

Occupational Safety in Production of Traditional Fishing Vessels in Indonesia

Jaswar Koto,^{a,b,*}, Munirah,^a and Dodi Sofyan Arief,^c

^a)Department of Aeronautical, Automotive and Ocean Engineering, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia

^b)Ocean and Aerospace Engineering Research Institute, Indonesia

^c)Mechanical Engineering, Universitas Riau, Indonesia

*Corresponding author: jaswar.koto@gmail.com

Paper History

Received: 15-November-2013

Received in revised form: 25-November-2013

Accepted: 16-January-2014

ABSTRACT

Traditional ship in Indonesia which usually built from wood has small capacity compared to modern steel ship. Compared to modern ship building, mostly the production is to assemble block by block with machines and big cranes. However, traditional ship is one hundred per cent made from the work of man. Workers are not properly trained in a formal engineering school but only learnt the skill from senior workers. Hence, all modern concepts such as the need for safety and a proper ship production flow are not a great concern for them. In this paper, safety issue in traditional ship production process is being observed conducting direct survey to traditional shipbuilding company in Bintan, Indonesia. It is hoped that the outcome is to bring safety awareness to the traditional ship builders.

KEY WORDS: *Traditional Ship; Equipment; Traditional Ship Production Process, Occupational Safety.*

1.0 INTRODUCTION

Occupational health and safety is a discipline of area that concerns on safety and health of people at workplace. It stands out act called as OSHA which covers on prevention steps, condition, contributing factors to safety issues and also legal

consequences of disobedient.

In Indonesia, legal basis which regulating occupational safety is law No.1 1970. On this law regulates about occupational safety in any workplace, whether on land, underground, in water or in the air which are in jurisdiction area of Republic of Indonesia. Several common hazard types such as chemical, physical and safety were covered under OSHA. The laws recommend and taught employers on prevention, securing and healing in the case if accident happened.

This paper intended to analyze the safety issue in the traditional ship production process. The survey was conducted by interviewing traditional shipbuilding company owner directly in Bintan Island, Indonesia. Objective of the study is to observe and to indicate the level of safety applied by traditional shipbuilding workers during working period. By the end of this study, it is expected that awareness of safety and the implementations on safety acts will be successful among the workers.

2.0 LITERATURE REVIEW

There are several institutions of higher education, particularly in Indonesia, doing research on traditional shipbuilding, such as the Bogor Agricultural Institute. Arofik (2007) and Umam (2007) focused in redesigning and the construction process of traditional paying ship in Pemakasan, Madura Indonesia.

Other researchers from other higher education institutions also conducted the study in the same field. Aji (2000) from University of Cendrawasih, Indonesia conducted research on local knowledge of traditional boat building by Biak tribe in the Warsa district Biak Numfor regency with descriptive methods of data collection through a structural interview technique. Putri (2009) from University of Indonesia conducted a research on risk management of Phinisi shipbuilding in project implementation. The study used descriptive research methods and approaches based on risk

analysis through surveys, observations and interviews.

Maidin (2003) studied the institution of boat-building by covering the way Malay boat-builders acquire knowledge, polish skills, organize their work, and the differences they show in their work, based on an in-situ observation and on interviews with boat-builders in Terengganu. Followed by Salam and Katsuya (2008) analyzed the transformation process of wooden boats in the second half of the twentieth century, in which modern technology played an important role, in order to understand the technological adaptation of the local people to the changing situation. E. Prayetno. et.al (2012) and Mufti F.M.et.al (2012) studied quality and design issues of Indonesian traditional ships, respectively.

3.0 OCCUPATIONAL SAFETY IN TRADITIONAL SHIP CONSTRUCTION

In the provinces of Kepulauan Riau, most of ship production industry holds by traditional format of working which explains the design drawing, ship performance calculations, shipyard layout, the production flow, the ship birthing and other requirements during ship production. Workers are trained to master up the skill of using traditional tools and equipment. The only goal of traditional ship building concept is to have the ship to be able to operate at the sea. In the perspective of current regulations, the concept of working carried out by the islands ship builders are rejected as it not satisfying and contradict to safety factors.

