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Building Information Modeling (BIM) Basic Competency Training to improve Building Construction Service Design Products in Banyumas Regency

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ABSTRACT

Background: Building Information Modeling (BIM) is a technology in the field of Architecture, Engineering and Construction that is capable of simulating all information in a development project into a three-dimensional (3D) model. One of the government's efforts in dealing with the Industrial Revolution 4.0 is implementing the use of BIM, and construction technology innovations in each project cycle. By applying the BIM method, both managers, consultants and contractors are able to save processing time, costs incurred and the required workforce. The application of BIM technology can minimize the impact of work delays, increased costs, and construction failures.
Contribution: The results of the analysis of the needs of partners show that not all construction service businesses, especially in Banyumas, know and implement BIM. This community service activity is intended to provide basic training to construction service businesses regarding the operation of BIM using Tekla Structures.
Method: The method used is a partner needs analysis survey, lectures, demonstrations, discussions, and mentoring.
Results: The results of this dedication show that as many as 81% of participants understand the BIM concept after participating in this activity.
Conclusion: The holding of this training will provide an overview, improve skills for construction services in Banyumas. Furthermore, it can be applied to the construction process (planning, implementation and maintenance), so that it will produce competitive construction service design products.

INTRODUCTION

Information and communication technology in digital format in the industrial era 4.0 is used in the construction industry throughout the world. Even digital technology has a big impact in accelerating infrastructure development so that it becomes more efficient and productive, one of which is Building Information Modeling (BIM). BIM is a set of technologies, policy processes where all processes run in an integrated manner in a digital model, which is then translated as a three-dimensional image [1]. The technology is also a process in generating and managing construction data during its life cycle. BIM uses 3D, real-time, and dynamic modeling software to increase productivity in building design and construction. In BIM, the models created by each discipline must be integrated as a whole so that coordination is needed in the form of collaboration between disciplines. The benefits include being able to resolve potential conflicts as early as possible and avoid rework or delays in the construction phase. BIM-based applications in designing a building can create architectural models as well as be used for structural analysis modeling which can be used to analyze internal forces and reinforcement requirements. After going through an integrated process, the final model created has all the information from the architectural plan, structure, reinforcement with automatic volume output [2]. The use of applications with the BIM concept can speed up project planning time by ± 50%, BIM reduces HR requirements by 26.66%, and saves personnel costs by 52.25% compared to using conventional applications. The added value generated by BIM on project activities and project performance has a significant influence on the success of construction projects [3]. The use of BIM technology is very helpful in the project implementation process, the user will very easily find out the condition of the shape of the project without being confused about the results. The resulting 3D modeling can be used as material for discussion by the entire project team to be able to decide which method of carrying out the work is most appropriate [4], [5]. Several applications based on BIM in planning a construction buildings can create architectural models as well as be integrated into structural analysis modeling. The final model created has all forms of information construction needed starting from the architecture, structure, structural details and volume output automatically, including Revit Structures, Glodon, ArchiCAD, All Plan, Dlubal RFEM. But for the procurement of software in Indonesia and in collaboration with the Ministry of PUPR, Trimble, namely Tekla [6], [7], [8], [9], [10]. Various tools from BIM are widely applied in the construction world, including the use of Tekla Structures. Tekla is a new revolution in the field of structural engineering that has several advantages over other application programs. Tekla is a project encyclopedia-based BIM tool that makes it possible to create and manage data accurately and in detail, and can create 3D structural models without forgetting complex materials and structures. This model can cover the entire building construction process from concept design to fabrication, installation, and construction management [11]. Advances in technology require construction services to be more productive and innovative, to be able to compete with both domestic and foreign competitors. We see together that many construction service players have started to enter and run their business in Indonesia. Of course, this is a challenge for all of us, especially construction and management services, in this case the PU Banyumas, where the skills and competencies in the field of construction must really be mastered. Various government efforts to offset the implementation of infrastructure that reflects the industrial revolution and digitalization in support of construction technology 4.0 have been carried out, one of which is the policy regarding the implementation of BIM as stated in the PUPR Ministerial Regulation Number: 22/PRT/M/2018 which requires the use of BIM in State Buildings. with criteria of area above 2,000m^2 and above 2 floors [12]. One of the benefits that can be obtained from BIM is increasing time efficiency, human resource

