INTERNATIONAL JOURNAL OF METACENTRE
MARITIME APPLICATION, TECHNOLOGY, ENGINEERING, AND TRANSPORTATION
www.ijm-nasp.unhas.ac.id
eISSN : 2809-8307

The Design of Digital of information System For Shipbuilding Proccess : Current Condition of Medium Shipyard

Andi Rachmat Darwis [1*], Suandar Baso [2], Syamsul Asri [2], Moh Rizal Firmansyah[2], Muhammad Akbar Asis[2]

[1*] *Magister Student, Study Program of Naval Architecture, Faculty of Engineering, Hasanuddin University*
[2,] *Department of Naval Architecture, Faculty of Engineering, Hasanuddin University, Indonesia*

Received: 02/05/2022
Revised: 30/05/2022
Accepted: 02/06/2022
Published:15/06/2022

DOI :

[*] Corresponding author:
ardrachmat.ar@gmail.com

Abstract

In the era of the industrial revolution 4.0, information technology is developing rapidly so that it is now easier to design an information system that can facilitate aspects of work. The ship production process in a shipyard involves complex information. The Information should be manage to keep the shipbuilding project progress with the Plan. The smooth flow of information during the ship production process will delay project completion and reduce costs. Currently, it take time to transfer information between departements since the required information distributed in paper based.Hence, a digital integrated information system that functions to facilitate the flow of information between departements is required to overcome the problem. This study aims is to design a digital information system facilitate the flow of information among four departements in a medium shipyard. The departements consist of the design,purchasing, material warehouse, dan production departement ..

Keywords: Information system; Ship production process; Ship production division

1. Introduction

A shipyard is a place designed to repair and build ships. There are approximately 250 registered shipbuilding companies operating in Indonesia with capacities between 50 – 50,000 gross tons.[2] From this range, most of these shipyards have capacities below 500 gross tons. The rest of the shipyards consist of shipyards with capacities range from 1000 to 5000 gross tons.

Most of the small shipyards in Indonesia have a core business of ship repair and new buildings. However, the applied production technology of building new ships in thesel shipyards is still relatively using the old version of ship production technology.

In today's industry 4.0 era, ship production technology must also be developed to the level of the the more advance technology which refer to the integration of Hull construction, outfitting and painting or better known as the Integrated Hull Construction, outfitting, and painting (IHOP) method at the stages of the development process of ship [3,4].

In The shipbuilding industry is in dire need of upgrading with new engines, software and new organizational restructuring implemented; however still faced difficulties with many changes during construction and a large number of ship series leading to loss of cost control and quality control [5].

To support the ship production process in the Indonesian medium shipyard, a digital information system for the ship production process is required. The Existence a digital information system will increase the ship production procces [6].

In the ship production process, a large amount of information is used and flows within and between the departments involved in the shipbuilding process. Each shipyard handles this information and its flow differently depending on the technology implemented at the respective shipyard. In general, it is difficult to standardize information and its flow that can be used for all shipbuilding projects in shipyards [7]. A ship production process is a very complex process, especially in the Design division (Engineering), material warehousing, production division and purchasing. division.

However, there are also several aspects that must be monitored or that need to be carried out in the 3 divisions in the shipyard's for good management process, including: man, material, money, machine and method [8] and [9].

2. Methods

The research method used is a case study The object of research is the ship production process information system aIndonesian medium shipyard.

Data collecting consist of information flow from and the four division consist of a0Design, production, warehousing and purchasing sections. b) Data on suppliers of ship construction components including: Location of the supplier, what products are offered/supplied, price of the product offered, lead time of the product and transportation cost of the product from the supplier's location to the Shipyard.

The stages of the research can be divided into: a) detailing any information about the material requirements that flow in each division and from the suppliers.b) Create a coding system to identify construction components, machinery components, production data c) Design of digital shipbuilding production process information system model.

2 .1. Information System Application Design Framework

Systematic flow in the design of this information system model is presented in Fig.1.

