

Implementation of Electronic E-Auction to Improve Shipyard Supply Chain Performance

Intan Baroroh^{1*}, Dian Trihastuti², Minto Basuki³, Bagiyo Suwasono⁴, Tuesdaysaka Gustaf Wasito⁵

(Received: 19 September 2025 / Revised: 27 October 2025 / Accepted: 27 October 2025 / Available Online: 1 December 2025)

Abstract— Material procurement in the supply chain accounts for 60% of the ship contract value and has the highest burden with the largest portion of fund distribution, often resulting in procurement delays. This has an impact on delays in the delivery of modular ship construction. Supply chain performance delays are partly due to conventional auction methods, which result in many cases of fraud and a greater potential for material delays. The potential for losses results in delays in ship production, even though risk assessment activities have been carried out as an improvement for the shipyard. The purpose of web-based electronic auction research is to find efficient and accountable prices that can be justified. On the other hand, manual meetings are not necessary, as vendors can participate in meetings and the auction process from their respective locations, minimizing the potential risk of delays in the supply chain material procurement and enabling the production process to proceed according to the initial contract. The results of the research are in the form of an E-Auction user interface for auction processes with two functions, namely administrator login and login for partners or vendors implementing E-Auction auctions, thereby improving aspects of technology, management, marketing, and human resources.

Keywords— Shipbuilding Delays, Supply Chain, Web-Based E-Auction

*Corresponding Author: intan.baroroh@hangtuah.ac.id

I. INTRODUCTION

In this era of globalization and rapid market changes, the *supply chain* aspect has become an important strategy for increasing corporate flexibility and responsiveness. The shipbuilding industry in Indonesia, including PT PAL Indonesia, plays a strategic role in supporting the national and international maritime sector. In addition to focusing on ship production, this industry also functions as a center of innovation and technology that is crucial for the sustainability of the maritime sector. The success of this industry not only supports the national economy but also serves as the foundation for the development of the maritime sector [5,2]. Despite its enormous potential, the shipbuilding industry in Indonesia, including PT PAL Indonesia, still faces a number of obstacles that require serious attention, especially in terms of *the supply chain* [3].

One of the main challenges is the dependence on imported raw materials and components [3], which often experience delivery delays, especially since the outbreak of the Russia-Ukraine war and tensions in the

Mediterranean Sea. The limited local supply of key *equipment* exacerbates this situation. Another problem is the lack of effective coordination between suppliers and manufacturers, which often causes production schedule delays. This uncertainty in the supply chain has a significant impact on production efficiency and overall project costs [4].

The priority issue for partners is that the procurement of ship materials and equipment has always been delayed, resulting in ship construction always falling behind the agreed contract. This is what causes delays in the procurement of ship materials and *equipment*. However, the procurement of materials for modular ship construction has not been widely researched, but there have been many risk assessments [5-14] of the shipbuilding process, with one factor being waiting for materials. One of the delays in supply chain performance is caused by the conventional procurement process for materials and equipment, which results in many potential delays in material delivery. This causes greater losses for the company due to delays in ship production. For , there needs to be an efficient material procurement system with capable supply chain vendor management. Shipyards are an industry that supports modern shipbuilding, both in terms of national defense and the country's maritime transportation needs. However, there are still many gaps that need to be addressed, especially material procurement, which accounts for 60% of the ship contract value and still faces many obstacles. In this case, the supply chain has the highest burden with the largest portion of fund distribution [15-17]. In practice, the supply chain has the greatest impact on the material supply system, which greatly affects the modular shipbuilding process. Delays in the supply chain are caused by limitations in the availability of goods or services, changes in material or service specifications, supplier difficulties, poor cash flow, failed negotiations, incomplete documentation, customs delays, failure to

Intan Baroroh, Faculty of Science and Marine Engineering, Naval Architecture and Ship Building Engineering, Hang Tuah University, Surabaya, Indonesia. E-mail: intan.baroroh@hangtuah.ac.id

Dian Trihastuti, Department of Engineer Profession Education, Widya Mandala Surabaya Catholic University – Indonesia, Email : dian.trihastuti@uphsurabaya.ac.id,

Minto Basuki, Department of Naval Architecture and Ship Building Engineering, Faculty of Industrial Technology, Adhi Tama Surabaya Institute of Technology (ITATS), Jalan Arief Rahman Hakim 100 Surabaya, East Java 60117, Indonesia, Email : mintobasuki@yahoo.co.id.

Bagiyo Suwasono, Department of Naval Architecture and Ship Building Engineering, Marine Science and Technology, Hang Tuah University (UHT), Jalan Arief Rahman Hakim 150 Surabaya, East Java 60111, Indonesia, Email : bagiyo.suwasono@hangtuah.ac.id.

