

# Analysis of Awareness and Utilization of BIM in Civil Engineering

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**Abstract:** Recently, Building Information Modeling (BIM) has emerged as a hot topic in the construction industry. However, the application of civil engineering, both domestic and foreign, is minor because of the distribution in a wide area, highly linear dependence and difficulty to take advantage of the standard library. Civil engineering requires a lot of time and financial resources compared to architectural engineering. If BIM is completely applied to civil engineering, it will be possible to manage the schedule and cost using 3D and facilitates effective communication between various stakeholders. For the application of BIM in civil engineering, we surveyed the awareness, utilization and effectiveness of BIM on the civil engineering companies. Also, we derived necessary improvements and analyzed new business areas for BIM application. The results of the study will be used as a reference of development for SOC civil engineering BIM ordering guide and related standard.

**Keywords-** BIM, Civil Engineering, Infra structure, Utilization, standard

## 1. Introduction

In the construction field, BIM has been highlighted as a hot issue. Various definitions exist for BIM. Ministry of Land, which is the central government agent that generates the construction has been establishing a digital model that provides trustworthy evidence that can aid in decision making during the life cycle of the facility based on the biological or functional qualities of the facilities in all areas of construction including buildings, civil, and plants as well as collecting the business processing and defining it as BIM [1]. In case of Korea, since 2012, PPS has prioritized the application of BIM in construction of turnkey and design competition of over 50 billion won, and by 2016, it will be expanded as all constructions will be the targets. Currently, researches related to BIM are being widely conducted. However, in civil engineering areas such as road constructions, BIM distributes in large areas and not only is the linear dependence great but due to conditions that make it difficult to apply the standard library makes application in domestic and foreign areas very negligible.

In case of civil engineering, it consumes much more expenses and air compared to construction, so if BIM can be applied adequately, the effects would be much higher. Therefore, BIM ordering guides in public organizations related to civil engineering and development in related standards is becoming considered as very important.

Therefore in this research, by taking civil engineering as the target, awareness of BIM, practicality, evaluation of level in business values will be surveyed and by understanding the BIM application technical standard, and will be used as the base resources for future civil related BIM research, public ordering guide, and standard development.

## 2. Pre-Survey on BIM

### 2.1 Objectives of BIM

What is the essential reason of applying BIM? The greatest and oldest BIM related International Organization called buildingSMART is displays the words 'better', 'faster', 'cheaper' and recently, 'safer' and 'green' has been added as well[2]. Eventually, in the perspective of the company, the essential revenue would be 'creating a lot of revenue.' The objectives mentioned earlier have been consequence due to the revenue of each organization. Many people already know and believe that in the near future, BIM will be conducted in form of basic working system. Therefore, diverse surveys have been conducted on factors that prevent the activation of BIM.

2.2 Surveys regarding the awareness of BIM in domestic and foreign areas.

According to the 2008 SmartMarket Report of United States, based on the survey results of applied restraints of BIM, lack in education and BIM professionals, lack in BIM introduction expenses and will, and lack in costs have been displayed as factors that restrain the activation of BIM [3]. According to the survey that was conducted BuildingSmart Korea Organization and Construction Organization in 2008, 81% of the survey targets held BIM software, but those who took advantage of it were small in numbers and difficulties have been rising in terms of education and operation.

In terms of the survey results conducted by Ju Ki Bum (2010) on construction companies, those who knew about BIM were reported as 81.3%, but those who did not know about BIM were reported as 16.3%. The restraint factor in introduction of BIM were reported as confusion/absence of government policy, lack of success cases of practical application, equipments and products of high costs, and absence of operators[4]. According to the research results on

survey analysis of application status of BIM in small and medium architectural design office, 80% answered that they do not use BIM and the 52% answered that they do not use it because it is difficult to use. 20% responded that they do not feel the need to use it[5]. However, the reported results are content that are the overall area of construction or limited to just the construction field, so it is currently difficult to understand the awareness of BIM, application status, and level determination.

### 3. Analysis of Awareness and Application Status of BIM in Civil engineering

In this research, in order to survey on the level of awareness of users regarding BIM of civil engineering field, increased usage of BIM and important changes, applicable tasks, investment revenue sector, and importance of preliminary research for application in BIM were conducted and the results were analyzed. For this survey, targets were 25 companies that have the highest contractor ranking out of all the engineering companies.