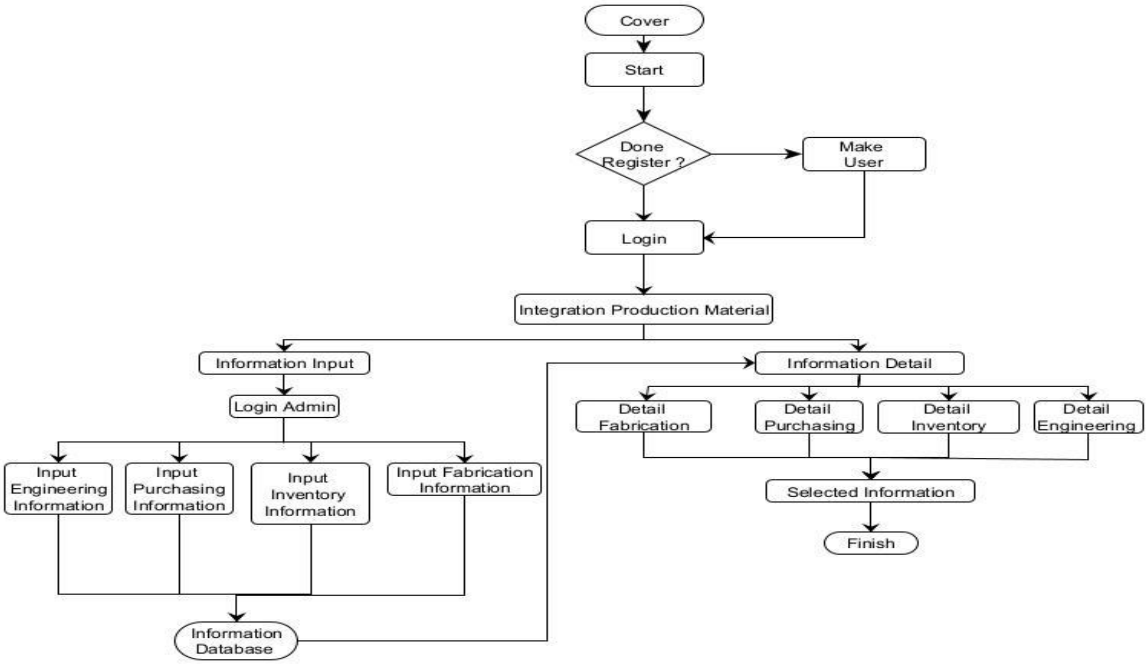


Figure 1. Framework for production information systems in each division.

Based on Figure 1 above, this information system model algorithm begins with the login stage. On the login menu each user must have a username and password that has been registered in the user database, otherwise must be register first.

The home menu is a menu that displays the types of information contained in the ship production information system. On the home menu there are 2 main menu options, namely the production information integration and the production process

On the information input menu, there are 4 divisions to choose from namely the Design Division, Purchasing Division, Material Warehouse Division and Production (Fabrication) Division. This menu is specifically only for the administration of each division that has been registered in the database. Information from each division can be seen by everyone who has registered in the user database. In this menu the user can select and print the desired information.

In the Production Process Menu, there is a choice of information on the Fabrication treatment of the Hull Block Section which has detailed information starting from Block, Sub Block, Panel and components.

3. Results and Discussion

3.1. Material Procurement Process

Presentation of Information on the Material Procurement Process in as shipyard is presented in the following 3 parts of the Flowchart :

