BIM Implementation in Public Construction Projects in Indonesia

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Abstract. The delayed of BIM advancement in Indonesia has proffered that Indonesian government awareness to generate an optimum knowledge and research in BIM implementation is frequently low. In order to catalyst some infrastructure projects which based government projects, the contractor companies should put their creativity and their improved knowledge to win the government projects. Regarding the existing challenges that frequently exist in several projects, BIM has been appeared as a sophisticated technology-based solution to overcome them. However, the level of BIM development in Indonesia nowadays has not been confirmed yet due to the BIM research evolvement is slowly. Even though, there are some companies which has utilised BIM either in their companies or their project such as the construction of Bakauheni - Terbanggi Besar toll road, the construction of Solo - Kertosolo toll road, etc. Nevertheless, the effectiveness and efficiency of BIM utilisation in a contractor company need to measure as an attempting to assist BIM research evaluation in Indonesia. By the questionnaire survey, this research is going to find out how BIM take the responsibility to reduce the complexity of diversity project. Moreover, the benefits and drawbacks which BIM contributes for several projects which have already through BIM’s role need to assembly as a further consideration for Indonesian government to arrange the convenience regulation regards to adopt BIM as the obligations later. Additionally, the assessment of the stakeholder’s role in BIM also necessary to evaluate since the optimum of BIM’s assignment in construction industry involving not only the contractor but also the consultant and the owner. Thus, the research is expected to endowment the further knowledge for BIM implementation in Indonesia.

1. Introduction
Regarding the construction industry development, Indonesia as one of the developing countries in the world particularly in Asia is sluggish for supporting the technology developing and the technology adopting by its competitor countries such as Singapore. Additionally, the issues which frequently appear in construction site still concern on delayed problem. For example, there are not few projects in Indonesia which still witness with the delayed schedule. It is caused by improper plan which arranged since the early stage of life-cycle project beside natural factors such as weather, disaster, etc.

In a further research, the background factor of lately development the construction industry in Indonesia is caused by the weakness of government attention towards improving the regulation of the renewable and sophisticated are carried out by the small-scale and the medium-scale construction companies in order to realisation the infrastructure equalisation in Indonesia. Indirectly, it has mean that the role of these two types company has been considered by government. Therefore, the
awareness regarding capability of these companies have to be a main point which must to be arranged concretely by government in order to reduce the existing challenges occur in a project.

Delayed work, excessed cost, and poor of work’s quality have still happened frequently either in a big or small project, particularly in government projects. Unsurprisingly, some projects which sponsored by government mostly face some technically issues. Nowadays, the existing challenges which usually occur in a project can be overcome by the current technology in construction industry which named Building Information Modelling (BIM).

Generally, BIM’s concepts have been developing since the earliest 1960s [5] [4] stated BIM is a set of building modelling processes that based technology and involves construction technology. On the other hand, Indonesian government targeting that the level of infrastructure developing must to significant increase. Additionally, [8] states that 93% of Indonesian government projects digital system to improve accuracy in design stage. Furthermore, [3] a chain of technology that will increase productivity whilst rectifying design, construction practice and practice maintenance which aims to enhance collaboration inter-organisation in construction industry. Additionally, [1] BIM is understood as the approaching current tools which described a variety of activities in object-oriented Computer Aided-Design (CAD).

On the other hand, the development of BIM is noticed as the sophisticated technology which has the complete solution towards the challenges occasion in construction industry. In the other words, BIM has been providing interoperability capacities and more intelligence [1]. To conclude, BIM is not only a process but also a viability technology which can summarize the set of processes which prevails in construction industry, such as reduce risk value, improving organisation management, etc.

1.1 BIM Development in Indonesia
As knowledge information, BIM have been used by some companies in Indonesia since 2012 [6]. However, despite the awareness level of BIM knowledge is high around 70%, the level of BIM implementation is still low which has 38% [2]. In theory, the advancement of BIM research in Indonesia is not mature yet. The reason behind, it is indicated by poor of publishing international journal regarding BIM implementation in Indonesia [6].

On the other hand, during the improving of construction industry necessity and the level of competition among the contractor companies in Indonesia, the graphic of BIM development in Indonesia has witnessed significant increased. Based on some reports which have been published in either the website or online news, there are some project examples which successfully implement BIM in the projects particularly Indonesian government projects. For instance, the construction of port in Sibolga, the construction of Indonesian Bank in Gorontalo, etc [7].

Despite BIM’s projects in Indonesia have necessary increased, the regulation which arrange the BIM implementation in Indonesia has not organised yet. Nowadays, the company-scale’s which has been applied BIM as the current technology is only the large-scale company. However, BIM is only utilised as the supporting technology by some, and others use BIM is only for project.

2. Methods
It is important to describe systematically that to support this research both qualitative approach and quantitative approach are the most appropriate methodology to choose for the research. The reason because these methods are the scientific method in which the problems discussed in this study must stand singularly and freestanding from objective reality as well as the experience behind from the respondents to answer the question is needed to enrich the answer of questionnaire. The mixed approach is assumed to be so repeatable, and able to isolate from the uncompromising reality of the cause and effect under investigation. Consequently, these approaches are appropriate because it tends for theory testing rather than theory building.

Regarding to Saunder’s research onion, the methodology approach which will use for this research is:

1. Philosophy: Positivism. The reason is the objectives point of view needed as the primary data.
2. Approach: Deductive. Deductive research is leading to use the quantitative methods which is chosen as the methodology for the research.