#### 3.1 Distribution of Respondents

After analyzing the positions of the respondents, it has been displayed that surveys were distributed between directors(40%), officers(36%), chiefs (20%), deputy(4%) in that order(refer to Fig.1). In terms of division between working period in the company, those who were employed for more than 10 years took up 80%, those who worked below 5~10 years took up 12%, and those who took up below 3~5 years took up 8%(refer to Fig.2). As the result of surveying the distribution of survey, more than 95% had the position of chiefs or higher, and more than 92% had been employed for more than 5 years. Those who had a lot of experience and higher ranking were considered as more reliable as level research regarding BIM took place.



Figure 1. Distribution per position

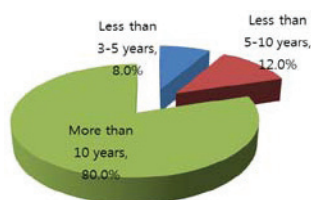


Figure 2. Distribution per working period

#### 3.2 Increase in Usage of BIM and Important Changes

When a question was asked on the year-on-year increase in usage of BIM, 40% responded that the number is below 10% and those who responded as below 10%~50% were reported as 40% (refer to Fig. 3). The response to answering the question about the important changes of BIM varied. 40% responded that the changes were increased, 56% answered that it is average, and only 4% answered that it became lower (refer to Fig. 4).

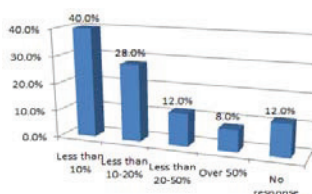


Figure 3. In crease in usage of BIM compared to earlier year

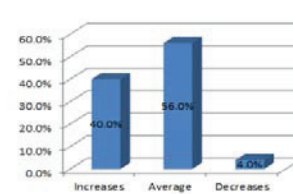


Figure 4. Importance in Changes of BIM

According to the survey result, the usage of BIM in civil engineering field is continuously growing and the level of awareness in users has been increasing as well.

#### 3.3 Tasks that are to be applicable on BIM

For the question that inquired about which method BIM would be applied if it was introduced, the highest was 15% in which they stated that they want to utilize it for stimulation.

The next highest was 10% with interference check, quantity, process management, design and production of drawing. Also, those included in the 8% were structural analysis, maintenance management of facilities, automatic quotation, and feasibility study. However, visualization, analysis, and regulation check were relatively low (refer to Fig. 5).

By following the application of BIM according to the research results, as the 2D delivery system switched into the 3D delivery system, it has been analyzed that it will create effects in stimulation and interference check. Thus, even though BIM can be utilized as a very strong tool for this law card, there have not been sufficient amount of education or applied cases regarding the content, resulting in a relatively low outcome in the task where application is desired.

The rest of the opinions such as landscape management, asset management, facility obsolescence forecast have been reported as possible for application

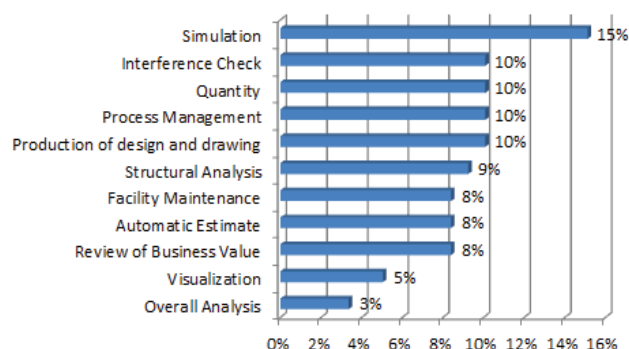


Figure 5. Tasks that desire to apply BIM

#### 3.4 Prediction of revenue in contrast of investment through the application of BIM

In order to make predictions about the revenues, 8 items were derived and were distinguished into 3 stages with increasing state, no changes, and decreasing state. According to the survey results in making prediction regarding the revenue, the highest number was 92% stating that

multilateral communication and comprehension will become increased. In addition, opinions which stated that optimistic influence in marketing will increase took up 84%, those stating that on-site safety will increase took up 80%, and 52% stated that task abilities in progressing projects will become enhanced. On the other hand, there were negative answers stating that productivity of employees will decrease, project costs will increase, and project circulation time will increase were high in numbers (refer to Fig. 6).