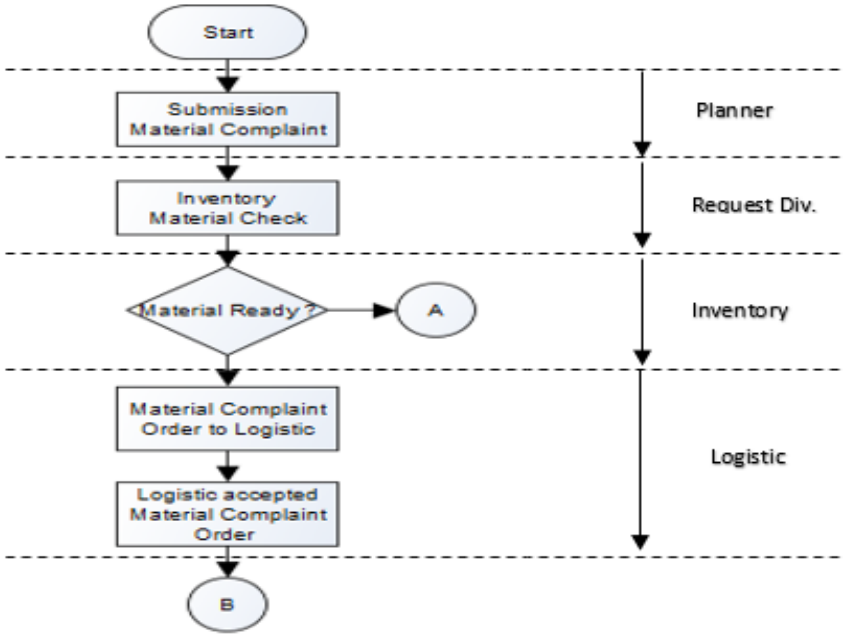


Figure 2. Material Procurement Process

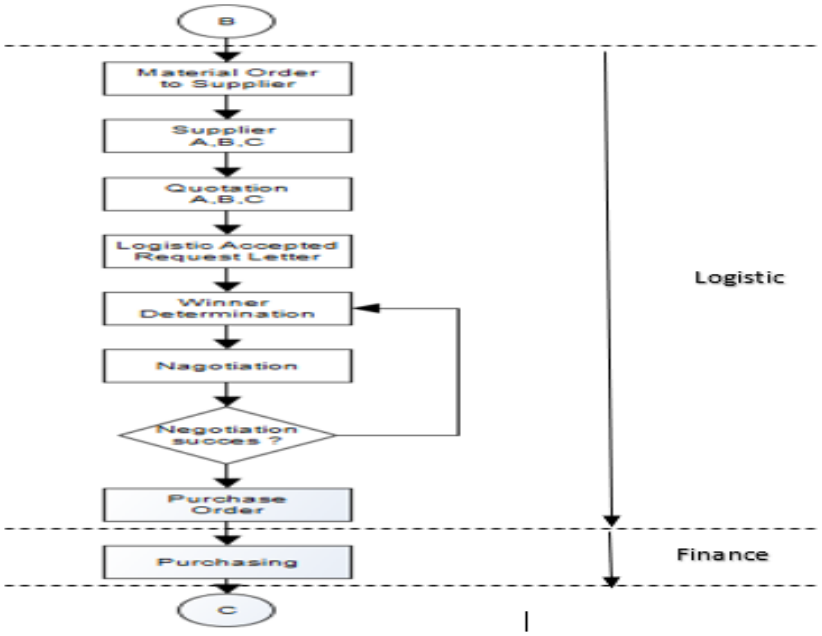


Figure 3. Material Procurement Process

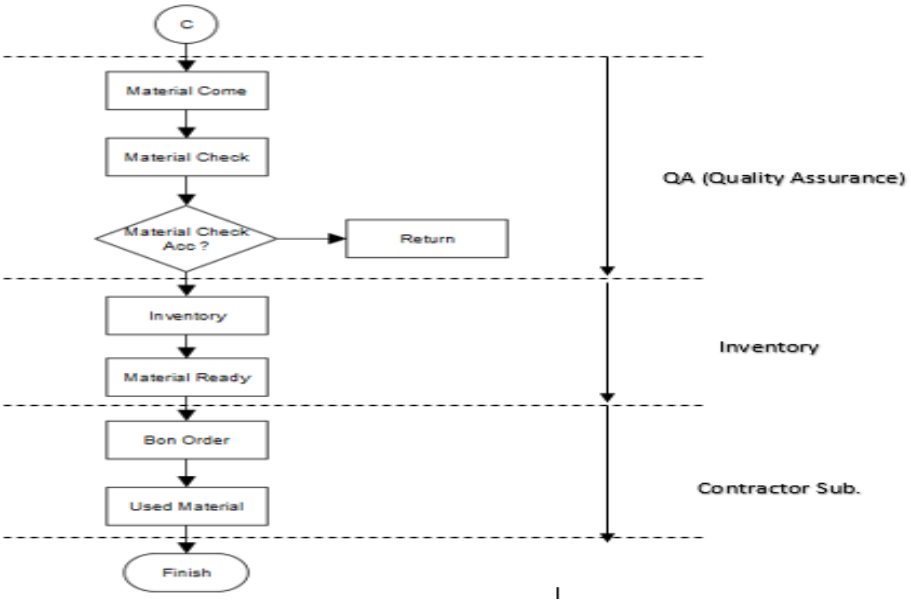


Figure 4. Material Procurement Process

The description of the material procurement procedure at are as follows:

a. The design that has been accepted by a shipyad is then processed in the Planner Section so as to produce material requirements that will be used in the construction of new ships. Furthermore, the Planner Section submits a Material Procurement Request to the Request Section.
b. Material Procurement Requests that have been received by the Request Section are then checked for Material Availability in the Warehouse.

c. Materials that are available in the warehouse can be used immediately after getting a Request Certificate by the Sub Contractor and materials that are not available will be made a Material Procurement Request to the Logistics Section of a shipyad.
d. After the Logistics Section receives a Material Procurement Request, the logistics section will write to suppliers regarding requests for material offers.
e. Supplier provides a Letter of Offer (Quotation) to the Logistics Section of a shipyad.
f. After receiving the Quotation, the Logistics Department determines the winners from the suppliers who participate in providing the Quotation.
g. After the winner is selected, negotiations will be held regarding the readiness of suppliers to supply materials at a shipyad.
h. If the negotiation fails, the winner will be re-elected (return to point 6). Meanwhile, if the negotiation is successful, the Logistics Section will make a Purchase Order to the Finance Department for further processing.
i. Furthermore, the Finance Department will make purchases in accordance with the Purchase Order from a shipyad. Logistics to the selected Supplier.
j. After the material arrives at a shipyad, the QA (Quality Assurance) Section will check material specifications based on the Purchase Order agreed by the Shipyard and Supplier.
k. If it does not match, a product return procedure will be carried out. And if appropriate, then the material will be stored in the warehouse and ready to be used.
l. The Sub Contractor will make a Request for Receipt to the Warehouse and can use the material as needed.

In the Material Requirement Planning (MRP) of a shipyad, there are several parts that play a role in the process of planning, procurement, storage and use of materials in order to create an integrated flow of material information. The information flow can be integrated with each other more efficiently if there is a model that is able to flow related information from one part to another precisely and quickly.

