Quantity Surveying Firm Change Model In Managing The Constraints Of Bim Implementation

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ABSTRACT

Recently, Building Information Modelling (BIM) has been introduced and promoted as a process which enables quantity surveyors to carry out their roles more effectively, increasing productivity and accuracy especially in Quantity take-off or Measurement. With the implementation of BIM, most of the quantities can be easily abstracted from 3D models and complete product information can be directly transferred into Bills of Quantities and cost estimation. Nevertheless, Quantity Surveyors' roles in BIM which have been introducing in previous years are unable to comply with BIM practices. Therefore, this paper aims to review the Quantity Surveying practices in managing the constraints of BIM implementation in Kotter's change model. The reviewed result indicates that culture constraints and process constraints have to be resolved in the initial stage of implementing BIM for consultant Quantity Surveying firms, followed by technological constraints and policy constraints. This reviewed result serves as a guidance for Quantity Surveying firms in planning their changes in BIM implementation in future.

Key words: Quantity surveyor, building information modelling (BIM), Kotter's change model.

INTRODUCTION

Generally, the innovation with the implementation of new technology tools displace the well-established traditional working processes. This new technology, is in fact, fraught with constraints, which are the precipitation of the potential challenges and risks associated with the technology. BIM is classified as systematic innovation that requires changes to almost every aspect of a firm’s business [9]. Such innovation is claimed to be more difficult to be implemented due to industry’s reluctance to changes in existing work practice and hesitation in learning new concepts and technologies [11].

In view of the perceived benefits of BIM approach that have been acknowledged widely, construction industry notably public sector clients often think that the market is not ready for BIM and afraid of increasing project cost by limited competition. [19] Malaysian construction industry is practicing traditional construction method using a non-integrated and a non-collaborative technology. In Malaysia, common construction procedures are performed traditionally in fragmented practices where the workloads are split into several entities and project teams work separately based on their relative responsibility. BIM will fundamentally change the construction professions working procedures in Malaysian construction industry once BIM is implemented. Due to this particular disruptive nature, workflow and process of BIM approach is considerably different from traditional method which emphasize largely on a collaborative team vision. In short, quantity surveying consultant’s firm practices need to be changed critically in implementing BIM.
Constraints of Implementing BIM:

Public sector is still cautious about the implementation of BIM due to the constraints listed in the several research findings. The constraints of implementing BIM can be classified into four categories: culture, process, policy and technology. Cultural constraints are pertaining to people or organisation resulted from knowledge problems, or related to collaboration and attitudes. Process constraints are in respect to problems related to workflows, procurement and contracts, or roles and responsibilities of participants. Technological constraints are referred to problems originated by software. For policy constraints, it relates to the ownership of intellectual property.

Cultural constraints:

Malaysian government encourages construction players to apply BIM to construction projects as it overcomes construction project problems such as delay, clash of design by different professionals and construction cost overrun [14]. Malaysia had already set up road shows about BIM and conduct numerous programmes to enhance the awareness of BIM, yet the response from the construction players, precisely the Quantity Surveyor is still not good enough. [22] According to a questionnaire finding prepared by UTM & RISM, 88% of respondents had never been involved in BIM project and only 12% involved in BIM projects. [22] This result indicates that BIM is not widely used in construction and civil engineering projects in Malaysia [1].

The implementation of BIM requires drastic changes of work practices, staff skills, contractual arrangement and collaboration of project teams [9]. The prime reason behind this is the fear and individual resistance to changes [2] [10]. With new BIM changes, staffs might think that they have to do more and learn new things without any increment. Consequently, the entire industry faces unfavourable obstacles notably the lack of training and awareness on BIM applications. [11]. Furthermore, the lack of communication and shared understanding suffered amongst project teams [11] serves as the root cause of difficulties in full implementation of BIM in construction industry since BIM system requires facilitating interaction with the model’s component and sharing of data [12].

Process constraints:

BIM implementation is a transition process from a CAD-based drafting to a BIM-based modelling moving from manual or CAD measurement to auto-extracting quantities which unavoidably demanded a change in the typical QS workflow. Upon relishing the benefits of BIM, Malaysian local authorities and organisations have been putting efforts in helping the industry to implement BIM in recent years. RISM has initiated several BIM committees within the AEC industry, while the Public Works Department (JKR) has started to implement BIM for selected projects. [23] Additionally, the Malaysian Construction Industry Development Board (CIDB) had formed a Technical Committee of Affordable BIM to promote usefulness and ease-of-use in implementing BIM technology for private and public organisations. [23] Nevertheless, there is a lack of a global standard regulation for design measurement [18] in current industries. The BIM approach generally actuates change in distribution of roles and responsibilities [11]. Such changes cause undesired problems where some traditional roles notably taker-off or measurer may become obsolete and eventually replaced by BIM facilitator. Therefore, QS firms have to re-plan a new organisation workflow and a new organisation chart on roles and responsibility of the QS staffs. In the worst scenario, QS firms might need to hire new workers who meet required skills and knowledge in BIM implementation in the organisation [15].