3.1 Indonesian Traditional Shipyard Layout

Kepulauan Riau is one of provinces in Indonesia which is an archipelago area consisting of large and small islands around 2.408 islands. 366 of the islands have been inhabited and 2.402 islands have not been yet. Kepulauan Riau Province dwelled upon earth about 253.420 km² which consisting 242.825 km² (96%) of sea and 10.595,41 km² (4%) is land, as shown in Figure.1.

Current research aims to promote a better understanding production process of traditional ship in Kepulauan Riau, Indonesia related to safety issues. As case study, the research carried out by visiting three wooden shipbuilders as follows: Kijang-Bintan Island, Kelong Island and Mana Island in Kepulauan Riau, Indonesia as shown in figure 1. All information and data are collected through interview and documentation.

Traditional shipyard usually produces the small and medium size vessel which is made from the wood. The ship will used as the small fishing vessel or as the leisure yacht. According to Deah at al, the traditional shipyard do not have the special place for the production process, sometimes it will located at the riverbank, at the waterfront or behind their house.

Location of the traditional shipyard is usually influence by the geographical factor and material resources. As we know, most of the traditional ship is produces by the wood. To reduce the operation cost, the shipyard is located not far from wood factory where the log was cut into the desired size of wood. The Craftsmen will order the desired quantity of wood form the wood factory based on the specification required by the customer.

The sizes of the shipyard usually not as big as the modern shipyard as they are not produce the traditional ship as a mass production as shown in figure 2. They are only able to build only

one of traditional ship depends on the size and specification from customer. They traditional shipyard consist of the Master Craftsmen which will lead as the leader at the ship yard. There was only one or two worker that will help the master in the construction process.

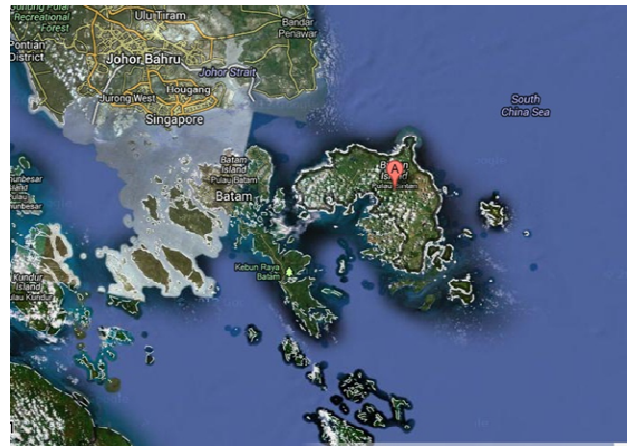


Figure 1: Bintan Islan, Kepulauan Riau, Indonesia. The Bintan Island is surrounded by sea and it is suitable as a shipyard location, source: Google maps.

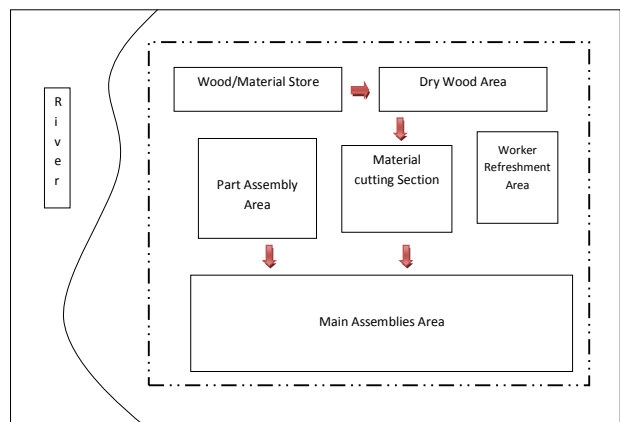


Figure 2: An example of traditional shipyard layout.

