

Boatbuilding tools were purchased by the owner of the dockyard is nothing new one, however in general the former tooling. The craftsmen tools can be purchased at a hardware store in the Bagan Siapiapi city. So, there are no tools to be ordered out of the Bagan Siapiapi city. In the traditional wooden dockyard, nothing at all that using a functional facilities, such as a slip way or rail slide to raise and lower the boat into the water, cranes for lifting equipment and materials that are large and heavy, and the winch etc. In terms of determining the boat design does not require a plan and line of special drawing at traditional dockyard. Determination of the design and shape of the boat is just based on sheer experience of foreman. To determine the capacity of the boat is based on the size of keel, amount of casco and the amount hull board. Keel size was 6 inches in thick. The more of the hull board is used as a result the greater capacity of the boat (GT) to be produced. Boatbuilding knowledge is gained based on experience gained from the production number of boats that have been produced over the traditional dockyat it self.

Wood as raw materials and processing for boat's construction. Wood as raw materials for boatbuilding in the traditional dockyard was obtained from existing forests along of the Rokan river. Several types of the materials were logged from the forest around Bagan Siapiapi. Materials were obtained through an order which ordered the encroachers of forest or to the loggers who have known foreman and owner of a dockyard. They relate trade in the range that has been a long time. Fishing vessel owners or entrepreneurs with a regular subscription are related dockyard owners.

Ordering of materials was usually conducted only when there was an order from the owner of the boat. Wood materials for boat's construction are usually ordered with a certain size in accordance with the boat's owner to dockyard owner. Then, the owner of dockyards ordered to loggers.

Almost all traditional dockyards were used same type of wood for boat's construction in Bagan Siapiapi. There is no significant difference between the wood used on one another dockyards. The types of wood are usually ordered to the logers such as *Parastemon* sp, *Vitex pubercens* Vahl, *Shorea platiclados*, *Tetramerista glabra* Miq, *Agathis dammara* (Lamb.) Rich, and *Dysoxylum densiflorum* (Bl.) Miq used in certain parts of boatbuilding. The wood type for material of boat smaller than 10 GT present in Table 4.

Table 4. The wood type as material for boat's construction in Bagan Siapiapi.

No.	Type of materials	Class		Part of boat's construction	The number of required	Price per rod (Rp)	Total price (Rp)
		Durability	strength				
1	Malas (<i>Parastemon</i> sp)	II-III	I	Keel	1 rod	800.000,-	800.000,-
2	Loban (<i>Vitex pubercens</i> Vahl)	I	I-II	Rip	34-50 rod	50.000,-	2.500.000,-
3	Pasak lingga (<i>Dysoxylum densiflorum</i> (Bl.) Miq)	II-III	II-IV	Tramson	6-8 rod	150.000,-	1.200.000,-
4	Pasak lingga (<i>Dysoxylum densiflorum</i> (Bl.) Miq)	II-III	II-IV	Stringer	1 ton	1.000.000,-	1.000.000,-
5	Meranti (<i>Shorea platiclados</i>)	II-III	II-IV	hull	2 ton	3.500.000,-	7.000.000,-
Total							12.500.000,-

Note: Total price based on the maximum amount of material

The main obstacle in the procurement of raw materials was difficulty to get the material in the forest around Rokan Hilir regency. It happened due to the increasing scarcity of wood species, other than those in the woods, also increasing the demand for wood by increasing wooden dockyard since several years ago. Raw material procurement of the wooden boat was also increasingly difficult after the issuance of a law that prohibits harvesting and utilization of forest products, especially those that will be traded in the form of wooden logs. However, the rules also apply for constructing a wooden boat.

Each a reservation wood for boatbuilding usually takes 20 to 30 days arrives to doackyard. Sometimes, the hard times of materials wood boat the orders can not be fulfilled at all, because of the type of wood that is intended is not available in the forest. Wood type material that is very difficult to obtain vessels usually is *Vitex pubercens* Vahl. *Vitex pubercens* Vahl commonly was used as rip of the boat, and *Parastenon* sp was used as a keel. For part of the boat that are not directly bear the burden or indirectly in the water can still be held, but it takes a long time to look for in the forest.

Overcoming the difficulty of obtaining wood as a boat material, the strategies used by the owner or the dockyard foreman is first, to provide a higher bid price on the wood material of their message to the seller and loggers. Second, the cannibalism method, i.e. taking and buying materials on wooden boat that have been damaged, some of the wood in the building is still possible to use a certain boat then take it. Rip and keel are part of the boatbuilding, which usually was purchased. Wood material for rip and keel were usually purchased at a price as Rp800.000, - to Rp1.000.000, - per cubic, its according to the material conditions. Third, if the main ingredient is not available, it can also be used substitutes. Desired wood was replaced with other types of wood; but its magnitude and relatively similar grade durable, such as *Shorea platyclados* as hull of boat. It can be replaced as *pemulai*, as well as *Parastenon* sp can be replaced *Dysoxylum densiflorum* (Bl.) Miq. However, the use of these material remains of course will reduce the quality and durability of boats made by the traditional dockyard.

