ANALYZING BIM PROTOCOLS AND USERS SURVEYS IN JAPAN

To Understand the Current Japanese BIM Environment, Through the Comparison with Different Countries

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Abstract. Japanese building and construction industry expect BIM for the rescue of forecasted workforce shortage due to the population aging. Although the use of BIM has been spreading over past years, the progress of BIM implementation in Japan is slow. This paper aims to identify the obstructive factor for industry’s smooth transformation. First, the authors analyze Japanese BIM protocols, which includes BIM standards and guidelines, to understand the status of useful information publically available. Second, multiple BIM surveys which targeted Japanese architect and contractor firms are examined to overview the situation from practitioners' point of view. Finally, the discussion and conclusion are led to find the fundamental issue to expedite the extensive use of BIM in Japanese architecture, engineering, and construction field.

Keywords. Building Information Modeling; Japan; Standardization; Guideline; BIM implementation.

1. Introduction

The building and construction field has been dragging down the productivity improvement globally. Building Information Modeling (BIM) is expected to be a "game changer" - a means for drastic transformation of Architecture, Engineering, and Construction (AEC) industry.

Japan starts experiencing that its population rapidly ages and gradually shrinks. Since it is more particular in the construction industry, there will soon be the severe workforce shortage. Today 33.8% of construction workers are older than 55 whereas only 10.8% is younger than 30, and this trend has been continuing for decades (MLIT, 2016). Therefore, enhancing productivity is vital to maintaining the Japanese building and construction industry. Introducing BIM is expected to be a pivotal technology to rescue this situation.

2. Expectation for Public Sectors in BIM implementation

Cheng and Lu analyzed the wide range of BIM information from 14 countries/regions and concluded that the public sector plays an essential and primary role in BIM adoption. They summarized six roles that the public sector...
can play for BIM adoption, which are (1) initiator and driver, (2) regulator, (3) educator, (4) funding agency, (5) demonstrator, and (6) researcher (Cheng & Lu, 2015).

For example, Building and Construction Authority (BCA) in Singapore set the BIM roadmap in 2010. To aim 80% of BIM adoption rate in 5 years, BCA listed five key strategies to help and guide business owners; (1) Allowing the public sector to take the lead, (2) promoting success stories, (3) removing impediments, (4) building BIM capability and capacity and (5) incentivizing BIM adopters (BCA, 2011).

The Ministry of Land, Transport and Tourism (MLIT) is the Japanese government agency for building and construction. MLIT announced the BIM pilot projects on 2010, in which they allocated three benefits to be achieved for the sake of the client as; (1) to enhance the clarity of design understanding, (2) to regularize the interdisciplinary coordination and attributional information, (3) to unify the building information platform (MLIT, 2010). It was expected to harvest the learnings through these trials to expedite the leverage of BIM technologies.

After seven years passed since then, it was reported that only two public projects adopted BIM in the design phase in 2017 by September. Even considering the increment by the end of the year, the number of public BIM project in the design phase decreased from past three years (five in 2014, six in 2015 and seven in 2016) (DECN, 2017). The progress of BIM implementation to Japanese projects is slow.

Kaneta et al. pointed out that the barrier to BIM implementation in Japan are raised from the lack of official activities, the absence of BIM management, and low interest of clients. Also, he mentioned the uniqueness of Japanese construction industry, which is the drawing production by general contractors, late decision making in projects, and the lower chance of productivity improvement (Kaneta et al., 2016).

The use of BIM is spreading in Japanese private projects over past years. It becomes more actively discussed that the keystone to rationalize the industry with leveraging BIM technology. Nevertheless, the Government also has a high expectation on BIM to enhance the industry’s performance. There seem to be missing pieces in the industry to expedite the use of BIM in Japan. This research tries to identify the factor that hinders the smooth BIM implementation.