In the production process, there are no applications of the big machineries in the ship yard. They are usually used only the small tools such as chainsaw, electric plane hammer and electric borer. All of this small tools and equipment will store at the certain part of the shipyard. As the number of tool applied is less, they are only need a small space compares to the modern shipyard.

Usually a wood that is used in the traditional shipbuilding is seldom available and the masters usually orders in a bulk quantity. They will store the wood at the closed spaced as to avoid the wood to defect and it will affect the quality of the wood. So the traditional shipyards have the specific places to store of the material as shown in the figure 3. Sometimes the woods that send to the traditional shipyard is wet and damps. So to improve the quality of the wood, it must be dry up at the outside of the yard in

order to avoid the wood from easy brittle. This drying process usually took up four months or more so it needs the special space to avoid it block the construction process.

The riverbank and waterfront is the important factor in designing the traditional shipyard as it will help them to launch the ship easily without using the heavy equipment or crane. When the traditional ship is ready for launching, it will directly move up to the river as shown in the figure 4.



Figure 3: Traditional shipyard warehouse



Figure 4: Traditional shipyard at Bintan island located near the river.

3.2 Equipments Used in Indonesian Traditional Shipyards

Manufacturing process of traditional ship in Kepulauan Riau, Indonesia is slightly different from modern ship in the way of building it. All of the process is carried out by human power with the aid of traditional equipment such as saw, chainsaw, electric plane, various sizes of press, blach thread and ruler, electric borer, gauge, nail, bolt, hammer, blorenge and mould as shown in figure 5. The superior of shipyard is called master shipbuilder or master shipwright or master craftsman, is in charged on leading, giving instructions and teaching workers at the yard. The master usually consults his experienced assistant and the ship owner to ensure ability of sailing afterwards and satisfying the owner.



Chainsaw



Electric Plane



Electric Borer



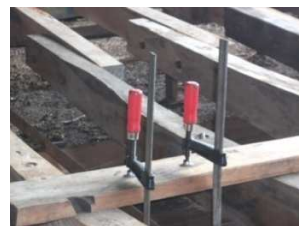
Gauge



Hammer



Blorenge



Small Press



Long Press



Nail



Bolt



Big Press



Blach thread and Ruller

Figure 5: Equipments used in Indonesian traditional shipyards.

4.2 Safety Issues in Ship Production

Each traditional shipbuilder has its own unique way to build a ship. Traditional shipyard in Mana Island used hot bending technique in fastening planks while traditional shipyards in Kijang and Kelong Island were using pressing technique. However, these shipyards has different technique between each other, in general, these shipyards has similarity production process technique to be derived. Figure 6 shows a flowchart of traditional shipbuilding process which is started from contract and payment until delivery.

