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CAD Technology Workshop with the Pierre Bougher Approach in Building Traditional Wooden Ships at Kelompok Usaha Bersama (KUB) Nenang Berlayar North Penajam Paser

Hariyono*, Rodlian Jamal Ikhwani, Chris Jeremy Verian Sitorus, Harlian Kustiwansa

Department of Naval Architecture, Kalimantan Institute of Technology, Balikpapan, 76127, Indonesia

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ABSTRACT – Program in the form of a CAD Technology Workshop using the Pierre Bouguer approach aims to improve the skills of traditional wooden ship craftsmen in the Kelompok Usaha Bersama (KUB) Nenang Berlayar, Penajam Paser Utara. This activity introduces Computer-Aided Design (CAD) technology as a modern solution to increase the precision, efficiency and quality of wooden ship designs without eliminating traditional values. Pierre Bouguer's approach which focuses on the stability and balance of the ship through drawing lines plans was applied to produce a better design from a technical and safety perspective. Implementation methods include intensive training, technical assistance, and ongoing evaluation, supported by lecturers and students from the Kalimantan Institute of Technology (ITK). The results of the activity showed a significant increase in craftsmen's understanding and ability to use CAD, as seen from the post-test results of participants who achieved an application level above 90%. This program not only helps craftsmen adopt modern technology but also creates a sustainable learning ecosystem through an online-based community. It is hoped that the application of CAD technology can encourage innovation in traditional wooden shipbuilding, increase competitiveness, and provide added economic value for craftsmen amidst the challenges of modernizing the maritime industry.

*Corresponding Author | Hariyono | ✉ hariyono@lecturer.itk.ac.id

INTRODUCTION

The importance of preserving the tradition of wooden ship building which has become a cultural identity in the North Penajam Paser area. Kelompok Usaha Nenang Berlayar (KUB) is a business group that still maintains traditional methods of building wooden ships, but is faced with the challenges of modernization and the need to increase production efficiency. On the other hand, technological developments, especially Computer-Aided Design (CAD) technology, can be a potential solution to support improving the quality of wooden ship designs without eliminating traditional values that have been passed down from generation to generation.

Pierre Bouguer's approach, known for his ship design theories, has become one of the main inspirations in developing efficient and safe ship designs, especially in the depiction of plane lines. This approach can be integrated in the use of CAD technology to produce wooden ship designs that are more precise and can meet modern safety standards, without ignoring local wisdom. By combining modern technology with traditional knowledge, KUB Nenang Berlayar can optimize the shipbuilding process, while expanding their market by offering higher quality and competitive products. Through this workshop, it is hoped that wooden ship craftsmen at KUB Nenang Berlayar can have a better understanding of CAD technology and how the application of Pierre Bouguer's approach can support the development of superior traditional ship designs. [1]

Several community service programs have previously been conducted in the region to address various challenges. These initiatives included workshops on engine repair and maintenance [2], training on gross tonnage (GT) measurement [3], and guidance on Occupational Health and Safety (OHS) practices in traditional shipbuilding [4]. This current program aims to encourage the sustainability of traditional wooden shipbuilding businesses amidst the challenges of the digital era, as well as strengthening the maritime cultural identity of the North Penajam Paser community In the era of global competition and the need for increasing efficiency, KUB Nenang Berlayar needs to adapt to new technology in order to survive and develop. One solution that can be offered is the use of Computer-Aided Design (CAD) technology, which allows ship calculations and designs to be carried out more accurately. [5] By using Pierre Bouguer's approach, which is known as a scientific approach in determining the balance and stability of ships, craftsmen can utilize CAD to improve design quality and precision in traditional wooden shipbuilding. However, limited knowledge and access to this technology are the main obstacles for craftsmen at KUB Nenang Berlayar. Therefore, a training program or workshop is needed that can introduce and teach CAD technology using the

Pierre Bouguer approach to craftsmen at KUB Nenang Berlayar. This workshop will not only help improve the technical skills of craftsmen in utilizing modern technology, but also encourage the development of their capacity in producing safer, more efficient and higher quality wooden ships, so that they can compete in a wider market.

INTEGRATING CAD TECHNOLOGY FOR SHIP DESIGN IMPROVEMENT

CAD Technology Training and Workshop with the Pierre Bouguer Approach: This program aims to introduce Computer-Aided Design (CAD) technology to wooden ship craftsmen at KUB Nenang Berlayar. This training will focus on the use of CAD in ship design with the Pierre Bouguer approach, which helps ensure the balance and stability of ships scientifically. [6]. KUB Nenang Berlayar in North Penajam Paser faces challenges in maintaining and increasing the efficiency of the traditional wooden shipbuilding process. With methods that still rely on inherited skills and intuition, ship craftsmen often face difficulties in achieving precise final results that match the initial design. This reliance on conventional techniques not only affects product quality, but can also lead to safety and vessel performance issues. Amid global demands to improve efficiency and quality, efforts need to be made to bring significant change to these communities so they can compete more effectively.