Technological constraints:

In practical, there are several active vendors developing BIM software in construction industry. In Malaysia, PWD recommended Revit architecture, Revit structural, Revit MEP, Navisworks and Cost-X and these tools serve as an application platform for Malaysian government. [14] Nevertheless, cost to adopt BIM tools might be a constraint for QS firms. The company needs to incur double cost to send workers to attend BIM training and to buy the tools. [17] The cost to adopt BIM tools such as Bentley system, Tekla, Cost-X and Navisworks is high and proper training is required to use them. [17] Secondly, interoperability issues between BIM packages were highlighted as a major negative effect and these interoperability issues between different BIM software packages, such as technical issues are unlikely to be resolved over time. [3] Incomplete information can lead to rubbish in rubbish out which the benefits of BIM might not be relished as stated in most of the research findings. Additionally, the number of BIM experts is very low in the Malaysian construction industry and this factor has an adverse effect on the cost of a construction project. [15]

Policy constraints:

In order to increase the efficient of BIM implementation, BIM models are required to be shared and work collaboratively among project teams, incurring the concerns on Intellectual Property and protection of copyrights [11] of the BIM models. Additionally, industry players do not have guidance on methods to work
through legal and procurement challenges with this added BIM technologies [19] In avoiding the risks due to issues of liability, ownership and intellectual property, Architects, structural engineers and mechanical & electrical engineers are reluctant to share BIM models and information among project teams, hindering the team collaboration in BIM [6]. Design consultants may need to convert BIM model to an open file format such as IFC format before sending the model to the project team members which may affect QS auto-quantifying accuracy due to data lost in the conversion process. On top of that, the absence of standard BIM contract documents [19] in this construction industry limits QS firms in BIM implementation in Malaysia.

Methodology and Discussion:

Kotter’s change model is a popular model for planning, implementing and sustaining change by John Kotter. The Kotter’s change model consists of 8 main steps offering straightforward guidance for change planning, [8] which serves as a good guideline for Quantity Surveying consultant firms in managing the constraints of implementing BIM. All identified constraints and solutions on BIM implementation from previous literature are included in this Kotter’s 8-step change model.

<table>
<thead>
<tr>
<th>Kotter’s change model</th>
<th>Action Plan</th>
<th>Constraints of implementing BIM</th>
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<td>1. Create a Sense of Urgency</td>
<td>Action 1: Create awareness about BIM and its applications (Pratesh &amp; Hawosh, 2013)</td>
<td>Lack of Awareness of BIM</td>
</tr>
<tr>
<td>Action 2: Provide orientation on clear understanding of BIM benefits (Khosrowpasha &amp; Ayazi, 2012)</td>
<td>Do not realize the benefits of BIM</td>
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<tr>
<td>Action 3: Support for usage and implementation through projects (Khosrowpasha &amp; Ayazi, 2012)</td>
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<td>Action 2: Training outside the organization (Khosrowpasha &amp; Ayazi, 2012)</td>
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<tr>
<td>3. Form a Strategic Vision and Initiatives</td>
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<tr>
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<td>Limited understanding and articulation of industry needs and technical requirements for BIM</td>
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<td>Action 1: Invite in the education and training of staff (Bryde et al., 2013)</td>
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<td>Action 1: Developing supplements to existing contract and procurement documents (Pratesh &amp; Hawosh, 2013)</td>
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<tr>
<td>6. Generate Short-Term Wins</td>
<td>Action 1: Agree protocols and work procedures (Giv &amp; London, 2010)</td>
<td>Element which does not exist in the building model could not be calculated based on component properties</td>
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<tr>
<td>7. Sustain Acceleration</td>
<td>Action 1: Collaboration between the construction stakeholders such as owners, architects, consultants (Khosrowpasha &amp; Ayazi, 2012)</td>
<td>Lack of information on contract obligations or unified documentation</td>
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<tr>
<td>Action 1: Identify changes to organizational processes and procedures (Hosein et al., 2015)</td>
<td>Measurement of MEP elements cannot be achieved directly in BIM Software</td>
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<td>8. Institute Change</td>
<td>Action 1: Creating a standard for lifecycle data modeling (Berger et al., 2011)</td>
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</tr>
<tr>
<td>Action 2: Creating a standard for lifecycle data modeling (Berger et al., 2011)</td>
<td>Lack of trust in completeness and accuracy of 3D models</td>
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<tr>
<td>Action 1: Identify changes to organizational processes and procedures (Hosein et al., 2015)</td>
<td>Countering the potential benefits of BIM</td>
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<tr>
<td>Action 1: Creating a standard for lifecycle data modeling (Berger et al., 2011)</td>
<td>Insufficiently communicated design information resulting in incorrect model interpretation</td>
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<td>Action 1: Creating a standard for lifecycle data modeling (Berger et al., 2011)</td>
<td>Stakeholders not endorsing fully the integrated BIM approach</td>
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<tr>
<td>Action 1: Creating a standard for lifecycle data modeling (Berger et al., 2011)</td>
<td>Need organizational changes and changes to the business processes</td>
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Fig. 1: Quantity surveying consultant firms change model based on Kotter’s 8 steps