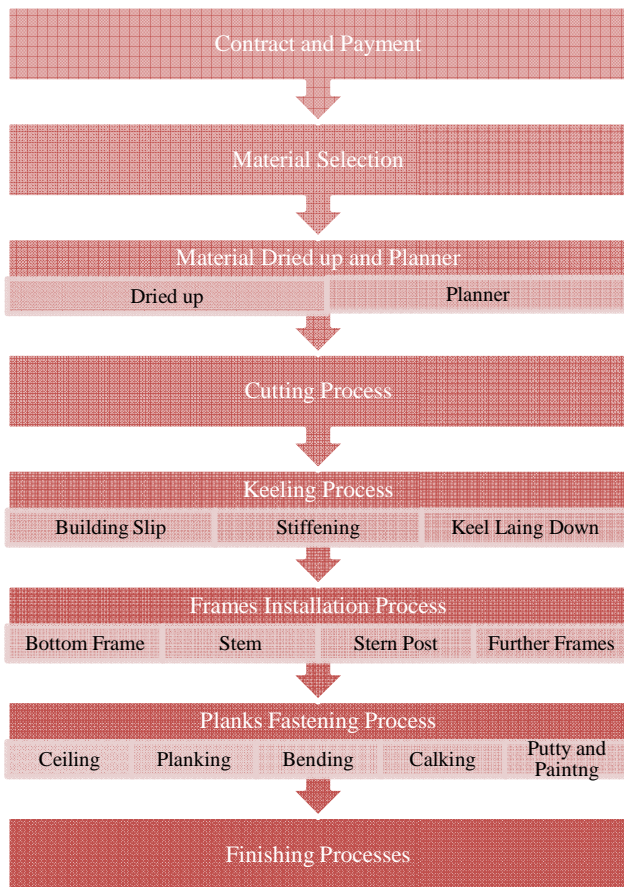


Figure 6: Flowchart of traditional shipbuilding process in Kepulauan Riau-Indonesia.

In traditional ship production process, there is no occupational safety. The shipyard as a protection provider does not recommend or encourage their worker on safety, not even providing personal safety equipment. In figure 7, labor works in unsafe condition and without personal protective equipment as it has regulated on law No.1 1970. As a result, workers are vulnerable to accidents in no time.

Figure 7 shows unsafe condition during working time. There are no effort on accident prevention are taken. The risk such as being squeezeed, struck down of wreckage, stepped on nail, direct contact with material, intruding dust in the eyes, and other injury that may occur as a result of non preventing efforts in minimizing accident. In this case, the purpose of occupational safety as a

mention by Suma'mur (1993) is not being achieved. If accident would happen, the production and productivity will be disturbed.

Planks are used to cover exterior and interior surfaces of the ribs or frames, and also on the beams of a ship. The skin called as strake is basically a line of planks and named after its position such as garboard strake, sheer strake. The planks fastening process is for upper plank and bottom plank as shown in the figures 8, 9 and 10.



Figure 7: Unsafe condition when cutting the wood.

Shipyard in Mana island used fire bending technique which applying diesel oil and fire to curve and to bend wood into desired form of ship steadily slow as shown in figure 11. Hot bending technique is to deform wood, so that at the time of bending, the wood does not break resulting in easier bending work. To begin with, diesel oil was spread onto the wood as oil base to prevent cracks along the wood which to be shaped. Absorbance of diesel oil will assist in heating the wood thoroughly. Then, the wood would be fired to acquire the curvy shape of a ship hull and then is joined edge to edge using ironwood dowels.



Figure 8: Unsafe condition when hitting a nail in the keel



Figure 9: Planks fastening at bottom frames of ship.



Figure 11: Planks bended using fire technique.



Figure 10: Unsafe condition when planking.

5.0 SUGGESTION AND RECOMMENDATION

All company of construction should be able to serve the worker best personal protection to ensure the safety and the smooth flow of production process. They also should know that any of safety requirements are failed to follow, they are charged on summon and worse, to be jailed for life.

Therefore, in traditional site like there in Kepulauan Riau, the worker should at least wear jacket, boot, glove and face protection such as goggle and mask during work. In the production of traditional ship, they are used to shave wood to create best structure of their ship. Hence, the most practical way to practice safety is to wear glove and goggle. When handling fire, fire extinguisher should always at least 2 meters near to the workers. Workers should wear jacket to prevent fire burn directly on their skin.

6.0 CONCLUSIONS

From description above, it is concluded that safety issue in traditional ship production process is not implemented or not important issue for company and workers as they not applying any safety practice even though occupational safety has regulated on law No.1 1997.

The shortcoming of this study is that safety issue in traditional ship production process are investigated without any comparison between modern ship production process and without make a safety management on traditional ship building company.

The ways of building traditional ships is far from the influence of technology. These would result defects and weakness on the safety for the design and operation. Current research provides the design process in the traditional shipbuilding at Bintan Island, Kepulauan Riau, Indonesia. The result is a comparison to current concept of design process in modern shipbuilding and

recommendation for the traditional shipbuilding and local government. The recommendation is use one of the four ways on the modern shipbuilding or combined from the four ways in order traditional shipbuilding can compete.