Firstly, the research analyzes the shared BIM protocols in Japan. There are multiple types of information useful to the practitioners, such as BIM standards or BIM guidelines. The authors compare the availability and their contents coverage with the ones from other countries, to examine the characteristics of it. Secondly, the authors study statistics to see the situation from the practitioner side. The research attempts to find the crossover of benefits and problems of BIM from different surveys. Finally, the conclusion will be made upon the discussion based on these two points of view.

3. Definition of BIM Protocol

Kassem et al. defined it as Noteworthy BIM publications (NBP)s, which are publically-available documents developed by various academic, governmental
and industry entities, aimed at a broad audience, and intended to promote BIM understanding, regulate BIM implementation or mandate BIM requirements (Kassem et al., 2015). Since the authors aim to examine the industry-wide common language for BIM, this paper targets to examine “BIM Protocol,” which includes the information called as BIM standards and guidelines as well.

4. Characteristics and problems of BIM protocols in Japan

4.1. NATIONAL BIM PROTOCOL IN JAPAN

MLIT issued the BIM guideline in March 2014, which is the only national BIM Protocol by 2017 (MLIT, 2014). This MLIT BIM guideline is applied to the public projects when a contractor (architect or builder) implemented BIM by the own decision, or when proposal-based technical studies are needed. The use of BIM is not a compulsory; it is not mandated to projects. MLIT BIM guideline focuses on basic concepts and the examples of technical studies by BIM. Further information for data standardization is left on the contractor side.

MLIT BIM guideline consists of three sections; (1) General Rules - 6 pages, (2) Design Process - 16 pages and (3) Construction - 3 pages. The explanation part of the document repeatedly remarks that the model can be developed depending on project’s need and it is possible to further the model detail at the contractor’s decision. There is considerable room for architects, engineers, and builders to customize the configuration per their preference. However, on the other hand, this guideline does not orient to regularize the contents and their data system for facilitating the data interoperability over projects.

The comparison with other BIM Protocols is made to understand the characteristics of MLIT BIM guideline. Table 1 shows the contents of BIM Protocols from UK, Hong Kong, Australia, Singapore, US, and Japan. Cells are colored when the BIM Protocol has the relevant statements in it. The number of “+” in the table shows the concreteness and richness of detail information for each regulation, to overview both coverage and depth of each BIM Protocol.

Compared with other Protocols, MLIT BIM guideline does not state about Project BIM Execution Plan (BEP), collaborative BIM working, folder structure and naming conventions and presentation styles.

BEP is vital in BIM projects to strategize the extent of BIM implementation in specific projects. Thus most BIM Protocols elaborate on the details in creating and agreeing on Project BEP. MLIT BIM guideline states that the execution method (including the name and version of BIM software and simulation software), execution contents and organization shall be mentioned in Project Execution Plan, which is regulated by Design Work Common Specification. Therefore BEP needs to be associated with the existing PEP protocol. However, the document does not provide the detail information or example of it.
Although presentation style, which regularizes the appearance in drawings
or other outputs from models, is not straightforwardly mentioned in MLIT BIM guideline, it is related to the definition of LODs. Tables in MLIT BIM guideline appendices show the model LODs in project phases of basic design, detail design, and construction. There is an annotation with each table which states that the detail level of geometric information shall refer to Design Drawing Standard for Architectural Construction, scale 1/100 et cetera. The guideline standardizes the model contents from the 2D presentation, for which the national standard already exists, after that the model is regulated to have enough detail to represent it.

The room name convention at the design phase refers to other MLIT outlines issued in 2006 and 2007, and the material and apparatus naming is to base on MLIT standard specification. The rest naming system is not regularized in the guideline.