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requirements and costs, as well as minimizing errors and construction risks [13]. However, it cannot be denied that some construction service businesses (small and medium) have not been able to experience the advantages and benefits of this BIM technology. It is hoped that the holding of this community service activity will provide benefits, especially for business actors in building construction services (small-medium) in the Banyumas district so that they can always be productive and competitive with an increase in competence regarding BIM. The level of interoperability of BIM-based modeling and structural analysis systems, it is very possible to be applied to the planning and construction implementation process, and to obtain more detailed information about building components (detaillng) [14], [15]. BIM-based modeling is expected to help reduce deficiencies in obtaining more detailed information from a structure. The integration process from structural analysis to Tekla Structure BIM modeling can be done well, several other supporting software that supports Open BIM can be applied and the Integration process is based on the IFC file type [13], [16].

METHOD

The methods used in the Devotion to the application of science and technology are: Lecture methods, tutorials (demonstrations) and mentoring. This activity is divided into 5 stage, which can be seen in Figure 1 and the following explanation:

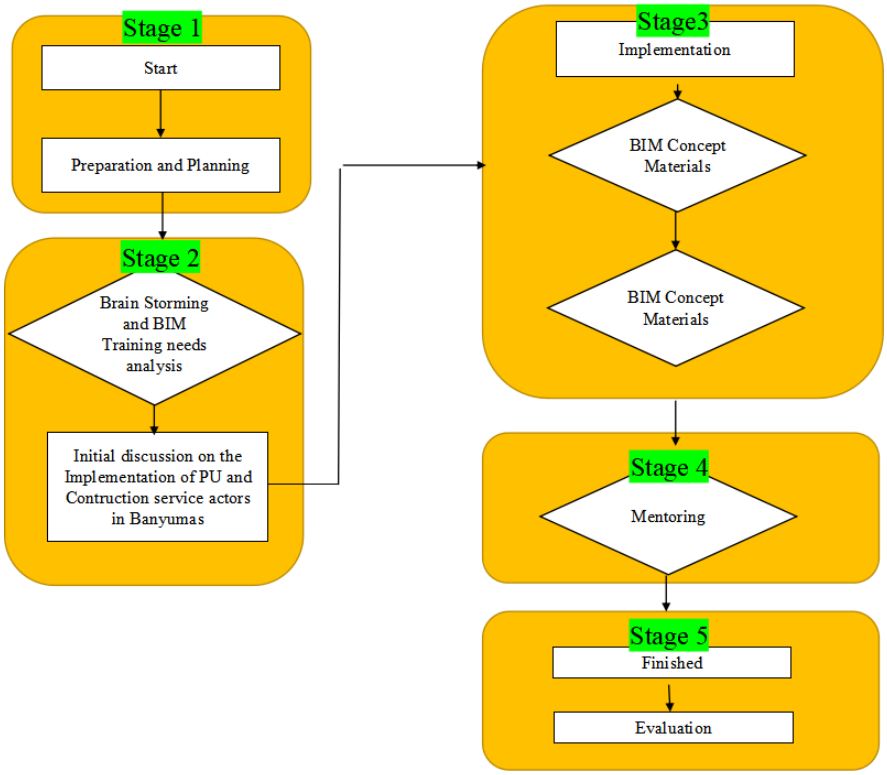

Figure 1. Community Service Activity Flow Chart

The first stage of activity is obtaining permits, application for dean's letter of assignment and preparation of material/activity materials to be submitted, site survey, checking of infrastructure: availability of computers, laptops, electrical installation, data collection of Construction Service Business Actors and PU Banyumas Service to participate in training. The second stage of activity is brain storming about BIM technology and its development, explaining

the theory, containing BIM theories and concepts, BIM definitions, BIM benefits, BIM characteristics, BIM dimensions. The third stage of activity is tutorials or demonstrations and practical use of Tekla Structures, 3D modeling of building structural components such as columns, beams, floor plates and reinforcement with Tekla Structures. design material components and structural details, explain drawings, make rebar detailing, make assemblies from concrete parts, make detailing steel and concrete connections [17], [18]. The fourth stage of activity is mentoring, assisting the application of the BIM Tekla Structures application to partners. The fifth stage of activity is Activity Evaluation, Evaluation is carried out after all the stages of the process are carried out including, what is the level of success of the community service activities carried out.