ACKNOWLEDGEMENTS

The authors also would like to acknowledge Mr.Akun (Master) and his assistants from Kijang Traditional Shipyard, Mr.Amin (Master) and his assistants from Kelong Island Traditional Shipyard, Master and assistants from Mana Island Traditional Shipyard and warm and grateful thank you to Mr.Hikmat Andi for giving hands, time and fully support for this research.

REFERENCES

1. A.Deah, Jaswar, E.Prayetno, H. Saputra, Mufti F.M, Sanusi, Risandi.D.P, Nofrizal, Zulkarnain, Surhan, and Bayo. (2012), Safety Issue in Production of Traditional Ship in Kepulauan Riau-Indonesia, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.571-575.
2. Aji, C. A. (2000). *Local knowledge of traditional boat building by Biak*
3. Adriana, I. (2010). *Occupational Health and Safety*. University of Indonesia Computer: Undergraduate Thesis.
4. Aji, C.A. (2000) *Local Knowledge of Traditional Shipbuilding by Biak Tribe, Sub-District of warsa, District of Biak Numfor*. University of Cendrawasih: Undergraduate Thesis.
5. Indonesia (1970).*Occupational Health.*: No.1
6. E.Prayetno, Jaswar, H. Saputra, Mufti F.M, Sanusi, A.Deah, Risandi.D.P, Nofrizal, Zulkarnain, Surhan, and Bayo. (2012), Quality Issues in Traditional Ship Production in Kepulauan Riau-Indonesia, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.485-489.
7. H. Saputra, Jaswar, Nofrizal, Zulkarnain, E.Prayetno, Mufti F.M, Sanusi, A.Deah, Risandi.D.P, Surhan, Bayo. (2012), Critical Path Analysis of Traditional Ship Production in Kepulauan Riau Indonesia, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.571-575.
8. Jaswar and Syafwan bin Anah, 2013, *Traditional Ship Production Case Study in Kepulauan Riau-Indonesia*, Departement of Aeronautic, Automotive and Ocean Engineering, Faculty of Mechanical, Universiti Teknologi Malaysia.
9. Mufti F.M, Jaswar, E.Prayetno, H. Saputra A.Deah, Sanusi, Risandi.D.P, Surhan, Bayo, Nofrizal, Zulkarnain. (2012), Design Issue in Traditional Shipbuilding Process, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.565-570.
10. Nofrizal, Zulkarnain, Jaswar, E.Prayetno, H.Saputra, Mufti F.M, Sanusi, A.Deah, Risandi.D.P, Surhan, Bayo, Yasser.M.A, Production Process of Traditional Ships in Kepulauan Riau-Indonesia, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.110-117.
11. OHSAS 18001 (2007).Occupational Safety and Health Management System. NCSI Publication
12. Republika (2012). The Number of Indonesia Fisherman Remain Two Million: April 13 2012.
13. Risandi.D.P, Jaswar, Mufti F.M, E.Prayetno, H. Saputra A.Deah, Sanusi, Surhan, Bay, Nofrizal, Zulkarnain. (2012), Planning of Traditional Ship Production in Bintan-Indonesia, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.586-589.
14. Simanjuntak, P.J. (1994). *Occupational Safety Management*. Jakarta: HIPSMI
15. Soeprihanto, J. (1996). *Personnel Management*. Yogyakarta: BPPE.
16. Suewedo, H. (2009), *Lingkungan dan Keselamatan Transportasi: Jurnal Manajemen Mutu*. 8(2): 133 – 140.
17. Surhan Jamil Haron, Jaswar, Nofrizal, and Zulkarnain. (2012), Delivery Issues in Malaysian Traditional Ship Production Process, *The 6th Asia-Pacific Workshop on Marine Hydrodynamics*, pp.582-585.
18. Suma'mur. (1993) *Occupational Health and Accident Preventing*. Jakarta: CV Haji Masagung.