4.2. OTHER BIM PROTOCOLS IN JAPAN

The Japan Institute of Architects (JIA) issued a BIM guideline in July 2012 (JIA, 2012). As the foreword states, this protocol focuses on the concept and potential use of BIM. JIA BIM guideline covers (1) desirable BIM organization, (2) expected roles of stakeholders, (3) potential BIM uses in project phases, (4) general regulations in data exchange, (5) primary rules in libraries, (6) potential BIM uses in engineering and quantity survey, (7) BIM cost, (8) BIM and urban information and (9) deliverable. JIA BIM guideline provides much more extensive coverage than the MLIT guideline, and it supplies more specific workflow along the project timeline. It is meaningful that the document consists of the standard scope of work for individual project members and the basic concept for the intellectual property right. Although the guideline supposes the reference by architects (including structure/MEP engineers), there is a comprehensive overview of contractor’s BIM benefit and expected use to overcome the joint-loss between design and construction stage. The guideline also contains the software list for BIM authoring tools and simulation tools. However, this JIA guideline does not provide the particular standard for data structure, naming convention or LODs. BEP is also not explicitly mentioned in JIA guideline.

Another BIM Protocol is the Standard Process Map for BIM Project issued by Architectural Institute of Japan (AIJ, 2015). The document bases the interpretation of International Alliance for Interoperability (IAI)’s Information Delivery Manual (IDM). It contains the process map part of IDM to contribute facilitating BIM implementation in Japan. In addition to the translation, AIJ Standard Process Map customizes the original to fit the commercial convention in Japan, especially the scope of work for each discipline. The document is available online, and it covers the LOD definition as well. This LOD is to regularize the depth of work with referring Model Progression Specification V08-08-20 by AIA.

Japan Federation of Construction Contractors (JFCC) has been working on centralizing the knowledge on BIM implementation by contractors and builders. After multiple publications for construction BIM, the summary of construction BIM in Japan was made available on November 2017 as “Encouragement of Construction BIM - a startup guide” (JFCC, 2017). The summary provides the concrete example on how to implement BIM in construction project based on the survey for the early-adopter construction firms. This JFCC guideline is much more
practice-oriented. It includes multiple case studies for how to tackle the BIM issues on low-hanging fruits, hardware environments, organization, education, and costs.

There are very few shared BIM template data widely available in Japanese. There are several publications which contain the templates for BEP. However, abovementioned BIM Protocols does not provide the model template data. AIJ made the BEP format available online, which has reasonably good coverage for BIM projects (AIJ, 2017). There are cases that architect firms or contractors develop their templates, but it is not the stage yet that such data is openly exchanged or distributed among many AEC practitioners.

5. Highlights and Lowlights from BIM practitioners

There are multiple surveys on the use of BIM in Japan. The polls articulate not only the benefits of BIM in projects but also the difficulties and problems found through the project experiences.

McGraw-Hill Construction carried out one of the most international BIM surveys on 2014. The study showed that the percentage of contractors at high/very high BIM implementation level in Japan was the lowest among the targeted ten regions, whereas the awareness to requiring BIM expertise as a factor in team formation was the highest (MHC, 2014).

National Building Standard in the UK made another international comparison in BIM implementation (NBS, 2017). NBS International BIM Report 2016 shows the high awareness of Japanese respondents toward BIM, which was as high as other countries except for the Czech Republic. The ratio of BIM use in actual projects was also equivalent to the rest regions. There is, however, a sharp contrast in the people’s attitude to the Government. 17% of Japanese respondents answered that the Government is on the right track with BIM, which is much lower than UK (54%) or Czech Republic (31%, Figure 2).

