing BIM.

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## 1. Introduction

Many researchers like Kaner et al. [1]; Khanzode et al. [2] and Staub-French and Fischer [3] regard Building Information Modelling (BIM) as a combination of Information and Communication Technology (ICT) product and process that can improve the construction process by improving the information exchange between parties in the construction projects because construction always regards as a fragmented industry due to its nature. BIM can be referred as the process of creating and using 3D parametric computer-aided-design (CAD) technologies for design that allows exchanging information within the construction project team in a digital format [4]; [5]; [6] and [7]. This model can be passed digitally between consultants in the construction projects How BIM can act as an integration platform in the construction industry? Amine and Nathaniel, [8] further explain that, in BIM, any model objects will carry their own geometry and attributes, when any authorised parties made any changes to an object, the system will change to all relevant views and documents of the project with no further modification, and the updated object can be shared by other's parties in the construction projects. The most important is the creation and contributions of information are from the collaboration between different parties in the construction projects. The used of BIM allows them to interact and communicate effectively between parties in the construction projects. These activities show how BIM can be an enabler for collaborative activities in the construction projects.

## 2. Malaysian's Construction Industry: Backgrounds and Issues

In Malaysia, the construction industry is one of the economic sectors after manufacturing and agriculture in contributing to Malaysian economics [9]. Shari [10], reported that since seventies until the eighty's construction industry in Malaysia has expanded from 6% to 15%, this shows how importance construction industry to the growth of the Malaysian economy. During the economic downturn from mid of 2007 until 2008 because of global financial crisis, the construction industry in Malaysia enjoyed an additional budget amounting to RM60 billion under government driven stimulus package to spur the construction activities in Malaysia [11]. Despite having a strong support from the Malaysian government, in reality, Malaysian construction industry facing a serious problem such as too depending on unskilled and foreign labour, low productivity and lack of innovation in construction [9]. Murali, S. and Soon, Y. W. [12] added about 17.3%, government contract projects in Malaysia were considered sick because of delay more than three months or abandoned due to various causes in the year 2005. Intan et al. [13] found that in Malaysia for public sector projects, only 46.8% projects completed within budget while for the private sector about 37.2% projects completed within budget. These figures show how serious the problems of Malaysian construction industry are facing and delay in completing the construction projects will contribute in increasing cost and time overrun.

There are lots of factors that contribute to cost and time overrun occur resulting from delay in the Malaysian construction industry. Abdul Rahman et al. [14] revealed that in Malaysia, a delay in the completion dates during the construction phase is almost 45.9%. Various researchers revealed that, the most prominent factor why delay starting to evolve during the construction phase is improperly managed the construction projects. These resulting delays during construction phase such fail to estimate the construction activities and duration resulting difficulty in planning, monitoring and controlling the construction projects, under estimate the project cost and fail to distribute the cost accordingly and misinterpret the design details [15]; [16] and [17]. We cannot solely accuse contractors as a main contributor to the delays in the construction projects, mainly these factors are interrelated within clients, consultants and contractors. Late payment received from the client, inadequate client's finance, late of decision making done by the client to any amended, and interferences from clients are the elements that contribute to delay in construction projects [14]; [12] and [18], and its effect the capability of contractors in completing his tasks. While, Abdul Rahman and Berawi [19] identified delays caused by the consultants can be classified into four main items: problems in detail design, slow correction of design problems and late inform and distribute the new design details, late review of shop drawings, and delay in tests and inspections. These factors can lead to delay in construction phase where the consultants fail to give appropriate and complete details to the contractor to perform the work in time, and the consequence is the contractor can be missed interpreting detail designs due to time constrain.

As the summary, there is a hiccup in terms of communication and transmitting the information between parties in the construction project in Malaysia and there is an urgency to establish an innovative approach to ensure all the information can be distributed equally among different parties in the construction projects through its life cycle. Therefore, each party needs a platform that can enhance the way of communication and the same time to share and to disseminate the information effectively and efficiently.