Tuesdaysaka Gustaf Wasito, Jombang Informatics and Computer Management Academy, Email : sakagustaf@gmail.com

optimize procurement networks and systems, damaged or incorrect materials, limited storage capacity, limited means of transportation, and inflated maintenance costs. This modular system is an implementation of the Product-oriented Work Breakdown Structure (PWBS) concept, which originally used the Full Outfitting Block System (FOBS) [18] run by PT. PAL. There were several obstacles that occurred because design, material, or equipment factors were often delayed, resulting in delays in ship delivery. Based on data from IPERINDO and BRIN, around 15–30% of ship projects experience delays [21], Shipyard data shows that there were delays in the delivery of 5 ships between 2011 and 2015, including two 17,500 LTD tankers, two 2400 HP tug boats, and an SSV Philipphines Navy ship, with delivery delays ranging from 0.5 to 6 months [3]. These delivery delays were influenced by the readiness of the supply chain in terms of material availability during the ship production process, even though PT PAL is capable as a shipyard in terms of technology in supporting modular shipbuilding technology [6]. This was because the materials or equipment to be installed were often not ready. The performance of the supply chain in the procurement of outfitting and equipment must bring about drastic changes in cost efficiency, productivity, and accelerate ship production [18]. Modular shipbuilding requires the supply chain system to work in parallel to provide all equipment and outfitting throughout the shipbuilding process [19]. Therefore, there is a need for an efficient material procurement system with capable supply chain vendor partner management. Negotiations during auctions have been conventional in nature, making them vulnerable to fraud during implementation.

Therefore, a new breakthrough in the form of an E-Auction, which is an electronic auction, is needed. The purpose of electronic auctions in community service is to find efficient and accountable prices that can be justified. On the other hand, manual meetings are not necessary; vendors can participate in meetings and auction processes from their respective locations. The objective of this community service is also to minimize the potential risk of delays in material procurement in the supply chain so that the production process is in accordance with the initial contract. The location is on Jalan Ujung, Surabaya, East Java Province, with an area of 120 hectares. The ships that have been built so far are Pertamina Oil Tankers, Power Plant Barges, and Hospital Support Ships. Initially, there were many delays in supply chain performance due to conventional auction methods, which resulted in many cases of fraud and a greater potential for material delays. This led to greater potential losses for the company due to claims of ship production delays. This activity supports Indonesia's SDGs 8 and 17, the President and Vice President's Asta Cita 2 and 5, and the 2017-2045 RIRN focus area, which is supported by community service that prioritizes engineering that supports domestic maritime industrial transportation. This activity provides education and implementation of digitalization during negotiations to shorten the time required.

If the initial stage (upstream) of the project is delayed, the subsequent process (downstream) will also be affected, causing cost and time overruns. The novelty of this research is a web-based electronic auction model as an early measure to anticipate fraud and delays in material procurement to minimize project delays. The focus of the research is the development of a web-based electronic auction system that does not incur cost or time overruns as planned. The methods used in the development of the electronic auction system are HyperText Markup Language, Cascading Style Sheets, JavaScript, and My Structured Query Language (SQL) to build a web interface for the electronic auction system for shipyard administrators and vendors or electronic auction participants. The results of this analysis can improve the effectiveness of shipbuilding supply chain management and reduce the risk of losses for both project owners and shipyards

II. METHOD

A. Description

This research is descriptive qualitative [20] with a case study approach to gain an in-depth understanding of supply chain performance during material auctions in support of shipbuilding in East Java, Indonesia, conducted from April to September 2025. Data was collected through observation, interviews, surveys, and literature studies, covering primary data from direct informants and secondary data from documents, articles, and books. Data analysis began with a literature study on the supply chain process of auctions, which are often prone to fraud due to a lack of transparency during the auction process. The digitization of E-Auction auctions is an effort to prevent fraud during negotiations that result in financial and time losses. Another solution is the implementation of E-Auction to bring in materials in a more scheduled or regular manner, thereby reducing wasted time due to late arrival of materials with various factors and material specifications that do not meet applicable standards. The use of E-Auction digitalization tools in the supply chain to enhance the credibility of the company, as well as to provide education and motivation that facilitates the implementation of auctions for the procurement of construction materials and ship repairs.

This new research creates a digital E-Auction model in the supply chain to enhance the company's credibility and provide education and motivation that facilitates the implementation of auctions. It minimizes the potential risk of delays in material procurement in the supply chain so that the production process is in accordance with the initial contract. The method used in the development of the electronic E-Auction is based on HyperText Markup Language (HTML), Cascading Style Sheets (CSS), JavaScript, and My Structured Query Language (MySQL) to build an electronic E-Auction web interface for shipyard administrators and vendors or electronic E-Auction partners. Technologically, this system was developed using the Laravel framework as the backend, while the frontend uses HTML, CSS, and JavaScript to create a responsive and user-friendly display. Data will be managed using MySQL as the main database, ensuring that all transactions and information

are stored securely and are easily accessible and can be used by a maximum of 100 users simultaneously. This application is capable of handling the auction selection process efficiently, ensuring that every transaction takes place in real-time and transparently. Cloud-based data storage allows companies to manage large amounts of data without worrying about capacity limitations. The final stage includes a discussion of the results, conclusions, and recommendations for supply system integration to mitigate the risk of delays in shipbuilding in the future.