3. Strategy: Questionnaire Survey
   a. Survey’s conduct in this study aims to separate the object which understood by the author with the results of the survey filled by the respondent. This is expected to get independent result without mixed with the author’s point of view.
   b. The survey results are premier data to obtain the final result. The survey will be conducted on 3 types of construction company level consisting of 2 small-sized firms, 2 medium-sized firms and 4 large-sized firms.
   c. The survey results are premier data that will be managed systematically to obtain the final result. The survey will be conducted on 3 types of construction company level consisting of 2 small-sized firms, 2 medium-sized firms and 4 large-sized firms.
   d. Respondents will be sent in the form of questionnaires via email in the form of questions related to the readiness of the Indonesian government in the process of standardizing the implementation of BIM and understanding of BIM application procedures in a structured.
   e. Due to the limited time and distance in the study, the respondents are the construction company consisting of 2 small-sized firms, 2 medium-sized firms in the city of Padangsidimpuan and 4 large-sized firms in Jakarta will be sent emails in the form of questionnaires to their respective companies. If the respondent did not answer the survey via email, then the survey will be continued through structured interviews to responded either via email or skype.

2.1 Problem and Solution
2.1.1 Problem
1. Limitations of language will be a major obstacle because the survey will be conducted on respondents in Indonesia.
2. Time difference between respondents and authors.
3. Understanding of questions asked to respondents

2.1.2 Solution
1. Questionnaires will be sent in two languages where for respondents who can fill in accordance with the language skills of each.
2. The author will follow the work time of respondents in the survey period.
3. The author will double-check the respondent's answer if discrepancies are found in the answer to the questionnaire.

Figure 1. Research Onion
3. Results and Discussion
After the respondents had filled out the questionnaire, the result of the first question in the questionnaire will be elaborated. The table below shows the response which gathered from the questionnaire survey.

3.1 Q1: What type is your company?
In the first main question, the respondents are provided two answers which are “Small” and “Large”. The respondent can choose one of the answers which according to their company scale. In order to analyse the data in SPSS, the answers are numbered by the researcher who “Small” is number “1” and “Large” is number 2.

3.2 Q2: Does your company familiar with BIM (Building Information Modelling)?
To generalisation the answer from the respondents, the researcher put two answers due to aid in analysing the data which gathered from the survey. The answer number “1” has meaning “YES” while for the answer “NO” the researcher symbolized with number “2”.

3.3 Does your company have been implemented BIM (Building Information Modelling) in your company organisation?
There are two indicators answer to question number 3 where the answer number 1 has meaning “YES” while the answer number 2 is for “NO”.

3.4 Q4: Is BIM (Building Information Modelling) your owner requirement before the project started?
The third question provides two options which respondents should choose as their answer. The first answer is signed as number “1” which has meaning “YES” and the second answer is “NO” which also signed as number “2”.

3.5 Q5: Does BIM (Building Information Modelling) have been applied in your project?
The question in number five is presented by two answers which in the first answer is symbolized with number “1” and the second answer with number “2”. Both answers have meaning “YES” and “NO” respectively.

3.6 Q6: Which percentage is BIM (Building Information Modelling) has been used in your project?
In this question, the researcher gave an option to the projects which chose “No” in the previous question to finish the survey because the next questions are only for the respondents who have implemented BIM in their projects. Furthermore, in order to levelling answer from the respondents, the researcher established the group answer to choose.

Here by the answer which the respondents can choose:

| Percentage | Number |
|------------|--------|
| 0 - 20%    | 1      |
| 21 - 40%   | 2      |
| 41 - 60%   | 3      |
| 61 - 80%   | 4      |
| 81 - 100%  | 5      |

3.7 Q7: What is BIM’s (Building Information Modelling) advantageous in your project?
In the research, the respondent which involved BIM in its projects have to choose the options of what BIM’s positive impacts for their effectiveness in construction progresses. The respondent is pleased to choose more than one option. Figure 2 presents the result of respondent options toward BIM’s advantageous. From the bar chart, it can be obtained that better communication and coordination have the highest option. Regarding the detail of the respondent response, the table below shows which companies that are using BIM in their project or not.
From the figure 2, there are only six companies which totally number of projects that applied BIM in the projects are seventeen. Half of the respondents are the active user in BIM while half others are not the user of BIM.

3.8 Q8: What is BIM’s (Building Information Modelling) barriers to adopt either in your project or your company organisation?
In the questionnaire answers, the respondents are offered to choose more than one answer. The question is only filled by the respondent which its project witnesses with BIM. Figure 3 illustrates that lack of the resources in BIM implementation is the highest number that respondents choose. It can be concluded that necessity of BIM resources is still high among construction companies in Indonesia. However, the resistance to change has the lowest weakness in BIM regarding the improvement of management organisation in company is easier than finding the expert of BIM.

3.9 Q9: Which stage is BIM (Building Information Modelling) utilised in your project?
In the research, the question regarding the usage of BIM in life-cycle project is provided with three answers which are pre- construction, construction and post- construction. The respondent is pleased to choose answer that relate in its own project.
3.10 Q10: Which stakeholder does involve in BIM (Building Information Modelling) usage in your project?

By the last question in the survey, the parties which have been entangled in BIM utilising can be measured. The respondent is prepared three options which can be chosen as what its project witness is. After comparing and analysing the methodology which convenience and fit with the condition of research environment, the researcher decided to do a questionnaire survey. Since the object of the study particularly mentioned is Indonesia, then the author arranged the sample size and the respondents targeted. Thereby, there were selected 30 respondents which would be the participants of the research.

Additionally, they are an engineering staff in the different projects from three the state- owned construction company as the large- scale company in Indonesia and five construction local companies in Padangsidimpuan, a small town in Indonesia, as the small-scale companies.

4. Conclusions

Surprisingly, the result of the survey was pleased where the number of respondents witnessed a significant increase. There were 35 respondents from twelve different companies in the research, hence, the data which had been analysed more than the expectation. The data analysing used SPSS and Microsoft Excel to gain both the statistic and the percentage result.

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