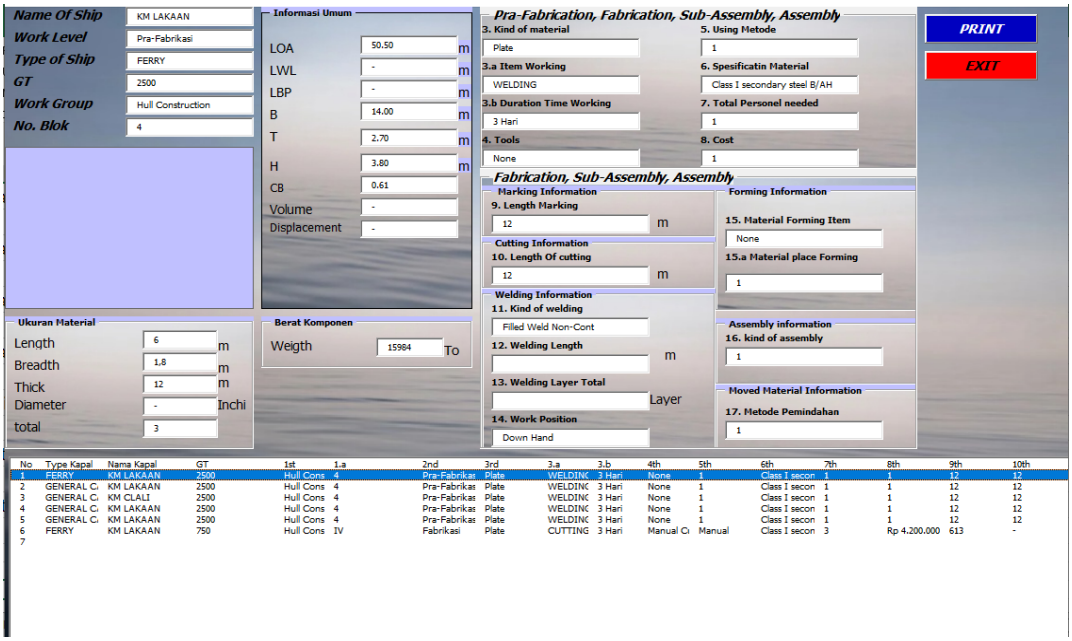
3.2. Information System Design

3.2.1 Detailed Features of Information System

The detail information feature serves to view information on material for the production of the hull block of the 750 GT Ferry Ro-Ro. Detailed Information Features are divided into 4, namely: Detailed Design Information Features, Purchase Information Details Features, Material Warehouse Division Information Features and Material Workshop Information Details Features.

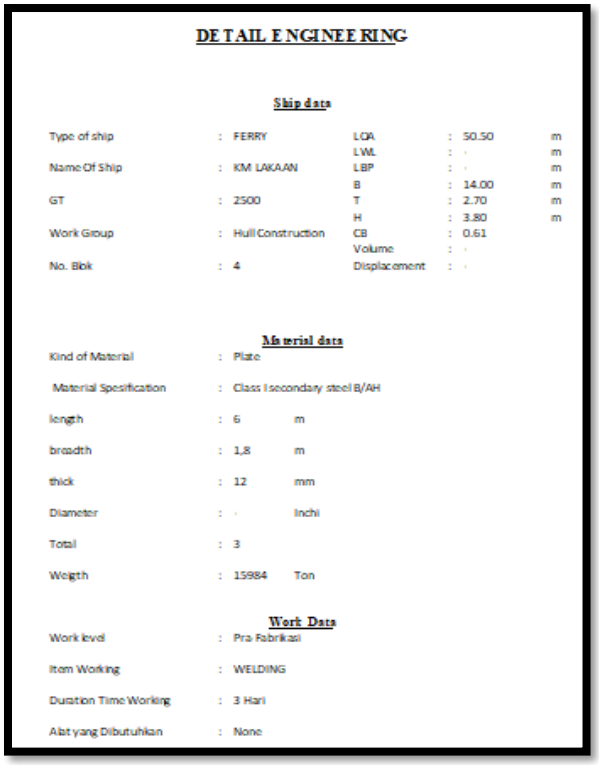
3.2.2 Detailed Engineering Information Features

The detailed design information feature contains work level, ship type, ship name, GT, input detail sizes and quantities of materials, ship data input, image input, component data input based on digits, print and exit orders as shown in Fig. 5 - 7.



No	Type Kapal	Nama Kapal	GT	1st	1.a	2nd	3rd	3.a	3.b	4th	5th	6th	7th	8th	9th	10th
1	FERRY	KM LAKAAN	2500	Hull Cons	4	Pra-Fabrikas	Plate	WELDINC	3 Hari	None	1	Class I secon	1	1	12	12
2	GENERAL C	KM LAKAAN	2500	Hull Cons	4	Pra-Fabrikas	Plate	WELDINC	3 Hari	None	1	Class I secon	1	1	12	12
3	GENERAL C	KM CLALI	2500	Hull Cons	4	Pra-Fabrikas	Plate	WELDINC	3 Hari	None	1	Class I secon	1	1	12	12
4	GENERAL C	KM LAKAAN	2500	Hull Cons	4	Pra-Fabrikas	Plate	WELDINC	3 Hari	None	1	Class I secon	1	1	12	12
5	GENERAL C	KM LAKAAN	2500	Hull Cons	4	Pra-Fabrikas	Plate	WELDINC	3 Hari	None	1	Class I secon	1	1	12	12
6	FERRY	KM LAKAAN	750	Hull Cons	IV	Fabrikasi	Plate	CUTTING	3 Hari	Manual C	Manual	Class I secon	3	Rp 4.200.000	613	-
7																

Figure 5. Stages of Detailed Engineering Information



DE TAIL E NGINEE RING

Ship data

Type of ship	: FERRY	LOA	: 50.50	m
		LWL	: -	m
Name Of Ship	: KM LAKAAN	LBP	: -	m
		B	: 14.00	m
GT	: 2500	T	: 2.70	m
		H	: 3.80	m
Work Group	: Hull Construction	CB	: 0.61	
		Volume	: -	
No. Blok	: 4	Displacement	: -	

Material data

Kind of Material	: Plate	
Material Spesification	: Class I secondary steel B/AH	
length	: 6	m
breadth	: 1,8	m
thick	: 12	mm
Diameter	: -	Inchi
Total	: 3	
Weigth	: 15984	Ton

Work Data

Work level	: Pra-Fabrikasi
Item Working	: WELDING
Duration Time Working	: 3 Hari
Alat yang Dibutuhkan	: None