The E-auction model process to be built into the supply chain system consists of an auction chairperson who will issue the minutes of the auction winner nominees. The auction operator from the shipyard holding the auction will enter the project data specifications to be included in the auction, the list of auction participants by entering the data of the list of auction participant nominees and the bid prices submitted during the auction.

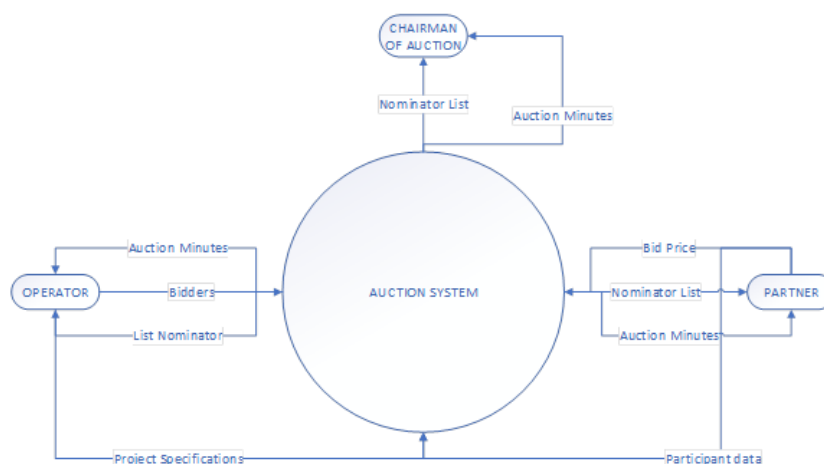


Figure. 1. Data Flow Diagram of the E-Auction Electronic Auction Supply Chain for Shipyards

Data Flow Diagram (DFD) is used to describe the network system between functions that are related to each other to show the flow of data storage. In online auction applications, DFD connects sellers, buyers, and administrators along with their information systems.

The digital technology-based E-auction program is a tangible manifestation of inclusive and adaptive public service innovation in line with current technological developments. This program was developed as a digital solution to improve transparency, efficiency, and accountability in the procurement of goods and services. By utilizing secure and responsive web technology, this system allows auction participants (the public) to participate in real-time from various locations, without geographical restrictions.

E-Auction is an information system designed to facilitate the auction process in the Supply Chain Division of PT. PAL Indonesia and to reduce fraud during the auction process and maintain the transparency of the auction process so that the auction process is very fair and accepted by all auction participants. The auction process using E-Auction was then integrated with the information system already developed by the Supply Chain Division of PT. PAL Indonesia, making the existing system even more comprehensive.

The E-Auction that has been developed is an improvement on the existing system in the Supply Chain Division of PT. PAL Indonesia in maintaining the transparency of the auction process, thereby ensuring good governance. The E-Auction that has been

developed is an application of information technology and part of the innovation developed in society or industry to maintain the relevance and participation of society in the management and realization of transparency. Transparency needs to be continuously developed in management in accordance with the maritime industry to maintain the trust of the national and international community. Negotiations in auctions have so far been conventional in nature, making them vulnerable to fraud during implementation. The conditions of conventional auctions can be seen in Figure 2, where there is still frequent lack of transparency and losse.



Figure 2. Conditions of conventional auction

The development of an e-auction model can be divided into several stages as shown in Figure 1.

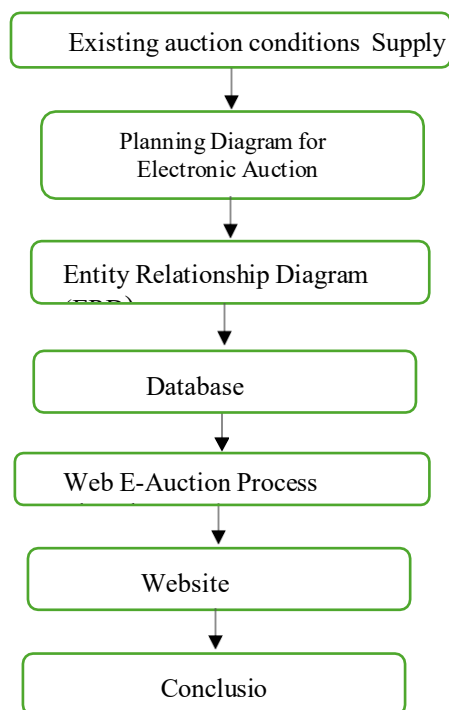


Figure 3. Auction Operator Flowchart

The stages of building an Entity Relationship Diagram (ERD), the Database Design stage, the Flowchart of the process flow of how the application will be run, and the stage of displaying the Website User Interface for administrators and Auction Operator users.

A. E-Auction System Planning

Planning begins by examining the existing e-auction conditions in the supply chain and identifying the needs of auction participants. Based on the existing problems.