Step 1: Create a Sense of Urgency

Initially, culture constraints of BIM such as lack of BIM awareness [11] and hesitation to embrace technological changes within organisations [5] are indicated as significant challenges in implementing BIM. QS firms need to create awareness about BIM application [19] to promote a sense of urgency around the need for changes. Additionally, it is a must for QS firms to provide assistance on clear understanding of BIM benefits [13] among QS staffs in order to strengthen their clarification on BIM benefits and flexibility. As an extensional progress, management support on uptake and implementation BIM project [13] directly enhances staff motivation, reduces staffs’ reluctance on BIM implementation as well as decreases undesirable fear of low success rate of BIM.

Step 2: Build a Guiding Coalition

Next, new roles and relationships of QS in the project team must be pre-planned since adopting BIM process requires a significant adjustment to the current practices. [19] Lack of communication and shared understanding constraints can be prevented if roles and relationships of project teams are demarcated clearly in the initial project briefing.

BIM training outside of the organisation is crucial in managing process constraints of BIM implementation. [2] BIM implementation in Malaysia is still in its infant stage as there is lack of industry expertise and training [7] currently. Project leader may lack of experience in organising the project team to relish the advantages of BIM [3].

Step 3: Form a Strategic Vision and Initiatives

After solving several culture and process constraints, a clear and effective implementation strategy [13] must be created to steer the change effort in the QS firms. Construction industry firms are accustomed to traditional way of leadership [19] and changes are required in adopting this new BIM technology. The new strategy must tackle the understanding and articulation of industry needs as well as technical requirements for BIM [11] For instance, creating a new BIM standard and protocols in QS firm are crucial as market is absence of standard BIM contract documents [19] and lack of a global standard regulation for design measurement [18].

Step 4: Enlist a Volunteer Army

In order to implement the new strategy, QS firms need to raise a large force of people who are BIM ready to drive the changes. QS firms have to invest in BIM education [3] and provide training to staff on new process and workflow [13]. Measurement methods of 3D models are totally different compared to 2D drawings. Internal trainings are needed as old staffs are lack of knowledge on QTO and cost estimation process for BIM. [18] Additionally, QS needs to face the Interoperability issues between different BIM software packages [3] when preparing the measurement and cost estimating.

Step 5: Enable Action by Removing Barriers

Removing barriers and obstacles of BIM implementation is the next step after a well-trained team has been setup. Supplements to existing contract and procurement documents are recommended to be developed [19] in solving legal issues around the ownership of BIM and lack of information on contract obligations or unified documentation. [16] Other than legal and policy constraints, technological constraints must be managed and removed. Cost estimation and measurement are failed to be prepared as missing elements in the BIM model cannot be calculated based on component properties. (Irizarry et al, 2013) Nevertheless, pre-processed and made readily BIM libraries [4] manage to resolve missing elements in BIM as all information has been pre-installed in the BIM libraries.

Step 6: Generate Short-Term Wins

After recognizing and rewarding staffs for implementing BIM change model, agreed protocols, standard evaluation and validation procedures [11] are therefore, crucial processes for QS firms after every success BIM project. These processes build staffs’ trusts on completeness and accuracy of 3D models so that they can relish the potential benefits of BIM in future projects.

Step 7: Sustain Acceleration

Collaboration between the construction stakeholders such as contractors to populate the databases [13] in BIM implementation helps in sustaining the acceleration in the change model as well as improves the integration, process and tools of BIM implementation. This helps in handling concurrency and integration of BIM model at early design stages and improves required tools for future BIM models.
Step 8: Institute Change

Lastly, identifying BIM changes to organisational process is necessary, [21] making it part of the culture in the QS firms business processes. Furthermore, QS firms should create a standard for lifecycle data modelling [20] to enhance communication among BIM project teams as well as efficiency of BIM models as well as stakeholders’ confidence in fully embracing the integrated BIM approach.

Conclusion:

Previous discussion of the Kotter’s 8 steps change model indicates that culture constraints have to be resolved in the initial stage of BIM implementation for consultant Quantity Surveying firms, followed by process constraints, technological constraints and policy constraints. Motivation and positive culture are undeniably needed in order to implement any new strategy in a company. New roles and protocols are the following steps for the QS firms change model to standardise all processes and workflow of BIM implementation. Last by not least, technological constraints and policy constraints are subsequent processes of removing barriers of BIM implementation in order to fasten the process of change from traditional QS practices to QS BIM practices.

REFERENCE