RESULTS AND DISCUSSION

The implementation of the activity begins with coordination with the head of the Banyumas PU and representatives of construction service providers prior to carrying out the activity. The activity was carried out on August 18 2022 in the PU Banyumas Office Hall and was attended by 21 participants, and then mentoring was carried out for 3 months. consisting of 11 representatives from the PU Banyumas and representatives from service providers as many as 10 participants consisting of planning consultants, contractors and supervisory consultants. The presentation of the material began with the operation and installation of Tekla Structures 2021. Minimum level, the operating system used is Microsoft Windows 8.1/10 64 bit, minimum 6GB of memory. The resource person explained that Tekla Strucutures can be installed via https://campus.tekla.com/ . In order to access downloads, users must create an account on Tekla. The installation display can be seen in Figure 2 below.

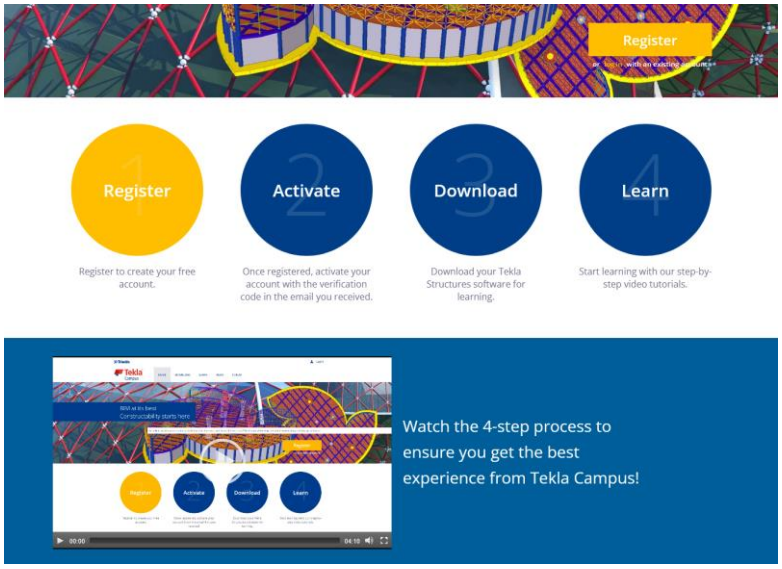

Figure 2. Register and Instalation Tekla Structures

Participants enthusiastically participated in this activity and several participants participated actively in following every step of this training it can be seen in Figure 3. The resource person delivered motivating material to the participants regarding the importance of the BIM concept in the construction process. PUPR Ministry Regulation number 22 of 2018 states that the use of BIM must be applied to non-simple State Buildings with criteria of an area of over 2000 m2 and above 2 (two) floors [13], [19]. As stated in the PUPR Ministry's roadmap regarding Indonesia's digital construction, it can be seen in Figure 4.

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Figure 3. Tekla Structures BIM training participants' activeness

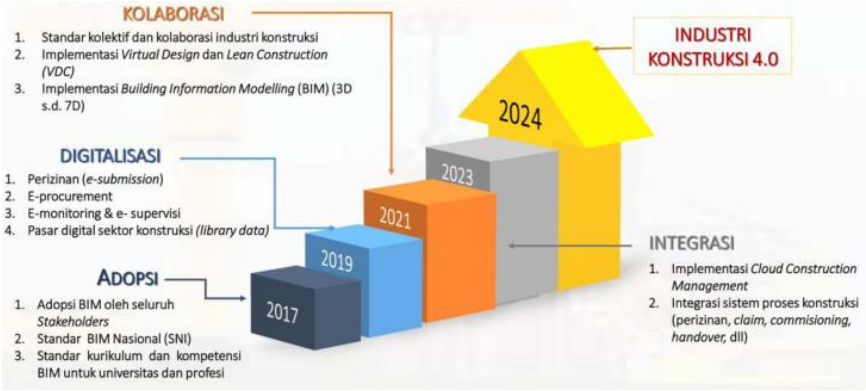

Figure 4. Construction Industry Roadmap 4.0 (Ministry of PUPR)

The training activities went well and the participants were enthusiastic in participating. The enthusiasm of the participants was quite high, some of the participants were able to follow each step well according to the training material, this training discussed the design of reinforced concrete structures modeled using Tekla structures, which consisted of Create Model, Detailing Rebar, Drawings & Report, General Arrangement Drawing, Single Part Drawing, Assembly Drawings, Making Reports [20]. The design results using Tekla Structures from the training participants are shown in Figure 5 below.