Figure 6. Print Display of Engineering Division Information (Part 1)

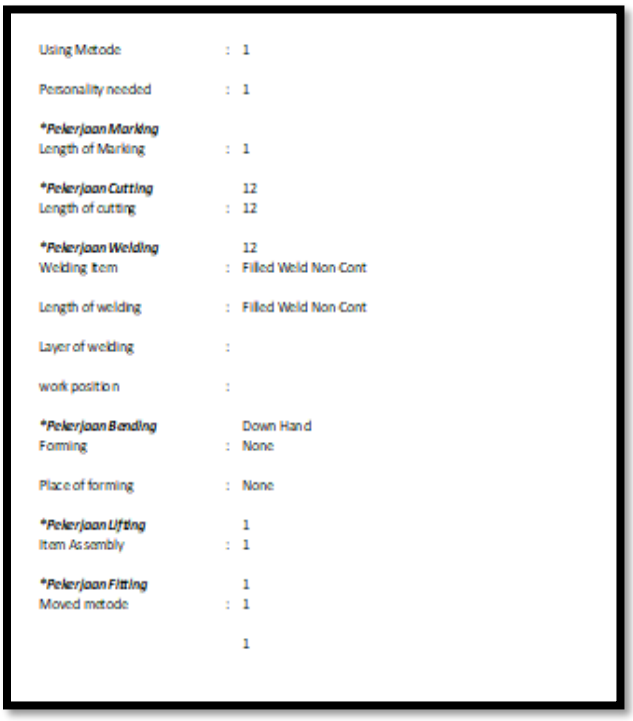


Figure 7. Print Display of Engineering Division Information (Part 2)

Based on Fig. 6 and Fig. 7 above, the information that can be known from the Design division is ship data details, material information details and work information details.

3.2.3 Detailed Features of Purchasing Information (Purchasing)

The detailed purchase information feature consists of date, ship name, material detail data, order status, delivery time and material arrival time, print and exit orders as shown in Figure 8, Figure 9

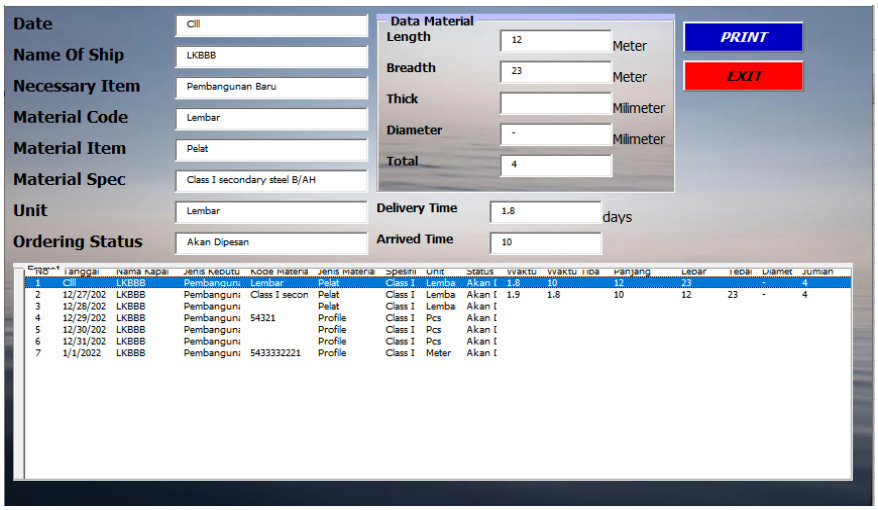
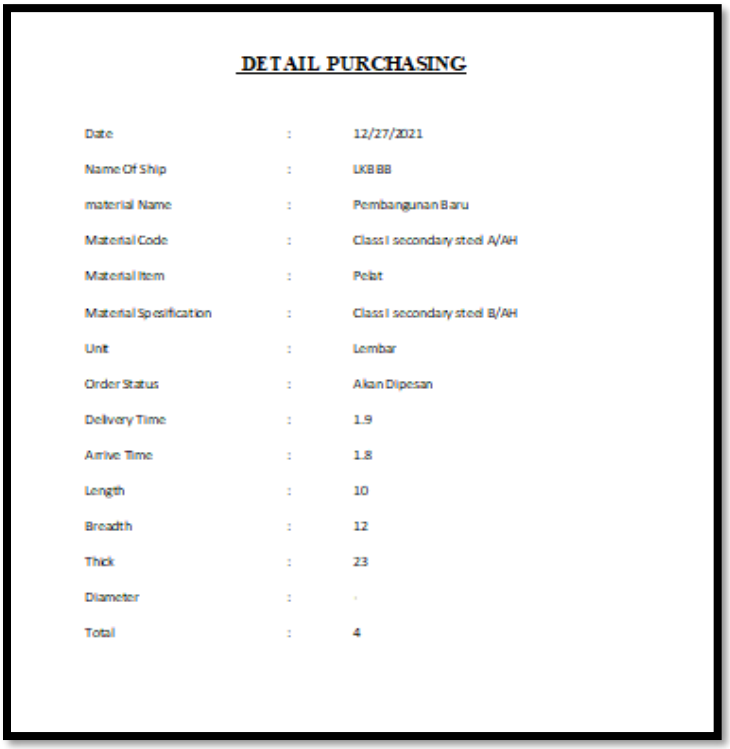


Figure 8. Detailed Purchasing Information



DETAIL PURCHASING

Date	:	12/27/2021
Name Of Ship	:	LKBBB
material Name	:	Pembangunan Baru
Material Code	:	Class I secondary steel A/AH
Material Item	:	Pelat
Material Spesification	:	Class I secondary steel B/AH
Unit	:	Lembar
Order Status	:	Akan Dipesan
Delivery Time	:	1.9
Arrive Time	:	1.8
Length	:	10
Breadth	:	12
Thick	:	23
Diameter	:	
Total	:	4

Figure 9. Print Display of Purchasing Information (Purchasing)

Based on Fig. 9 above, the information that can be known from the purchasing division is material specifications , material order status , material arrival time and quantity of material ordered.