According to the survey result, due to the 3D visualization, more distinct modeling has been made possible as when compared to 2D formation. This led to amplification in communication and comprehension, optimistic aspects of marketing, and making it possible for prediction of site safety leading to high revenue following pre-recognized dangerous elements.

However, in relative terms, following the complexity of modeling comes with the reduction in productivity of employees as well as purchase expenses of BIM related software, increased amount of time in production following the complexity of the model, and acquisition costs of professionals have been analyzed to cause negative influence on the revenue structure. These are assignments that need to be solved in introducing BIM to the civil engineering field.

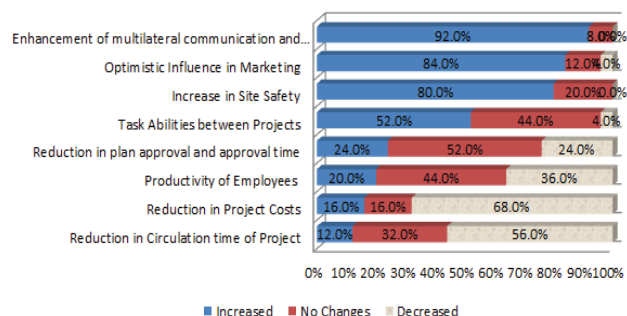


Figure 6. Prediction of returning revenues from investment through the application of BIM

### 3.5 Analysis of Importance that needed for application of BIM

In order to analyze the importance, 14 kinds of survey items were derived and were divided into 3 stages such as increase in the importance, no significance, and decrease in the importance.

In the level of analysis results regarding the importance in the application of BIM, importance of enhancement in BIM software and compatibility between BIM software applications took up the highest responds of 92%. Next were opinions that stated the importance of educational training regarding BIM application as well as detailed information through 3D resulting product and possibility of production took up 80%. The next highest responses were regarding modeling service that can easily be used outdoors and interests regarding BIM as well as owners and executive officers. On the other hand, the opinions pointing out the importance of cost reduction of BIM software was relatively low. Therefore, the level of importance regarding software cost was analyzed as the lowest (refer to Fig.7).

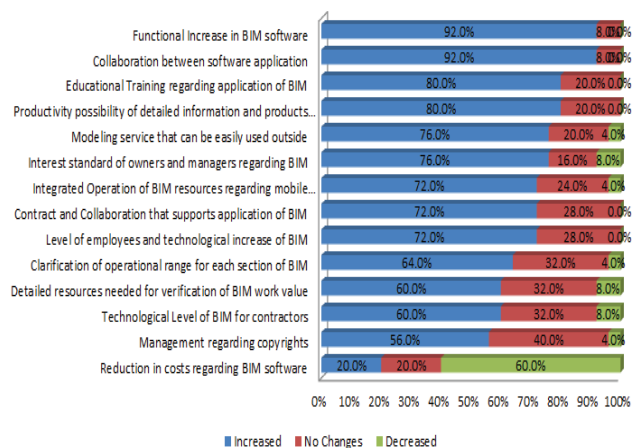


Figure 7. Importance needed for application of BIM

## 4. Conclusion

Based on the survey result on engineering companies, application of BIM in the civil engineering field is continuously increases, and the awareness of importance was very high. Especially, it has been reported that introduction of BIM in stimulation, interference check, calculation of quantity, process management and drawing production would cause a large effect. When BIM is introduced, the areas that would display the biggest effects in contrast of the investment are multilateral communication and increase in comprehension, increase in positive impact of marketing, and increase of site safety. On the other hand, it has been reported that there are concerns regarding reduction in productivity of employees, increase project costs, and increase in the project time. The importance of application in BIM have been reported as the functional enhancement of relevant software and interoperability between software.

In order to do so, software manufacturing companies related to BIM have to strengthen the cooperation system and in addition to the national plans and policies needed for settlement practices, development of related standards, training program and education of BIM practitioners have been considered as urgent. In addition, in order to materialize the BIM product and clarify the scope of work, related guidelines would be considered as important. This research can be applied for future BIM ordering guideline and evidence of related standard developed as well as basic resources.

## 5. Acknowledgment

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