B. Entity Relationship Diagram (ERD)

The ERD contains entity tables that are interconnected between one entity and another. In designing the auction application, four entities are required, namely: Operator, Auction Chairperson, and Partners.

C. Database Design

Database design is needed to meet the requirements for application development. Several tables will be needed, such as: xproject table (information about projects), member table (information about auction participants), and bid table (information about bid values).

D. E-Auction Web Process Flowchart

The flowchart shows the process flow of how the application will be run. Starting from when the user opens the application until it is closed again, it can be explained briefly with a flowchart. In the online auction application, we created two flows, the first for seller users and the second for buyer users.

E. Website Display

The website display begins with the auction login for auction administrators and auction participants. It contains several features for auction administrators and features for auction participants. In addition, there are also minutes of the auction results as a nominator for the auction winner. Everything is integrated to fulfill Eaucion activities in preventing fraud and increasing the transparency of auction activities so that the implementation of the supply chain supporting shipbuilding and maritime industry floating vehicles is carried out in accordance with the construction contract.

III. RESULT AND DISCUSSION

This system is designed to improve the efficiency of the auction process and ensure transparency in transactions. This application is used by several users with different roles. Engineers issue Bills of Material as a basis for planning the procurement of goods. The planning team compiles a Material List in accordance with the project implementation schedule. The supply chain team conducts a sourcing or inquiry process with several potential vendors to obtain the best offers. Interested vendors submit their bid prices or quotations. The verification team evaluates the incoming offers to ensure they meet the company's requirements.

Technologically, this system is developed using the Laravel framework as the backend, while the frontend uses HTML, CSS, and JavaScript to create a responsive and user-friendly interface. Data is managed using MySQL as the main database, ensuring that all transactions and information are stored securely and are easily accessible and usable by up to 100 users simultaneously. This application is capable of handling the auction selection process efficiently, ensuring that every transaction takes place in real-time and transparently. Cloud-based data storage allows companies to manage large amounts of data without worrying about capacity limitations.

The benefits for the company are to support the goods auction selection process and facilitate the supply chain department of PT PAL in selecting the best bids. This application ensures that every stage of the transaction is carried out with high transparency and security, as well as efficient integration between users of the auction process. Its usefulness as a digitalization tool is to decide auction policies for shipyards in a credible and responsible manner. In describing the network system between interrelated functions to show the data storage flow. In the online auction application, the Data Flow Diagram in Figure 1 is shown in Figure 4. The Entity Relationship Diagram connects sellers, buyers, and administrators along with their information systems. The ERD contains entity tables that are interconnected between one entity and another. In designing the auction application, four entities are required, namely: operator, auction chairperson, and partners, as shown in Figure 4.

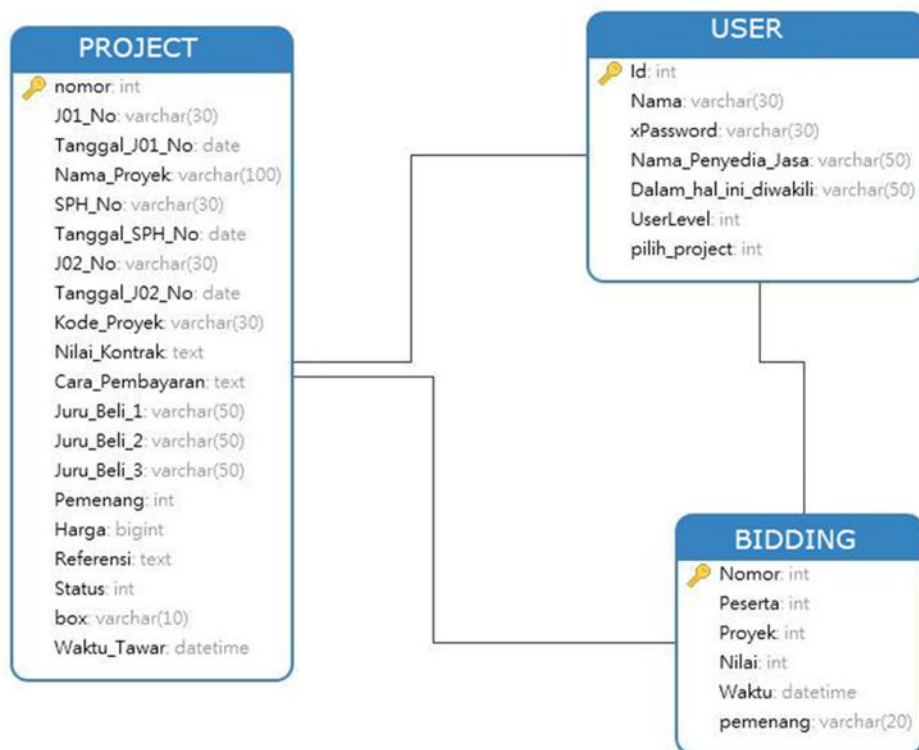


Figure 4. Entity Relationship Diagram

Based on the Entity Relationship, there are three program relationships consisting of the project entity, auction member entity, and bid entity. The project name contains a description of the project code, date, contract value, winner, and bidding time. The member entity

contains the ID, service provider name, and project selection. Furthermore, the bid entity consists of the number, participant, project, value, time, and project winner.