3.2.3 Detailed Features of Material Warehouse Information

The detailed material warehouse information feature consists of 2 parts, namely inventory and outgoing material information.

- **Inventory Information Details**

  In the detailed inventory information contains the data input date , detailed material data available in the warehouse based on information from the Design division and the purchasing division, maintenance costs for materials, reorder quantity which contains information on the minimum inventory of materials to be reordered by the purchasing division, reorder status filled based on the minimum quantity available in the warehouse, print orders and add them as shown in Fig. 9 and Fig. 10

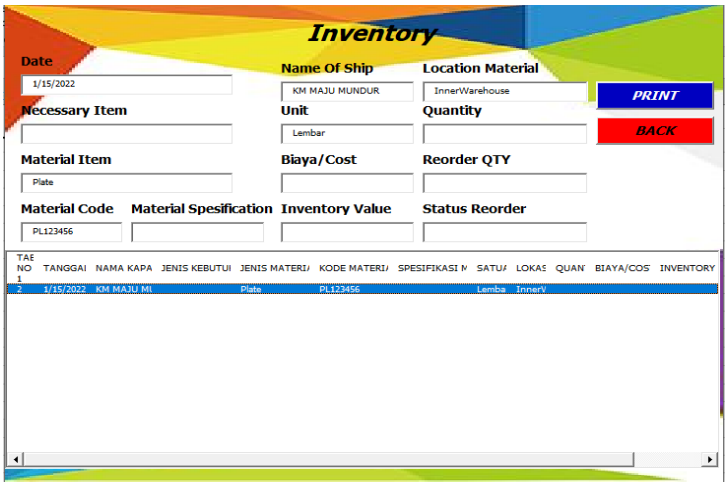


Figure 10. Detailed Inventory Information

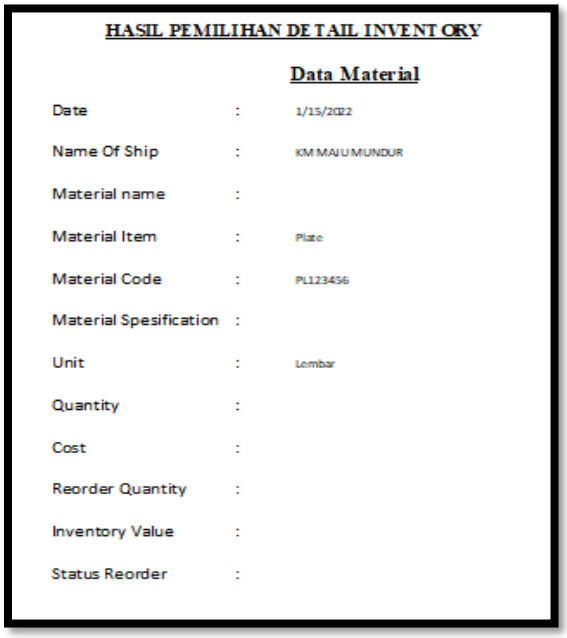


Figure 11. Print Display of Inventory Information

Based on Fig. 11 above, information that can be known from the inventory section is material specifications , amount of material available, material maintenance costs, minimum amount of material for reordering and status for material orders.

- Outgoing Material Information Details

In the input section of the material information out, it contains the date the materials came out, the details of the material that came out according to the request of the production division, the amount of material available and the amount of material that came out, the print and exit orders as shown in Figure 12 and Figure 13.