Figure 1. KUB Nenang Berlayar

The solution that can be implemented is to introduce Computer-Aided Design (CAD) technology in the wooden ship design process. CAD technology offers greater precision in measurements and design, and minimizes discrepancies between plans and final results. In this case, Pierre Bouguer's approach, which specifically emphasizes the balance and stability of ships, can be a scientific basis that supports improving the quality of wooden ship design. By introducing this technology, craftsmen can design safer, more stable and efficient ships, and minimize errors caused by intuition without accurate mathematical calculations. [7]

Figure 2. The process of building ships at KUB Nenang Berlayar using traditional methods

Limited knowledge and access to CAD technology is a significant challenge. To overcome this obstacle, training programs and workshops need to be organized, where craftsmen will be introduced to the use of CAD with the Pierre Bouguer approach. This workshop will increase the technical capacity of craftsmen in utilizing modern technology, while helping them produce higher quality and competitive products in the wider market. [8]. With this support, KUB Nenang Berlayar can be better prepared to face the challenges of the modern shipping industry, while still maintaining the cultural heritage of traditional wooden shipbuilding.

METHOD

Implementation of the PKM program begins with the preparation of the implementation team for each planned activity. The team consists of supervisors/lecturers and implementers who involve ITK students as the implementation committee in the field and the Penajem Paser Utara Joint Kelompok Usaha Bersama (KUB) which is the target of the training. The supervisor and implementation team must understand the concept of ship building models using CAD using the Pierre Bougher method well and clearly. To develop concrete steps in solving problems at the Kelompok Usaha Bersama (KUB) Nenang Berlayar in North Penajam Paser, here are several stages that can be followed:

Indentify the problem KUB Nenang Berlayar

a) Analyze the main needs and problems in the traditional shipbuilding process.
b) Meet KUB members to discuss the challenges faced, both in terms of skills, technology and production efficiency.
c) Identification of traditional shipbuilding between traditional shipbuilding methods and the application of more modern technology.

Survey and Determination of Activity Locations

AutoCAD Training for Wooden Ship Building in Penajam aims to improve the skills and knowledge of wooden ship craftsmen in using computer-aided design (CAD) software, especially AutoCAD, which can increase the precision and efficiency of the ship design process. Penajam was chosen as the location because this area has a fairly large and active community of wooden ship craftsmen, but many still rely on traditional methods of shipbuilding. Through this training, it is hoped that craftsmen can integrate digital technology into their design process, so that they are able to produce more competitive and quality products. This program also involves lecturers as the main facilitators who provide direct guidance to craftsmen, as well as helping formulate effective teaching methods that suit the needs of the local community.

Preparation of activity equipment

Preparation of equipment for activities requires various needs that are designed to support the smooth running of training and optimal understanding by participants. The main equipment that needs to be prepared is a computer or laptop that is sufficient to run AutoCAD software, as well as sufficient AutoCAD licenses for all training participants. In addition, a projector and large screen will be used so that the instructor can clearly display the step-by-step guide to all participants. Other supporting materials such as training modules containing tutorials and references to AutoCAD applications specifically for wooden shipbuilding need to be provided to make it easier for participants to follow the material and repeat practice after the activity. During the activity, direct measurements will be carried out in the field regarding the effectiveness of using CAD using manual methods so that it requires supporting equipment such as water levels, roll meters and others. Finally, snacks and drinks will be provided to maintain the energy of the participants and trainers during the activity. All of this equipment is prepared to ensure that the training runs smoothly and provides maximum benefits for the participants in Penajam.

Implementation of Activities

a) Introduction to CAD Technology for Production Optimization

Introducing CAD (Computer-Aided Design) technology based on Pierre Bouguer's approach to traditional ship craftsmen. Then conduct direct training on how to use CAD in ship design to increase accuracy and efficiency, including digital simulation before production.

b) Intensive Training and Mentoring

Hold intensive training for craftsmen regarding the use of CAD software in every stage of ship design and construction. Then provide modules or training materials that are simple and easy to understand, tailored to the level of technological knowledge of the craftsmen. Provide regular assistance, for example through field visits or online mentoring, to ensure the implementation of CAD is effective.

c) Collaboration with Experts and Academics

Establishing collaboration between KUB and universities, such as the Kalimantan Institute of Technology (ITK), to obtain technical and academic support in implementing CAD. Involving students in mentoring activities as part of the community service program, which also supports project-based learning.

Evaluation and Continuous Development

a) Conduct regular evaluations of KUB's progress in implementing CAD technology, including the quality of the ships produced and the efficiency of production time and costs.
b) After basic training, conduct advanced programs for skills development, such as more complex ship design or use of other digital manufacturing technologies.

