

BUILDING INFORMATION MODELING: DEFINITION, IMPLEMENTATION, AND EVALUATION IN SUPPORTING DEVELOPMENT OF MOROTAI TOURISM AREA

Dimas Hastama Nugraha¹⁾, and Nino Heri Setyoadi²⁾

^{1,2)}Ministry of Public Works and Housing Yogyakarta, Indonesia

[E-Mail: dimashastamanugraha@gmail.com](mailto:dimashastamanugraha@gmail.com)

ABSTRACT

The rapid development of science and technology in the 21st century affects all scientific disciplines, economics, and government, include digital technology for architect, design and construction. Indonesia Government Regulation Number 50 of 2011 declare Morotai island as a national tourism strategic zone. In 2018, the Research and Development Office for the Application of Settlement Technology planned to have Tourism Toilet in the Daruba Region, for visitors and local residents. This Toilet facilities is equipped with Biofilter Technology, Fast Sand Filter Technology, Reserve Osmose, and Sanita Pool. This application was also supported by the application of Building Information Modeling (BIM) technology which has been widely used in the construction sector with the aim of monitoring the realization between plans and development so that it is more precise and efficient.

Based on this, the study wanted to see what is BIM, the extent to which the implementation and evaluation of its application in supporting the development of Tourism Areas in Morotai. This solution was obtained by collecting primary and secondary data. The method to get primary data was by conducting interview with Project Owner, Planning Consultant, Contractor. This evaluation model consists of four components to evaluate which are Design, Installation, Process and Product (Results).

Result of the study. Building Information Modeling (BIM), as an increasing technology in the Architecture, Engineering and Construction (AEC) industry, has been applied to various research topics ranging from project planning, structural design, facility management, and others. Since the '90s, BIM has been implementing applications in several constructions in Indonesia, but it has not made significant progress. In Morotai's work, work was made based on field conditions. The work of BIM was carried out covering architectural, structural, and mechanical electrical and Plumbing (MEP) aspects. For architectural and MEP aspects use Archicad Software, while for structural use Tekla Design. The general description of the results of the architectural display of BIM is as follows. The Level of Design used in this BIM is Level of Design 5, or up to the Volume calculation level. Evaluation in BIM implementation make with Discrepancy Evaluation Model (DEM). Discrepancy Evaluation consist of 4 stages, Design, Instalation, Process, and Implementation.

Keywords: BIM, definition, implementation, evaluation.

INTRODUCTION

The rapid development of science and technology in the 21st century affects all

scientific disciplines, economics, and government. The advancement of technology has changed the life and work of humans

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from the most basic things too complex things. Digital technology advances triggered a 4.0 industrial revolution. The internet facilitates communication and Digital technology became the beginning of the 4.0 Industrial revolution. Information between millions of people throughout the world. The current industrial revolution is driving automation systems in all active processes. With the advancement of technology, this helps facilitate human work, including in the world of construction [8].

Morotai Island as a National Tourism Strategic Zone, or can be called "KSPN" [1]. In 2015, the tourism sector ranked second in the leading sector, which is one of the drivers of economic growth in Morotai Island Regency, North Maluku [2]. The approach to developing tourism destinations in terms of amenities is one that will be addressed by focusing on public infrastructure such as electricity, water, telecommunications, and waste management which is a form of environmental sustainability.

On the other hand, the condition of the development of sanitation infrastructure at Morotai KSPN is not much different from the condition of clean water infrastructure, the facilities are minimal and poor. One area in Morotai Island Regency that has the potential to implement clean water and sanitation facilities is the Daruba area. Daruba City has the potential to support the tourism sector in Morotai Island Regency. There needs to be a detailed development plan, both technically and operationally and planning for infrastructure maintenance, which will support the development and fulfillment of people's needs optimally. In 2018, the Research and Development Office for the Application of Settlement Technology planned to have Tourism Toilet facilities or can be called "MCK Plus" in the Daruba Region, for visitors and local residents. This Toilet facilities is equipped with Biofilter Technology, Fast Sand Filter Technology, Reserve Osmose, and Sanita Pool. The existence of MCK Plus facilities

in the development of the Daruba area is very important because it will increase access to tourist facilities, access to local residents and will strengthen Daruba as the central area of Morotai. The development of this area is considered important because it can improve the regional economy in Morotai.