## 3. What Building Information Modelling (BIM) can offer to Malaysian Construction Industry

To enhance the image of the construction industry in Malaysia as one of the most sectors contributing to the Malaysia's economic and having a full support from the government of Malaysia, there is the urgency to shift the paradigm from using the traditional approach into more innovative approach and the same time able to increase the operational performance of construction projects. The construction industry in Malaysia needs to evolve by upgrading the current construction approach, whether in

terms of practice, management or technology in order to meet the global standard. Information Technology (IT) can be exploited to develop a new technology that can offer a platform for integrating between different parties in the construction industry in an innovative way. So, now is a perfect time to implement BIM in Malaysian construction industry, which is in line with the needs of the government of Malaysia to strengthen the construction industry's image.

There are lots of benefits that BIM can offer to Malaysian construction industry, especially in enhancing the communication between different parties in construction projects. BIM able to streamline and aids clear communication between client, consultant and contractor in construction projects by providing a single respiratory system for exchanging digital information in one or more agreed format. Khanzode and Fisher [20] and Azhar et al. [21] believed that, this approach can reduce errors associated with inconsistent and uncoordinated project documents because BIM capable of carry all information related to the building, including its physical and functional characteristics and project life cycle information, in a series of "smart objects." Fig. 1 shows the vision of BIM to promote the collaborative approach between parties in construction projects. Other benefits that BIM can offer besides enhancing the collaboration between different parties are having better design and drawing coordination, constructability conflict resolutions, automated cost estimating and simulation of project planning [22] and [3].

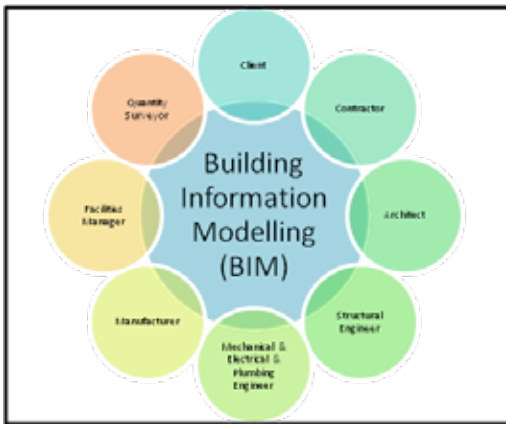


Fig. 1: The vision of BIM in integrating the different parties through BIM

In the summary, BIM could offer the Malaysian construction industry as an innovative way that could improve the design process by providing improved and continuous assessment of the design and ease design amendment, improved communication through a project's life cycle, enhanced coordination, planning, scheduling and monitoring of construction projects and able to provide a real information of "as built" construction projects. However, despite a lot of benefits gained from BIM, implementing BIM in Malaysian construction industry need a good and clear roadmap or strategy that can assist Malaysian construction players to successfully adopting BIM. Smith and Tardif [23]; Succar [24] and Eastman et al. [5], agreed that the implementation of BIM requires a strategic implementation plan to gain the full benefit from BIM, otherwise the construction industry will benefit from a small subset of what BIM has to offer.

## 4. Implementing Building Information Modelling (BIM)

In Malaysian construction industry, the widespread of Information and Communication Technology (ICT) and the influence of ICT to speed up the working process cannot be deniable, however according to Steward et al. [25]; majorities of construction industry players are still unable to gain the benefits from it. Mui at al. [26] believed there are many of the companies invest in technology advancement because they simply followed the others companies that successfully implement ICT without doing feasibility studies. They are not aware of the problems might be arisen, what is the right strategies and why they need that technology, while Yusuf and Othman [27] added that lacking in training and limited by expert users in the area of ICT in construction industry worsen the current situation. Meanwhile, Wade and Hulland [28] viewed that some of the organisation failed to adopt and adapt the rapid changing of ICT technologies, practices, process and expertise in their organisational processes. To avoid these pitfalls, a thorough study needed to be carried out to identify the right approach or strategy in adopting BIM in construction industry.

### 4.1 BIM Implementation by Singapore

In Singapore, CORENET (COnstruction and Real Estate NETwork ) was launched in 1995 with its goal to *'to reengineer and streamline the fragmented work processes in the construction industry, so as to achieve quantum improvements in turnaround time, quality and productivity.'* CORENET which is lead by the Ministry of National Development and driven by the Building and Construction Authority (BSA) is the main organisation involved in the development and implementation of BIM for government projects [29]. A study conducted by Khemlani [30] revealed that Singapore promoting the usage of BIM since 1997 which is started with an e - submission system to submit the building approval plan called e-PlanCheck. Under this system any submission for approvals must used of BIM as one of their conditions. Currently CORENET already completed the development of BIM Guideline to support the implementation of Building Information Modelling (BIM) called 'Integrated Plan Checking'.