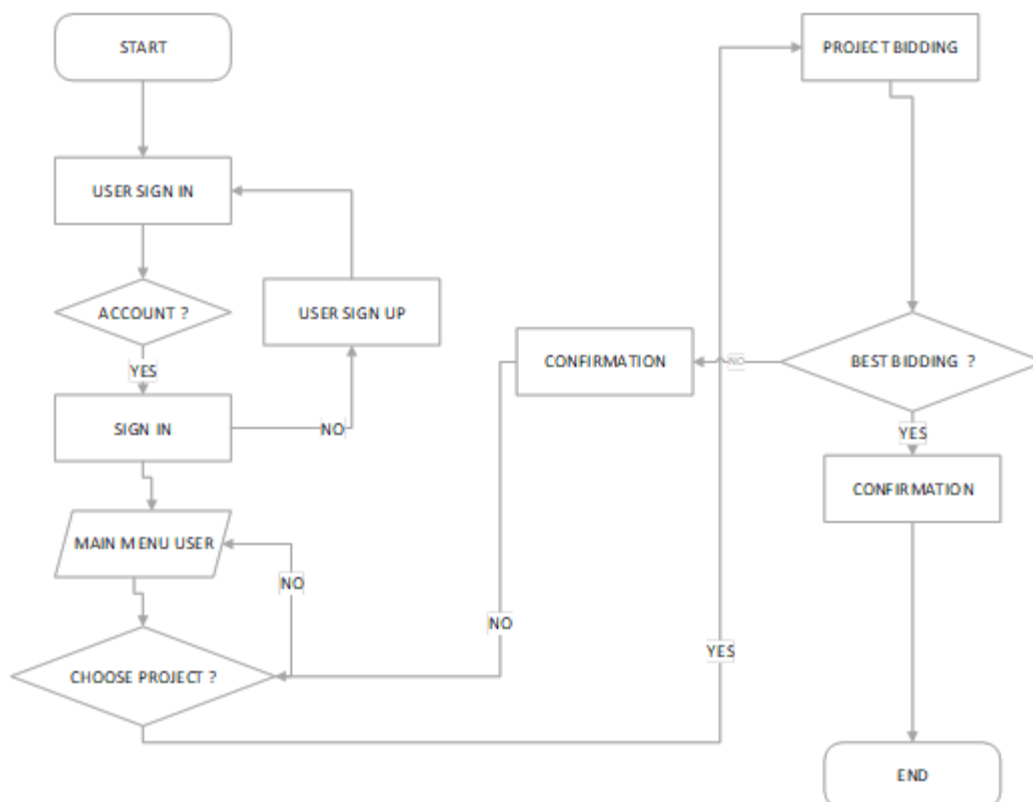


Figure 5. Bidder Flowchart

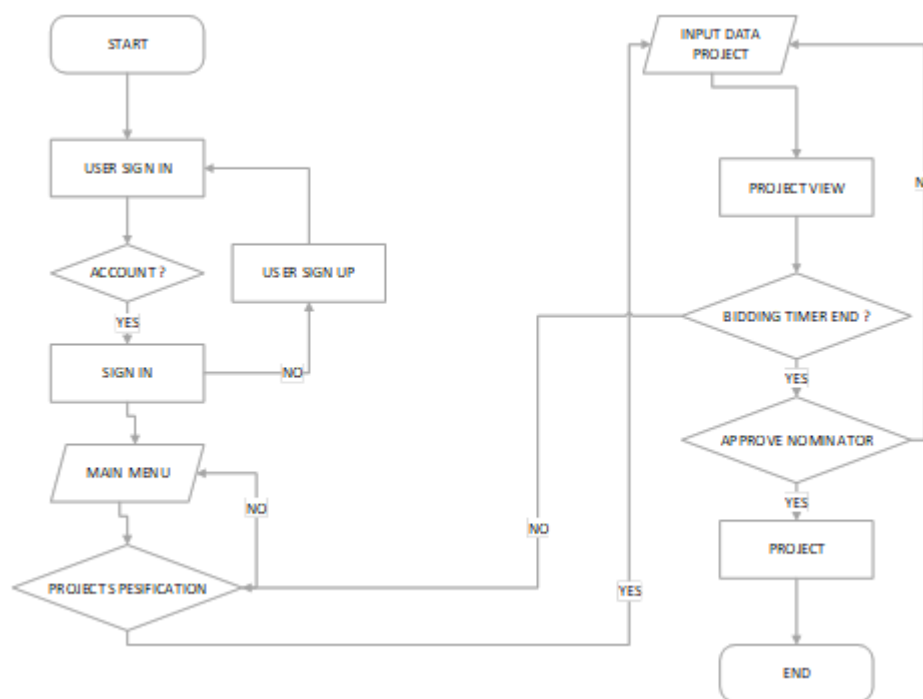


Figure 6. Auction Operator Flowchart

The steps taken in the implementation of E-Auction to ensure an accountable auction are as follows:

- Registration & Verification of Providers involves providers registering an account in the e-auction system. After completing company data, legalities, and required documents, the LPSE Admin verifies the completeness and validity of the documents. Output: Active accounts for providers who pass verification.
- Procurement Package Creation by the Working Group involves the ULP Working Group creating a procurement package: (Package name, technical specifications, estimated price (HPS), auction stage schedule). Auction documents are uploaded to the system. Output: Active procurement package accessible to providers.
- The Auction Announcement system announces auction packages according to schedule. Providers can view package details and procurement documents. Output: Packages are available for participant registration.
- Registration and Document Download by Suppliers in the form of suppliers registering to participate in a specific auction and downloading auction documents for review. Output: Auction participants are registered and ready to participate in the bidding process.
- Instruction (Auction Explanation) – Optional in the form of a working group holding a question and answer session via the system (written or video conference), clarification of auction documents is provided to participants. Output: Minutes/clarifications are announced to all participants.
- Submission of Bids: Providers submit price bids and technical documents through the system, which automatically encrypts them. Output: All bids are stored in the system (encrypted).
- Opening and Evaluation of Bids: The system automatically opens bids according to the schedule, and the Working Group evaluates the bids technically and in terms of price. Output: Evaluation results determining the winner.
- Determination & Announcement of Winners: The Working Group determines the winners based on evaluation. The system automatically announces the winners to all participants. Output: The winner's decree and auction results are published.
- Objections/Appeals: Participants who are dissatisfied can submit objections through the system, and the Working Group provides answers/responses to the objections. Output: Completion of the objection period or appeal process.
- Contract Signing: The PPK invites the winner to sign the contract, and the system records the contract as part of the procurement. Output: Electronic contract or supporting contract documents.

A simulation of the implementation of the E-Auction, which is an electronic auction, was conducted on August 27, 2025, and improvements were made on Wednesday, September 10, 2025. This was done to refine the program to meet the needs of the PT PAL family cooperative and vendors during auctions in the field. In the implementation of this E-Auction, there are two display sides, including:

- For administrators held by shipyard operators with the link: rock.hangtuah.ac.id/ptpal
- For vendors or supplier partners supporting the supply chain, with the link: rock.hangtuah.ac.id/lelang

The administrator's program interface can be viewed in Figure 6. This login page is used to authenticate users before they enter the system. Users are required to enter

their username and password. If the login is successful, the system will redirect the user to the main menu. This login security is important to restrict access to auction administrators only.

Figure 7. Login Display for the Auction Operator Administrator of PT PAL Indonesia

Project	Username	Password	Nama Penyedia Jasa	Dalam hal ini diwakili	User Level
E190NE24, BMPP	admin	admin	-	-	Administrator
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa1	Jasa1	PT.LAUT MAS	RONI SUBAGYO	Default
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa3	Jasa3	PT.ADI KENCANA	RUDI WARAHNAN	Default
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa2	Jasa2	PT.LAUT MAS	RONI SUBAGYO	Default
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa4	Jasa4	PT KENCANA EMAS	Hadi wiyono	Default
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa5	Jasa5	PT CENDANA EMAS	Irwani wiyono	Default
E240ND15, PLTU LABUAN BANTEN PROYEK HE C3W	Jasa7	Jasa7	PT Timur Jaya	Intan	Default

Figure 8. Website Home Display for Online Auction Operator Administrator Features

In Figure 8, there is a screen display as an administrator function which can be described as follows:

User: administrator who uses the application. The username displays Change auction member data from various vendors with unlimited capacity, meaning that one million vendors can be entered.

Project: Change project data to enter various projects and bidder data lists with filter facilities, winner determination, and bid printing (there are columns for bid time, project code, project name, SPH (price quotation letter sent by the vendor to PT PAL), SPH date, winner, and status. Auction menu: This display has features for participants, projects, values, time, and projects. One company can have multiple users. If different bids are made, they can be done using the quick edit button. This display provides a form for editing member information. Data that can be changed usually includes member names, addresses, contacts, and other information stored in the database. The goal is to keep the data accurate and up to date.

The project menu has edit, quick edit, copy, print, and export features that are similar to the user menu. When the project code field is selected, it will print the negotiation report. This section displays the project edit form. Admins or authorized users can change project details such as the project name, document number, date, and project description. This feature helps update project information when there are changes in the field.

The auction menu consists of the auction participant field, auctioned projects, bids, and auction submission time. The rightmost button is the nominator menu. When clicked, it will enter the participant as the auction winner.