With conditions as mentioned above, the Research and Development Center for the Application of Settlement Technology of the Ministry of Public Works and Public Housing carried out the initial replication of clean water and sanitation technology in the Daruba area, South Morotai District, Morotai Island Regency. This clean water and sanitation technology includes Biofilter, Quick Sand Filter, Reserve Osmose and Sanita Pool.

A biofilter with a capacity of 4382 m³ is a dirty water treatment plant that will later enter from the toilet and exit to the Sanita Pool and finally dumped into the sea. Reserve Osmose is a drinking water installation. The Quick Sand Filter is a clean water treatment plant. This technology supports Tourism Toilets, which are equipped with Male Toilet facilities, women, Disable Abilities, Prayer Room and Viewpoints. This tourist toilet also complements the Coast Polder and Road Tourism facilities, which are also built by the Ministry of Public Works and Housing, Indonesia.

This application of Tourism Toilet is also supported by the application of Building Information Modeling (BIM) technology which has been widely used in the construction sector with the aim of monitoring the realization between plans and development so that it is more precise and efficient. Building Information Modeling (BIM) has emerged as one of the main streams in construction research and civil engineering in the last decade [7]. In Indonesia, BIM is something new. Complying with the principles when designing, starting from the design, structure, mechanical electrical-plumbing in Indonesia in one unit is still new. In

Indonesia, in the last 3-4 years, only large construction companies such as PT. Wijaya Karya and Pembangunan Perumahan have started their big work. In Morotai, the implementation of BIM was carried out by a consultant on a small scale.

Although the application of BIM in Morotai on a small scale, it is an interesting learning ground to the extent that BIM contributes to the acceleration of the technology replication process, especially from the stages of planning, construction, and monitoring evaluation. Based on this, the study wanted to see definition of Building Information Modelling, the implementation and evaluation of its application in supporting the development of tourism area in Morotai.

For evaluation, this study makes Discrepancy Evaluation Model (DEM). Study about DEM, generally used to evaluate program or performance. For example, study by [5] about Improving the Performance of Internal Auditor in Implementing the Supervision Policy in Pemprov DKI Jakarta. Or [3] who research about Evaluation of Placement and Protection Programs of Indonesian Migrant Worker.

METHODOLOGY

The method to get primary data was by interview with project owner, planning consultant, site manager of contractor & supervision consultant in this project and also by observing the focused area. The secondary data are gathered by collecting documents related to Morotai, for example shop drawing of building. This research used qualitative approach analysis in conducting the evaluation of the BIM implementation. Researcher is using one of Discrepancy Evaluation Model (DEM) to analyse the data. This evaluation model consists of four components to evaluate which are design, installation, process and product (Results).

RESULTS AND DISCUSSION

Building Information Modeling

Building Information Modeling (BIM), as an increasing technology in the Architec-

ture, Engineering and Construction (AEC) industry, has been applied to various research topics ranging from project planning, structural design, facility management, and others. Furthermore, with increasing demand for energy efficiency, the MEA industry requires rapid energy retrofit from existing building stocks to successfully achieve the 2020 Energy Strategy target [4].

Many definitions about Building Information Modelling. BIM as a tool to manage building information over the whole life cycle, and it is support data of maintenance and the construction process [6]. Boukara and Naame, 2015 also describe BIM an intelligent model based process that provides insight help plan, design, construct, and manage building and infrastructure.

Technological advances also affect construction in Indonesia [8]. Construction in Indonesia has long used technology to simplify work such as CAD applications. Since the '90s, BIM has been implementing applications in several constructions, but it has not made significant progress.

In fact, Several countries in ASIA that have already implemented BIM, including South Korea, Taiwan, India, China, Philippines, Singapore, and Thailand. Singapore = 2011. Chinese = 2012.

Building Information Modeling was conducted to see how the planning was carried out in the framework of the Initial Replication of Clean Water and Sanitation Technology at Daruba Pantai, Morotai. Jobs using BIM (with government work owners and small-medium contractors) have never been done in Indonesia. BIM's work in Indonesia has only been carried out for the scope of large Construction Business Entities (such as PT Wijaya Karya, PT Pembangunan Perumahan) and large types of work.