It is not easy to shift the paradigm from the traditional approach into innovation approach. According to Evelyn and Fatt [31], first approach done by CORENET in order to achieve its goal is gaining a support from the BSA and Singapore chapter of the

International Alliance for Interoperability (IAI). A development of e-PlanCheck must comply with Industry Foundation Classes (IFC) standards. It is one of the critical success factors for smoothing the pace of adoption of the system. Another factor is building owner and Computer Aided Design (CAD) users required that all the CAD software must IFC-compliant to tender any projects under the BSA. This to ensure that any software that be used by the construction players able to communicate with e-PlanCheck.

CORENET has developed its own strategy and action plan to ensure this system well accepted and can be fully used in the real environment. There are five actions in CORENET's strategy and action plan which are;

a) Conducting seminar to disseminate the capabilities of BIM technology through seminars, forums and discussion among industry and academia.
b) Pilot testing with the industry to identify if there any setback of the system and to gain the feedback from the users to enhance the capability of the system.
c) Collaborating with Institute Higher Learning in order to assist the industry in the use of 3D BIM in their works and conduct research related with BIM technologies and process.
d) Provide the training grants to enhance the knowledge of the works in the use of IFC-BIM based tools.
e) Collaborate with the government bodies and developers to stipulate the requirement of the 3D IFC CAD model in the building contract as mandatory.

[31].

### 4.2 BIM Implementation in Hong Kong

In Hong Kong Building Information Modelling (BIM) known as Object Oriented Computer-Aided Design (OOCAD) and the government of Hong Kong through one of its agencies Hong Kong Development Bureau realised that, the current Computer-Aided Design (CAD) which is widely used in the construction industry cannot be directly applied into BIM. In order to increase the usage of OOCAD, a working group named The Works Project Information Standard (WPIS) was established under the policy agenda for the 2005 policy. The WPIS working group will be working closely with the other working group which monitoring and controlling the existing CAD software named The CAD Standard for Works Projects (CSWP) working group. One of the tasks for WPIS working group is to come out with any recommendation for the requirements of OOCAD before a new standard to support BIM can be issued [32].

In 2007, discussion between WPIS working group, CSWP working group, the construction players and the vendors of software realised that in private sector projects, there is a growing trend to utilise the BIM in their projects. During the discussion session, there are few recommendations have been given for the adoption of BIM in Hong Kong, which is;

a) WPIS and the CWSP working group will study and analyse the impacts and barriers when migrate from CAD standard and OOCAD standard and the future trend of BIM software.
b) Come out with a clear road map to indicate the time frame for implementing BIM and provide a strategic plan to assist the industry players in implementing BIM.

[33]

The widespread of the BIM in Hong Kong is very fast after that discussion, and as a result the Hong Kong Institute of Building Information Modelling (HKIBIM) was established in 2009. This effort has come from a group of Hong Kong corporations, stakeholders and experts in BIM application. In general, the objectives of HKIBIM are to promote and create awareness of BIM, to enhance the utilisation of BIM, to develop and establish the standard of BIM practices, conduct a research for improvement and to establish BIM Guideline for Hong Kong [34].

HKIBIM provides a platform to industry players, including the government of Hong Kong agencies to gather and to discuss on how to improve the implementation of BIM in Hong Kong. HKIBIM viewing that there is a possibility of increasing the usage of BIM in Hong Kong. Therefore, HKIBIM recommends some strategy action for the government to take for regulating the utilisation of BIM solution as followed;

a) Develop BIM implementation guidelines that can assist the construction players in implementing BIM and the same time it could give a clearer picture where BIM in Hong Kong heading to.
b) Pilot testing is one of the strategies, especially for a newcomer who had the intention to implement BIM, and the government should encourage some construction companies that secure any contract to adopt and implement the partial part of BIM components. Incentives can be given to any construction players who implement BIM in their construction projects
c) Seminars, colloquiums, workshops and forum are the platforms that can be used to share the knowledge, experiences, expertise and discussion that can promote and improve the implementation of BIM.
d) Since the implementation of BIM new in Hong Kong, the government of Hong Kong should establish a new department in any agencies that could monitor and evaluate the process of adopting and implement BIM in construction industry.
e) The BIM policy should recommend that the design information be open and made available to other partners so that the design can be easily understood and evaluated [32].