The program display for vendors or supplier partners supporting the supply chain can be seen in Figures 9 to 11.

In Figure 10, the vendor display includes the service provider's identity and representative name. The online auction section features Project Code, Project Name, Auction Deadline, Time Remaining, Time Expired, Current Lowest Bid Value, and Bid Value.

Figure 9. Partner Supplier Login Menu Display

Figure 10. Supplier Partner Menu Content Display

Figure 11. Program Display for Auction Implementation for Vendors or Supplier Partners

The system will be operated by an administrator appointed by the website owner. The person operating the system is responsible for all processes that occur on the online auction website. Some of the tasks that will be carried out during operation include:

- Performing system updates or repairs.
- Entering information regarding requirements and procedures for participating in online auctions.
- Receiving and taking action on complaints of fraud or prohibited activities in the forum by users.
- Performing routine website maintenance.
- Having the authority to delete users proven to have.

IV. CONCLUSION

Digitalization of E-Auction auctions in the supply chain to enhance company credibility, as well as provide

education and motivation to facilitate the implementation of auctions for the procurement of construction materials and ship repairs. This prevents fraud during negotiations that could result in financial and time losses. Both of these losses will have an impact on the length of ship construction due to late arrival of materials and material specifications that do not meet applicable standards.

- Training resources, both partners and vendors, to improve IT digitalization skills and prudence in negotiations. The aspects of this activity are social aspects, including the knowledge and skills of partners and vendors. Digitalization of E-Auction auctions to facilitate the work of procuring goods, as well as providing education and motivation that makes it easier for partners and vendors to have knowledge and skills in digital E-Auction.

E-Auction can be applied by officials, auction participants, and vendors because the program is easy to

implement and is continuously evaluated for improvement. E-Auction is a small part of the supply chain management (SCM) process. Therefore, it needs to be developed by integrating the entire SCM process so that accountability can be easily traced. The plan is to develop warehousing by using tools such as semi-robotic machines for the warehousing service process. Storage racks utilize existing assets, but building the facilities requires considerable costs. For the program we are working on, it will only need to be integrated with the existing system at PAL (IM4). The Maritime Industry 4.0 (IM.4) system adopts *Artificial Intelligence* (AI), *Internet of Things* (IoT), *Big Data*, and *Dashboard Monitoring* technologies. *This* aims to analyze *inventory management* to support *supply chain* operational performance.

ACKNOWLEDGEMENTS

The author would like to express his appreciation to Kemdiktisaintek for the Community Empowerment committed fraudulent acts and cancel transactions during the auction process. Going forward, website maintenance will be carried out periodically along with improvements and developments over time. So, if there are tools that are considered important but were not available on the website when it was first created, they can be added during the development process, or tools that are not effective can be removed from the website.

- Provide a deadline to the relevant parties to complete the technical evaluation of the materials to be ordered. The Project Team must assist in coordinating with all parties to accelerate the technical evaluation process, especially with the Owner regarding the agreed master contract.

Partnership scheme dated May 28, 2025, number 124/C3/DT.05.00/PM/2025 and the follow-up contact from PTS-Chair dated May 29, 2025, number B/30/DT.05.00/PL/UHT.C7/V/2025, Universitas Hang Tuah Surabaya, and partners Koperasi Keluarga Besar PT-PAL and the Supply Chain Division of PT PAL Indonesia for their support.