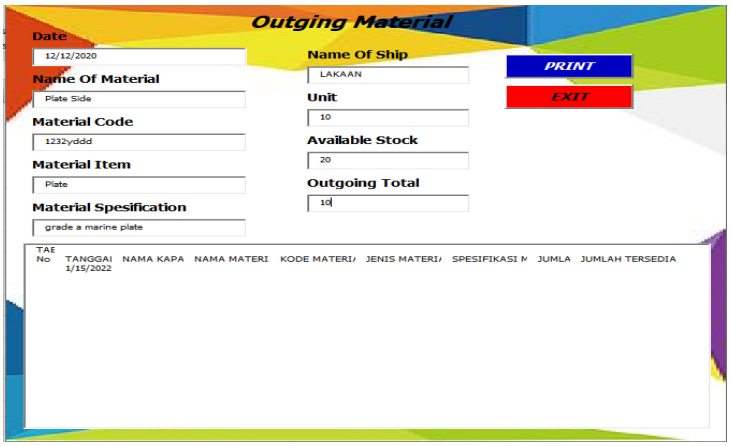


Figure 12. Details of Outgoing Material Information

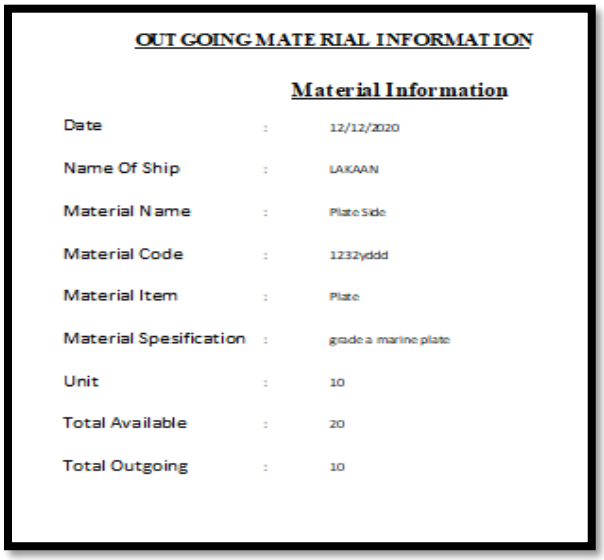


Figure 13. Print Display of Outgoing Material Information

Based on Fig. 13 above, the information that can be seen from the outgoing materials form is material specifications, the amount of material that comes out of the material warehouse.

3.2.4 Production Information Detailed Features

The process for checking the coding of ship construction components is through VBA (*Visual Basic for Application*) .

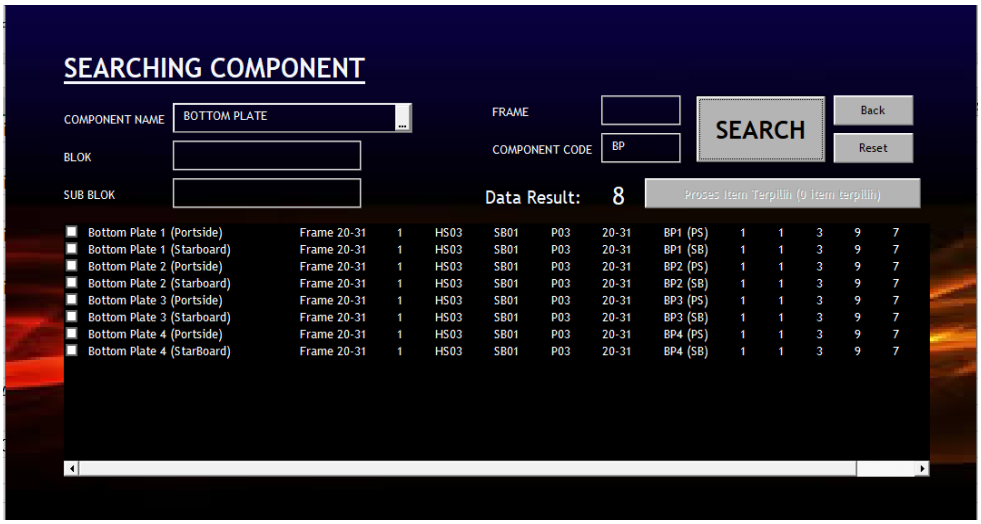
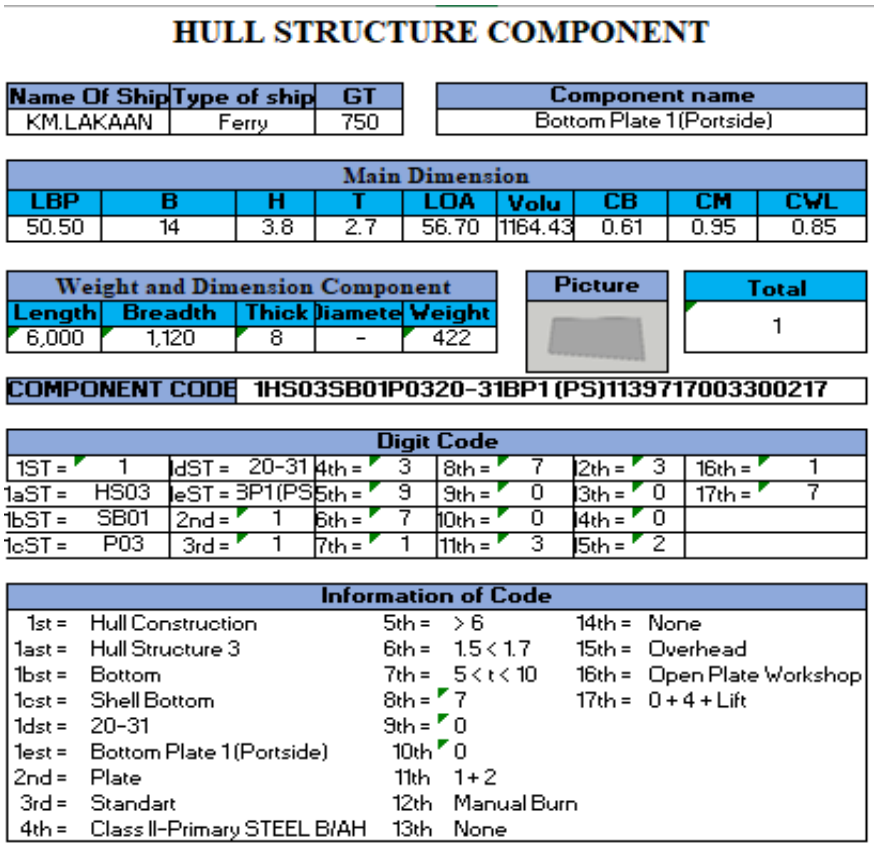


Figure 14. Component Information Search Menu

One example of the automatic identification of the code on the Ferry Ro – Ro 750 GT ship. Precisely on the *center girder construction component* located in *frames 20-31* or in block 3. Then the results of identifying component codes can be seen in the following figure:

Figure 15 Identifying component code information

In addition to displaying the result of identifying the component code). In the VBA (*Visual Basic for Application) design that has been created, you can also perform print* commands . Where if the identification of the component code is printed, the *print out results* can be seen in the following figure.