## 5. Lesson Learnt from Singapore and Hong Kong

Singapore and Hong Kong seemly enjoyed the strong support from their government to push Building

Information Modelling (BIM) into their construction industry in terms of policy and contract. Involvements from the private sector also play a significant role in speed up the process of adoption and implementation of BIM in their construction industry. Willingness of Private sector to take part in the pilot project gives a huge significant impact to the pace of implementing BIM, where the feedback from the pilot project will be used as a continuous quality improvement to improve the current practice. Series of awareness was conducted by both countries to disseminate the knowledge of BIM and the same time; it can convey the benefit that can be gained by implementing BIM to the construction players. Involvements from local universities are inevitable to conduct research related with BIM technologies and process. To increase the participants from the industry in implementing BIM incentives are given whether for training purpose to enhance the worker's knowledge or tax reduction. The only different approach between Singapore and Hong Kong is Singapore more toward doing collaboration between government agencies and private sector whereas Hong Kong intended to establish a new role for government agencies to monitor the implementation of BIM. The collaboration between government agencies and private sector in Singapore is to ensure and encourage the private sector to specify the requirement of the Industry Foundation Classes (IFC) 3D model in their contract and for the government project; there are no issues because the requirement of the IFC 3D model is already stated in the contract. Contrary in Hong Kong, the establishment of the department of BIM is more to monitor the implementation of the government's BIM policy and as entrusted with the task of overseeing BIM initiatives.

Implementation of BIM in Malaysia demands the involvement from the government, and this can be the driving force towards higher utilisation of BIM in Malaysia. To gain the trust or involvement from the government, forming a BIM working group is one way like Hong Kong, in their early stage adopting BIM. Construction Research Institute of Malaysia (CREAM) under the Construction Industry Development Board (CIDB) can play a significant role to gather all parties in the Malaysian construction industry to discuss the direction of BIM in Malaysia. Collaboration with local universities in research and development can be done through research grants, which are provided by the government such as Exploratory Research Grant (ERGS) or Science Fund. On top of that, collaboration with the local universities will enhance the knowledge of the academia in BIM and the same time the local universities are able to modify their curriculum to meet the demand from the industry by offering the course that can be produced the students who ready with 3D parametric model. Seminars, colloquiums and workshops can be conducted between the industry and the local universities. Incentives can be used to promote the use of BIM, such as tax redemption to accelerate the pace of adoption of BIM. CIDB has implemented this approach for contractors who implement Industrial Building System (IBS) in their construction projects and this approach also can be used for those who are implementing BIM.

## 6. Conclusion

Implementation of Building Information Modelling (BIM) in the Malaysian construction industry is not impossible, and it is achievable. Hong Kong and Singapore already showed the possibilities of implementing BIM in their construction industry. Roles of government to be a driven factor of implementation of BIM in Malaysia cannot be denied, but the government cannot be alone in promoting and spreading the importance of implementing BIM. All industry players have to play their own role to ensure the success in implementing BIM in Malaysia. Therefore, in Malaysia, forming BIM working group could be a starting point to spark the pace of adoption and implementation of BIM. This working group can start to;

a) Evaluate, study and testing the available BIM technologies in the markets.
b) Identify and choose any construction projects as a pilot project.
c) Documented all the processes from the beginning of the pilot project.
d) Documented the entire lesson learnt from the pilot project.
e) Road Tour to disseminate the lesson learnt gained from the pilot project.

These steps just a kick starts to spark the intention of the government of Malaysia to instil the concept of innovation in the construction industry. Further research needs to carry out especially to identify the evaluation criteria for selecting the right BIM technologies, criteria for selecting the appropriate pilot project, analyse the worker's knowledge, analyse the suitable project delivery method and analyse and identify the strategic plan that can fit into any organisation who wants to implement BIM.

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