REFERENCE

- [1]. Mustajib, MI, Ma'ruf, B, Basuki, SSA, Putera, EY; Irawan, B, Baroroh, I, Sutrisno, S; Dewi, DA, Prioritizing Key Internal Strategic Factors for Long-term Competitiveness of Medium-sized Shipyards using the DEMATEL-ANP Method, Results in Engineering 25, 103996, 2025. DOI: 10.1016/j.rineng.2025.103996
- [2]. Arifandy, I., Daga, R. & Didiaryono, 2023. Analysis of the Government Goods and Services Procurement System at the South Sulawesi Provincial Goods and Services Procurement Bureau Through the Reviu Application. Nitro Management Science Journal, 2(2), pp. 122-137.
- [3]. Kurniawati & Pribadi, 2008. Material Supply Chain in the Shipbuilding Industry. PSP Bulletin, pp. 38-58.
- [4]. Santoso D, Lestari R, & Pratama A, (2020), "Analysis of supply chain management in the maritime industry," Journal of Maritime Engineering, 12(3), 78–85.
- [5]. Nazla, A. & Vikaliana, R., 2024. Risk Analysis in the Procurement Process at Indonesian Oil Companies Using the House of Risk Approach. Journal InTent, 7(1), pp. 33-40
- [6]. Palippiu, H., Wahyudiin & Rahmat, N., 2021. Risk Analysis of Shipbuilding Using the Consequence/Probability Matrix Technique. Journal of Marine Science and Technology Innovation, 2(5), pp. 86-91
- [7]. Intan Baroroh, Galuh Valent Setiawan, Ali Azhar, Didik Hardianto, Akhmad Basuki Widodo. (Received: August 10, 2023 / Revised: August 15, 2023 / Accepted: August 16, 2023). Risk Analysis of Delay In Ship Repair KM Binaiya with Bayesian Network Method. International Journal of Marine Engineering Innovation and Research , Vol. 8(3), Sept. 2023. 449-459 (pISSN: 2541-5972, eISSN: 2548-1479).
- [8]. Intan Baroroh , Ndaru Gilang Ramadhan, Didik Hardianto, Tri Agung Kristiyono. (Received: November 14, 2023 / Revised: November 15, 2023 / Accepted: November 16, 2023). Risk Evaluation of Repair Delays with The Failure Modes and Effects Analysis (FMEA) Method. International Journal of Marine Engineering Innovation and Research, Vol. 8(4), Dec. 2023. 605-615 (pISSN: 2541-5972, eISSN: 2548-1479).
- [9]. Intan Baroroh, I.M. Ariana, A. A. B. Dinariyana. Risk Analysis of Engine Room Module Installation with Integration of Bayesian Network and System Dynamics. International Review of Mechanical Engineering (I.R.E.M.E) IOP Conf. Series: Earth and Environmental science 557, Vol. 16, No. 6 ISSN 1970–8734. June 2022, <https://doi.org/10.15866/ireme.v16i6.22456> 012048, IOP Publishing Doi. 10.1088/1755-1315/557/1/012048
- [10]. Wenny Prawati, Intan Baroroh, (Received: May 11, 2025 / Revised: June 3, 2025 / Accepted: June 23, 2025 / Available Online: June 30, 2025). Hospital Auxiliary Vessel Fore Part Zone Planning to Improve Productivity with Precedence Diagram Method International Journal of Marine Engineering Innovation and Research, Vol. 10(2), June, 2025.525 - 536 (pISSN: 2541-5972, eISSN: 2548-1479).
- [11]. Intan Baroroh, Didik Hardianto, Siswo Hadi Sumantri, Sutjipto, Tri Agung Kristiyono. (Received: July 9, 2024 / Revised: August2, 2024 / Accepted: August 9, 2024). Risk Evaluation Concept of Supply Chain in Modular Construction Shipbuilding
- [12]. Intan Baroroh, Buana Ma'ruf, Minto Basuki, Didik Hardianto, Tri Agung Kristiyono. Engine Room Module Installation System Risk Analysis Based on Bayesian Network. International Journal of Technology 15(1) 75-86 (2024).
- [13]. Ariany, Z., Pitana, T., & Vanany, I. Risk Assessment of New Ferry Ship Construction in Indonesia Using the Failure Mode Effect and Analysis (FMEA) Method. Journal of Applied Engineering Science (2023). 21, 3, p. 872-883 12 p.
- [14]. Zulfaidah Ariany, Trika Pitana, Iwan Vanany, 2024. Integration of FMEA and Bayesian Network Method for risk assessment of component delays in ferry ship construction. Journal (2024) (EUREKA: Physics and Engineering) Number 1.
- [15]. Baroroh, I., Sutjipto, Hadi S. Siswo, Jadmiko, Edi., 2025. Shipyard Supply Chain Performance for Modular Shipbuilding Construction. Hang Tuah University Press, 1(1). <https://doi.org/10.30649/uhtpress.v1i1.15>
- [16]. Baroroh I, M. Ariana, A.A.B. Dinariyana, 'Supply Chain Performance analysis on modular construction Shipbuilding'.
- [17]. Baroroh I, Febrianto T., Eko, Hadi S. Soswo , Azhar. Ali, Hardianto. D, Agung K. T, Implementation of Material Control in Tugboat Ship Building Using the Lot For Lot (LFL) Method Case Study : (PT.PMP). International Journal of Marine Engineering Innovation and Research, Vol. 9(3), Sept. 2024. Pp. 408-416, 2024. DOI: 10.12962/j25481479.v9i3.20859
- [18]. Baroroh I, Buana Ma'ruf, Basuki, M, Hardianto, D., Kristiyono, A. 2024, 'Engine room Module installation system risk analysis based on Bayesian network,' International Journal of Technology 15(1), p.75-86.2025.doi:10.14716/ijtech.v15i1.5136
- [19]. Baroroh I, Made Ariana I, A.A.B. Dinariyana, Suwasono, B, Hardianto, D. , 2025. Risk Evaluation of Engine Room Installation in Modular Ship Construction using the Bayesian Network Method. Hang Tuah University Press, 1(1). Retrieved from <https://repository.uhtpress.hangtuah.ac.id/index.php/UHTPress/article/view/13>
- [20]. Sugiyono. Quantitative, Qualitative, and R&D Research Methods. Bandung: CV Alfabeta, 2022. 1405, 2022; Statistics for research.
- [21]. BRIN, 2023. Investment Project Ready to Offer, Jakarta: Badan Riset dan Inovasi Nasional