HULL STRUCTURE COMPONENT

Name Of Ship	Type of ship	GT
KM.LAKAAN	Ferry	750

Component name
Bottom Plate 1(Portside)

Main Dimension

LBP	B	H	T	LOA	Volu	CB	CM	CWL
50.50	14	3.8	2.7	56.70	1164.43	0.61	0.95	0.85

Weight and Dimension Component

Length	Breadth	Thick	Diamete	Weight
6,000	1,120	8	-	422

Picture

Total
1

COMPONENT CODE	1HS03SB01P0320-31BP1 (PS)1139717003300217

Digit Code

1ST =	1	1dST =	20-31	4th =	3	8th =	7	12th =	3	16th =	1
1aST =	HS03	1eST =	3P1(PS	5th =	9	9th =	0	13th =	0	17th =	7
1bST =	SB01	2nd =	1	6th =	7	10th =	0	14th =	0		
1cST =	P03	3rd =	1	7th =	1	11th =	3	15th =	2		

Information of Code

1st =	Hull Construction	5th =	> 6	14th =	None
1ast =	Hull Structure 3	6th =	1.5 < 1.7	15th =	Overhead
1bst =	Bottom	7th =	5 < t < 10	16th =	Open Plate Workshop
1cst =	Shell Bottom	8th =	7	17th =	0 + 4 + Lift
1dst =	20-31	9th =	0		
1est =	Bottom Plate 1(Portside)	10th	0		
2nd =	Plate	11th	1 + 2		
3rd =	Standart	12th	Manual Burn		
4th =	Class II-Primary STEEL B/AH	13th	None		

Figure 16 Print Display of Production Component Information

4. Conclusions

Based on the discussion, the following conclusions can be drawn:

1. The results of identifying information in each division are:
   In the Design division: information on the main size of the ship, the materials used and the details of the work to be done.In the purchasing division: information on the status of the material order and the time of arrival of the material ordered.In the material warehouse division: material information is available, material information is out, when material needs to be reordered.In the production division: fabrication component identification information
2. The design of an information system model that involves four divisions/sections in the shipbuilding process with some detailed information presented above, namely the design division (engineering), the purchasing division (purchasing), the material warehouse division (inventory) and the production division .

Acknowledgments

The authors would to like to thanks for all parties for their support for this research.

References

[1] HM Bunch and RC Moore, “Ship Production 2nd Edition.” p. 442, 1995.

[2] Ma'ruf , B. National Ship Industry Development Strategy Based on Domestic Production and Market Technology. Agency for the Assessment and Application of Technology, 2014.

[3] S. Vanessa, H. Marko, F. Niksa , M. Tin, “Toward Shipbuiding 4.0 - an Industry 4.0 Changing The Face Of The Shipbuilding Industry” Brodogradnja . 2018.

[4] Ma'ruf , B. National Ship Industry Development Strategy Based on Domestic Production and Market Technology. Agency for the Assessment and Application of Technology, 2014.

[5] Kagermann. H., Wahlster W., Helbig J. "Recommendations for Implementing the Strategy Initiative INDUSTRIE 4.0", Report Berlin: Industrie 4.0 Working Group of Acatech, Germany. 2013.

[6] Firmansyah, M.R, Asri, S, Fachruddin, F, Wahyuddin, Clausthaldi, F.R, 2021, Identifying and Formulating Information System of Ship Production Process for an Indonesian Small Shipyard, International Journal of Metacentre, Vol. 1, No. 1, pp. 12-23.

[7] Kim, H., at all, “Applying digital manufacturing technology to ship production and the maritime environment”, International Journal of Computer Integrated Manufacturing, 2002, Vol. 18, No. 6, pp. 427 – 441, DOI: 10.1108/09576060210429748

[8] T. Lamb and A. Arbor, “ENGINEERING F0R SHIP PRODUCTION by Prepared for The National Shipbuiiding Research Program bY The Society of Naval Architects and Marine Engineers Ship Production Committee The University of Michigan N/A,” no. January, 1986.

[9] lejandro Sanches-Sotano , Alberto Cerezo-Nawvaez , Francisco Abad-Fraga, Andres PastorFernandez and Jorge Salguero-Gomez, nn , Trends of Digital Transformation in the Shipbuilding Industry, DOI: http://dx.doi.org/10.5772/intechopen.91164 , pp. 1 – 23

[10] Widjaja , Production Management for the Shipping Industry. 1996

[11] Tularji (Ed), IPERINDO Directory 2015 – 2016 – Industrial Company Association Indonesian Offshore Ships and Facilities, DPP Iperindo , 2015