RESULTS AND DISCUSSION

AutoCAD software has many benefits in designing wooden ships, especially in increasing efficiency, precision and design quality. With the CAD (Computer-Aided Design) feature, AutoCAD allows designers to create detailed 2D or 3D models of wooden ships, including hull shape, internal structure, and other additional elements. This makes it easier to visualize the design before the construction process begins, so that the potential for errors can be minimized. AutoCAD also allows for quick design modifications if needs or specifications change. In addition, using AutoCAD helps produce neater and more professional technical drawings, which can be used as a reference by shipbuilders in the construction process. AutoCAD's ability to integrate data, such as structural loads and material calculations, also supports more economical and environmentally friendly planning. Thus, AutoCAD not only simplifies the design process but also supports efficiency and accuracy in the construction of traditional and modern wooden ships.

The line plan is very important in ship design because it serves as the first step to ensure that the hull shape meets the criteria of hydrodynamics, stability, payload capacity and fuel efficiency. By studying the lines plan, ship designers can evaluate whether the hull shape is able to reduce water resistance and provide optimal speed and efficiency [9]. In the ship design process, line plans allow designers to carry out design iterations systematically. If the results of the analysis indicate the need for modifications, such as reducing drag or increasing stability, changes can be applied directly to the lines plan. Thus, the lines plan is not only a visualization tool, but also an analysis and communication tool between designers, engineers and shipbuilders. This entire process makes the lines plan an essential component in modern ship design, connecting the initial concept to the realization of the ship in the field.

Figure 3. AutoCAD Introduction Workshop for wooden ship craftsmen

Making wooden ships in North Penajem Paser still relies on traditional methods without taking into account design. Through this workshop, traditional shipbuilders are invited to combine local wisdom with modern technology, so as to increase the competitiveness of the local shipping industry without ignoring traditional values. This workshop also opens up opportunities for shipbuilders to produce more competitive designs, both for domestic and international markets. The hope is that this technology can be implemented in a sustainable manner to encourage economic progress in local communities.

Figure 4. Initial stages of building a wooden ship

Building a wooden ship without clear and detailed design drawings can have various serious consequences, both from a technical, economic and operational perspective. From a technical perspective, ships built without a design are at risk of experiencing construction errors, such as uneven load distribution, dimensional discrepancies, or the use of suboptimal materials, which can reduce the ship's strength and stability. Economically, the work process is often slower and more wasteful because there is a greater possibility of revisions or disassembly due to errors, which ultimately increases production costs.

Figure 5. Hands-on inspection of wooden shipbuilding

Discussion with one of the craftsmen making traditional wooden boats at KUB Nenang Berlayar Penajem Paser Utara. Traditional wooden ship making does not have design drawings and only uses the experience possessed by wooden ship craftsmen which has been passed down from generation to generation. So the dimensions of the main size of the ship and the capacity of the ship usually do not match the initial planning.

Figure 6. Measurements of wooden ships

Measuring the main dimensions of a traditional wooden ship is an important step in ensuring that the ship is built according to the owner's needs and requests. This process includes measuring main dimensions such as the length, width and height of the ship which will later become a reference for determining the ship's capacity. In practice, this main size is often the main benchmark for ship owners to ensure the ship is able to accommodate certain desired loads or functions. However, in the construction of traditional wooden ships, it is often found that technical aspects such as the thickness of the trusses, the distance between the trusses, and the construction calculation analysis are not designed in detail. The thickness of the tusks, which are the backbone of the ship's structure, plays a crucial role in maintaining the ship's strength and stability. If this thickness is not designed properly, the ship's structure can become weak and susceptible to damage, especially when facing tough operational conditions.

Figure 7. Educate craftsmen about shipbuilding by making designs using AutoCAD.

Increasing the understanding of the traditional wooden shipbuilding community regarding the use of AutoCAD software requires a strategic and adaptive approach to local conditions. The first step is to explain the direct benefits of this technology, such as increased design precision, reduced errors and time efficiency, how traditional ship designs can be adapted to digital models. Apart from that, intensive assistance during the workshop process is very important to ensure that participants can ask questions and get solutions to the difficulties they face.

CONCLUSION

The CAD Technology Workshop with the Pierre Bouguer Approach succeeded in introducing and training traditional wooden ship craftsmen at KUB Nenang Berlayar, North Penajam Paser, to use CAD technology in the ship design process. Through intensive training, craftspeople gain a better understanding of the importance of digital design to improve product precision, efficiency and quality. Pierre Bouguer's approach applied in this workshop provides a scientific basis for craftsmen to produce more stable and safer ship designs. A significant increase in participants' knowledge and skills can be seen from the post-test results which show the application of CAD technology reached more than 90%.

Even though there are several obstacles, such as limited equipment for participants and challenges in scheduling activities, this program has succeeded in creating a positive impact on the development of craftsmen's competencies. Apart from improving technical skills, this activity also encourages the formation of an online-based learning community to support the continued application of CAD technology in the future. With a combination of traditional methods and modern technology, this program is expected to help craftsmen produce high-quality wooden ships, increase competitiveness in the market, and preserve the tradition of wooden shipbuilding amidst the challenges of the digital era.

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