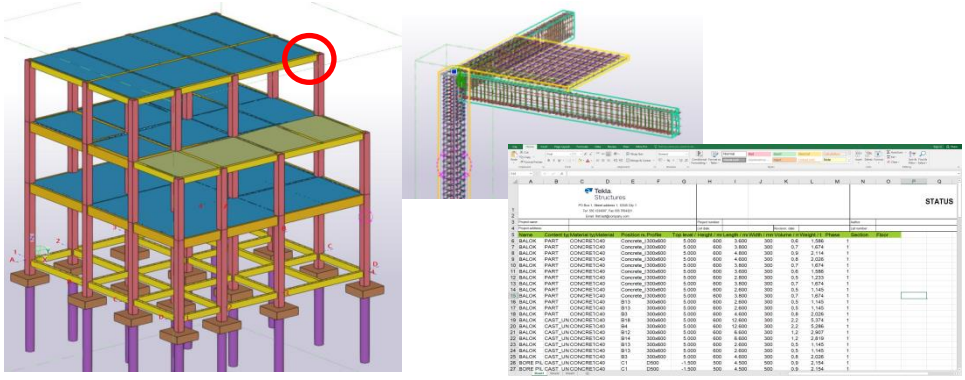

Figure 5. Product design using Tekla Structures from the participants

The results of the Tekla Structures BIM training participants provided feedback and discussion regarding the material presented, as many as 71.4% of participants stated that so

far they were not familiar with the BIM concept further are shown in Figure 6, this is quite a concern regarding knowledge, especially construction service providers and PU Banyumas.

Figure 6. Participants' responses to knowledge about BIM

This training activity was considered very useful, especially for PU and Construction Service Providers in Banyumas Regency where it showed an increase after this activity was carried out, as much as 81% there was an increase in understanding of the BIM concept among training participants shown in Figure 7, for this reason it is necessary to have similar activities that support the development of realize the digitization of construction gradually.

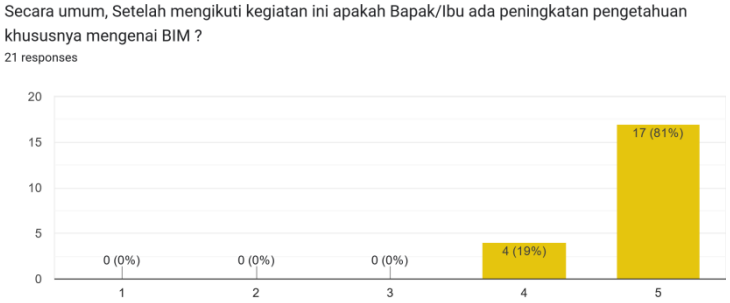

Figure 7. Increased knowledge of participants about BIM

The training participants gave a positive response regarding the application of the basic concepts of BIM, especially the Public Works Service and Construction Service Providers, it is hoped that the BIM application will be applied to the construction service auction process and the development process will be gradual, shown in Figure 8 and Figure 9 below.

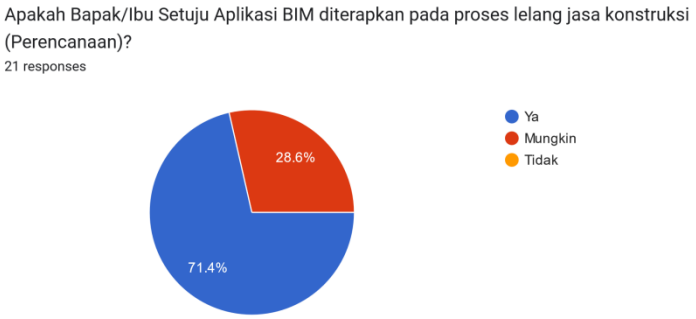

Figure 8. Participants' responses to the implementation of BIM in the construction sector

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Figure 9. Participants' responses to the readiness to implement BIM in the construction process

CONCLUSION

Based on the results of the implementation of community service activities, conclusions and suggestions for improvement were obtained. The conclusion obtained from the results of this service is that the service activities run smoothly and face-to-face assistance, the participants are very enthusiastic about this service activity. So that it is expected to increase knowledge and skills in understanding and concepts of BIM and BIM-based applications. Based on the evaluation of activities 81% there is an increase in understanding of the concept of BIM. Suggestions for the future are the need to hold similar activities to support technological developments in order to realize the gradual digitization of construction.

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