Implementation in Morotai

In Morotai's work, work was made based on field conditions. The work of BIM was carried out covering architectural, structural, and mechanical electrical and Plumb-

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ing (MEP) aspects. For architectural and MEP aspects use Archicad Software, while for structural use Tekla Design. The general description of the results of the architectural display of BIM is as follows. The Level of Design used in this BIM is Level of Design 5, or up to the Volume calculation level.

As a tourist toilet that accommodates technology including biofilter, fast sand filter, Reserve Osmose and Sanita Pool. The existing BIM also helps make existing technology modeling. The description of sanitation and clean water technology modeling is as follows:

Figure 1. Modelling BIM of Tourist Toilet in Morotai

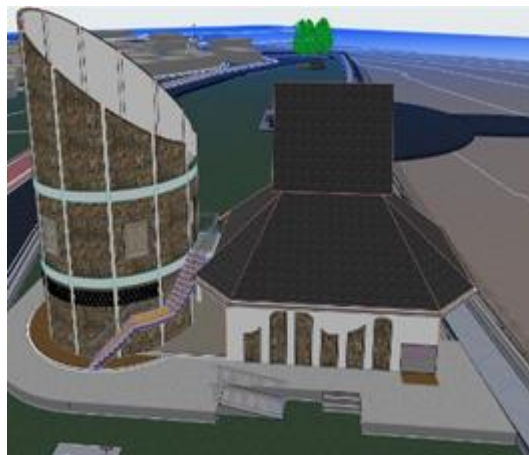
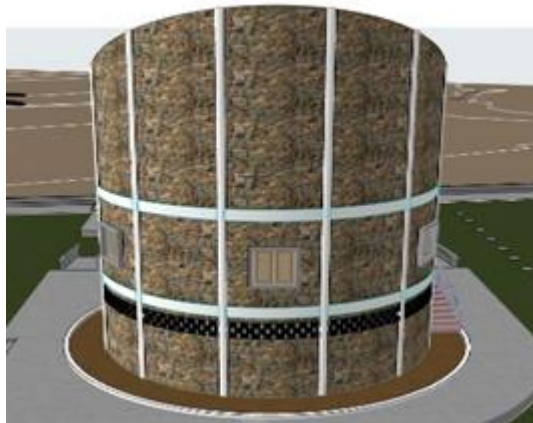


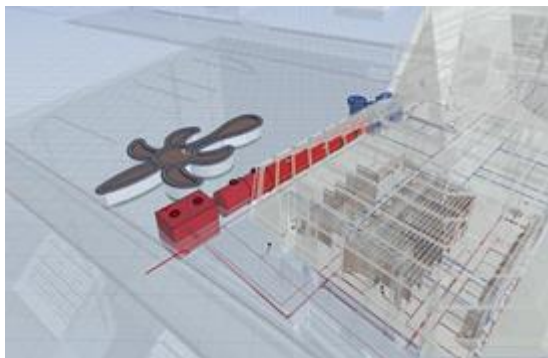
Figure 2. Toilet Modelling BIM display in Morotai



When making technology such as Biofilter in Building Information Modeling (BIM), the team translated the Detailed Engineering Design image from the consultant and adjusted it to Archicad. The existing DED image is taken from the Biofilter producer model, PT. Mega Fiber.

To make quick sand filter technology, just like biofilter, the team translated the detailed engineering design image from the consultant and adjusted it to archicad. Modeling was taken from CV. Lusika Engineering. For Reserve Osmose, the team only made a symbol and for Sanita Pool, the team made it directly on Archicad.

Figure 3. Biofilter and Sanita Pool BIM display in Morotai



Evaluation in Morotai

Evaluation in BIM implementation make with Discrepancy Evaluation Model (DEM). Discrepancy Evaluation consist of 4 stages, Design, Instalation, Process, and Results. In design stages, In designing stage there are two aspects that are evaluated: first, the internal preparation of BIM and secondly, the purpose of the supervision interen.

Internal preparation of BIM started by BIM teams in Ministry of Public Works and Housing, In general, BIM work is carried out after the signing of the contract for planning work is completed. The BIM output is not included in the scope of output carried out by the planning consultant, because BIM introduction and stage of BIM is late than Contract signing.