JFCC BIM guideline contains the part of BIM survey which bases on 62 contractors’ answers to the questionnaires, including the obstructive factor on BIM implementation from three aspects: internal understanding, cost, and workforce (Figure 3). The respondents more addressed the issues of investment on time and money than the social factors. The survey summarized that the education and workforce are two significant obstacles to develop BIM in corporate-level (JFCC, 2017).
Another industry-wide poll was done by a working group of Architecture Institute of Japan (AIJ, 2017). Research Committee on Information Systems Technology carries out a biennial survey of architect firms and contractors, and their 16th report was published on February 2017 (Figure 4 and 5). According to which, the respondents answered that the most massive problem in BIM use was the designers’ inability of using BIM and the time required to master it. The lack of industry-wide protocol standardization ranked at fourth in architect group and third in contractor group. On the other hand, the percentage of corporate which already implemented MLIT BIM standards remained 5% among 93 respondent firms in total. The expectation on BIM delivery to the Government stayed low (19.5% in architect group, 9.1% in contractor group), despite other items such as the improvement on multidisciplinary data sharing (68.3%, 58.2%) or the automated quantity takeoff (36.6%, 40.0%) marked high number.
There is another perspective understood from the question, which asked if the respondents refer other projects’ case study shared in seminars. The sum of answers for "do not know," "not informative," and "informative, but not directly applicable to our environment" reached up to more than 70%.

6. Discussion

The Japanese Government has addressed the BIM issue for almost ten years. MLIT published BIM guideline to encourage the practitioners’ spontaneous BIM adoption. However, the BIM implementation for public projects is not steadily proceeding thus far.

MLIT BIM guideline leaves a significant area for designers or builders to configure the BIM plan per their preference. It may raise confusion to project tenderers in the absence of practical information rather than enjoying the flexibility of the standard. Moreover, since BIM adoption is not a mandatory, architect and builder may hesitate to take the initiative to set up the holistic project BIM environment.

Meanwhile, the practitioners have high interest in benefit of BIM. They express concern about the lack of education system and human resources to accelerate the BIM adoption further. Although MLIT BIM guideline is reasonably known, very few firms implement it to the project. They are willing to share BIM models within the project boundary, but learning from other case studies are not preferred because they recognize it as not fruitful.

Japanese AEC firms wish to enrich BIM workforce to resolve the facing BIM problems. They long skilled BIM users or well-organized training programs. Cultivating useful BIM standard will expedite solving this issue; however, industry-wide BIM Protocol is not regarded as a paramount. There seems a gap between recognized problem and underlying theme.

Middle and large building projects in Japan usually deploy CAD operators. It is especially common in influential architect corporates or general contractors. With outsourcing the drafting works to the specialists, this system lets designers and builders more concentrative on project management. The above surveys seem...
to have reflected this project scheme; therefore they looked more for CAD/BIM enabled people than universal BIM Protocol.

CAD operators are independent of project contractors. Experienced operators have extensive knowledge of localized drawing conventions, and it incentivized them in getting jobs in the market. It can be said that CAD operators sometimes have more profound insights on the drafting protocol than the contractors. Some enthusiastic CAD operators are eager to become BIM operators for their further advancement, however, the majority of proficient yet aged CAD operators are not motivated to gain a new skill-set. The contractor side still expects the extensive knowledge to the operators to resolve the project issues immediately and efficiently. This mismatch started to be recognized as a blank area in human resource.

For the successful transformation towards BIM-enabled industry, it is evident that enriching BIM talent is urgent. Multiple Japanese universities recently started BIM programs in architectural curricula. Numbers of AEC corporates are looking for the modeling human resources in overseas countries such as Philippines, Vietnam, or India. Some leading AEC firms started to share their know-how widely available to contribute mitigating the situation. In any case, having an industry-wide BIM Protocol is vital to enhance the compatibility and universality of individual attempts. Proposing useful BIM Protocol from the practitioner side will give a driving force to resolve the multiple fundamental issues in Japanese AEC industry.

7. Conclusion

Although there are multiple BIM Protocols available in Japan, they are not raising a driving force to resolve the BIM issues people experience in projects.

Multiple surveys revealed that BIM workforce is perceived as the most massive problem in BIM implementation. However, there is room for improvement in spreading useful BIM Protocols to resolve the practitioners’ BIM concern. Considering the ecosystem in Japanese building and construction, developing industry-wide BIM Protocol upon the active information exchange is highly needed to grow BIM skill for future.

References