Considering the work time of the job consultant for design work is only 6 months and compressed to 3 months, because of pursuing the construction auction process, the initial intent of the Research and Development Office, Ministry of Public Works and Housing, as the owner of the work to work on BIM from the beginning, received little response from the planning consultant. This is because 4 things are: 1) BIM output is not included in the contract; 2) The Planning Consultant pursues the main output according to the contract first; 3) The existing software by consultant not BIM authorized software, and; 4) The BIM expert isn't owned by planning consultant.

In Installation stages, there are 4 (four) aspects will be discussed: 1) aspects of the human resources (HR); 2) the supervision mechanism, and; 3) the supervision guide-lines. Aspects of human resources from consultants are not optimal. No existing human resources has qualified to BIM, this is due to the relatively new BIM and BIM's understanding for them. The PU has also offered consultants to be assisted, but they are resistant because they are not in the contract. In the end the consultant was assisted by partners from PU.

For the mechanism of supervision, supervision is carried out by PU and PU partners to the supervision consultant. Supervision was done looking at DED from BIM's aspects. For the supervision guide, it is done by looking at the shape and structure and MEP of the building being built. This guide looks at the effectiveness of BIM implementation on existing buildings.

In process stage, respond to that condition, the Ministry of Public Works and Housing and partners from Indonesia Islamic University, tried to offer a planner consultant in the form of software incentives and assistance from experts. Finally, after the negotiation process, the results were obtained that BIM still could not be implemented from the start of the planning, but entered in the middle of the planning process. Planning work still uses existing software, namely Autocad and after that it is done with Archicad which it in BIM authorized software.

Actually BIM started from the initial session of planning, but was not implemented properly. The design process is carried out with existing software, Autocad, not BIM-based software such as Archicad and Tekla Design.

The process of working on BIM was carried out by the Ministry of Public Works and Housing, after obtaining the DED from the consultant planner. As consequence, the flow of this process becomes long time. Because many of the Autocad images are

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not suitable when described as BIM and 3-dimensional based, so for good images and processing, it must have been repaired and calibrated. The long-standing process with the flow, far from the spirit of BIM, is accelerating the planning process.

In Result Stage, BIM when implemented in the site, was useful when giving a 3D picture to the Supervisor and Contractor, for example the ceiling picture that will be done, or the location of the clean water pipe. But the picture given was only a screenshot (image), not through software.

Hardware and software can't be found in site. Supervisors & contractors in Morotai, which was in fact the Eastern Region of Indonesia, do not understand what is BIM and the software used. The owner of the work must strive to explain what BIM was to the contractor and supervisor. In the CCO calculation (Contract Change Order), especially when recalculating the volume, BIM is quite helpful in explaining details to the supervisor, and as a comparison of volume calculations using excell.

CONCLUSION

Based on the results and discussion there are several thing that can be summarized as follows:

1. Building Information Modeling (BIM), as an increasing technology in the Architecture, Engineering and Construction (AEC) industry, has been applied to various research topics ranging from project planning, structural design, facility management, and others. Many definitions about BIM.
2. In Morotai's work, work was made based on field conditions. The work of BIM was carried out covering architectural, structural, and mechanical electrical and Plumbing (MEP) aspects. For architectural and MEP aspects use Archicad Software, while for structural use Tekla Design. The general description of the results of the architectural display of BIM is as follows. The Level of Design

used in this BIM is Level of Design 5, or up to the Volume calculation level.

3. Evaluation in BIM implementation make with Discrepancy Evaluation Model (DEM). Discrepancy evaluation consist of 4 stages, design, instalation, process, and results.
4. The application of BIM in the initial replication construction project in Morotai has not been fully effective in accelerating the planning process to the construction of tourist toilets and the technology contained within it.
5. The weak understanding and commitment of the construction service providers, especially planners and contractor consultants, is due to the absence of a clear legal standing in the implementation of BIM.
6. In monitoring the implementation of BIM it turns out that it is effective in helping the process of design change in detail and measured.
7. To develop the implementation of BIM in the future a strong policy/regulation must be developed that can become a legal standing for construction service operators in carrying out construction services work.
8. Indonesia's construction industry needs a new breakthrough in facing the future. Globalization and free trade is a big challenge and will be a problem for the national construction industry if adequate action is not taken to increase the productivity of the national construction industry.

Conclusion of this study, The application of BIM in the initial replication construction project in Morotai has not been fully effective in accelerating the planning process to the construction of tourist toilets and technology contained within it.

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