Table 2. Number of wood required for shipbuilding

No.	Type of Boat	Capacity (GT)	Required wood			Total
			Board	Beam	Rip	
1.	Fishing boat	a). 1,5	0,4 M ³	0,15 M ³	0,1 M ³	0,65 M ³
		b). 3,5	0,85 M ³	0,35 M ³	0,25 M ³	1,45 M ³
		a). 5	1,5 M ³	0,5 M ³	0,3 M ³	2 M ³
		b). 10	2,4 M ³	1 M ³	0,6 M ³	4 M ³
2.	Cargo boat	c). 20	4,8 M ³	2 M ³	1,2 M ³	8 M ³
		d). 50	12 M ³	5 M ³	3 M ³	20 M ³
		e). 100	24 M ³	10 M ³	6 M ³	40 M ³
		f). 500	120 M ³	50 M ³	30 M ³	200 M ³

Source: Ahmad et al., (2004)

Step of the wooden boatbuilding. Processing of wood materil for boatbuilding was relatively more difficult than the process several types of other boat materials. Therefore, the necessary knowledge, skills and techniques or tips specific processing such as in the case of indentation or arch form in certain parts of the boatbuilding. The owner dockyard or foreman gain knowledge of this wood processing techniques from his parents for generations, which was used generally also a b boat builder.

Pattern of wooden shipbuilding enterprises and traditional boatbuilding system is very possible for them to lower their knowledge to a child or close family, because recruitment system or handyman based family and kinship relationship. However, there are also some boat builders who gain knowledge of techniques to make it boat directly from the experience gained from creating another boat in the



dockyard. However, the experience gained makes the ship was not the one in a short time. At least it took more than eight years.

Knowledge and skills to process the wood boat material not only form a specific part of a wooden for boat building, but also make the material preservation. The goal is that the material is resistant to pests and weathering, shrinkage does not occur during use and easy to process as well as the shape of the building work on the installation of certain boat. Therefore, before the wooden boat materials used or mounted on the boat building, wooden to be preserved first and subsequently processed in accordance with the shape of the building materials where the paired boat. So the process of using an ingredient in the manufacture of wooden boats is through the process; namely: forest wood roughly shaped and then dried and molded detail and smooth as the processing activities. Then conducted preservation and finally the installation of the boat building are according to the following workflow.

Wood as a raw materials → Formed (roughly) → dried → Formed (detailed/refined) → Preserved → Installation

Preservation is carried on wooden boat material especially with activity drying to reduce the moisture content of wooden to be used. Wood drying conducted with the wooden sunning under the scorching sun for at least more than 20 days. Drying is to avoid or minimize the possibility of a gap in the wall connection board of boat body (Figure 3). Wet wood will experience shrinkage when dry or worn for a long time and exposure to sunlight. If the boards are wet that the hull mounted as a wall, then in the opening under the sun lighth will experience drying, which resulted in a gap between the boards to each other (Nofrizal 2008; Nofrizal et al., 2014). The longer it the gap will be enlarged and cause boat to leak.



Source: Nofrizal and Ahmad (2012)

Figure 3. Drying wooden boat material in traditional wooden shipbuilding.

Order to improve the durability of wooden boat material and prevent the natural weathering process and wooden pests such as animal sticker / tacks and poker, then used preservatives (Ahmad, 2012: 2012a; 2012b). So in creating wooden boats preservatives are also required to ensure the resilience of the body or the wooden boat building. Preservative commonly used among other things, solar, black holes, the toxic chemicals and waste oils. For the size of boat 2 GT normally requires 30 liters of solar or waste oils. This type of preservative easily obtained at a hardware store around Bagan Siapiapi town.

The traditional dockyard owner and foreman generally have no other knowledge about alternative materials for making boat, such as fiber reinforcement plastic (FRP), steel, and other materials. Therefore, if the wood is not they earn, then the boatbuilding activities at its dockyard stopped. Then they usually look for alternative jobs such as making fishing gear, as a house constructor and as a fisherman. Thus, the threat of being unemployed for a very large boat builder, especially if the wood is no longer available for boat building.

Meanwhile, the desire for alternative materials or wooden substitute materials is not owned by owner of the dockyard. It is, because they do not have the knowledge and techniques of processing alternatives, or the replacement. Nevertheless, the desire to learn alternative or substitute materials is quite large among foreman and owner of the traditional dockyards. Unfortunately they do not know what to learn or get information about where it is not available in the environment they attempt.

Production of the wooden dockyard. Traditional wooden shipbuilding production depends on the availability of wood as raw material (Ahmad *et al.*, 2004; Nofrizal *et al.*, 2014). So the traditional dockyard owners are expecting the ease of the forester to get wood as raw material, because of their sustainability depends only on the material. Availability of raw materials is crucial kept his boat submission time specified by the buyer. Without the raw materials available it is difficult for them to be punctual submission boat on order. In fact it is not uncommon to wait for the raw materials that have been ordered to come over the business they do or do other work. In addition, the resulting production of wooden boats they are also determined by the equipment they have. Most of the equipment that they have comes from stuff used or when there is a new but low quality. So some times it takes care of the equipment again. Although with this condition the traditional wooden dockyard still produces wooden boats. However the production of wooden boats in the traditional shipyard as disturbed or even stopped as seen in Figure 4.

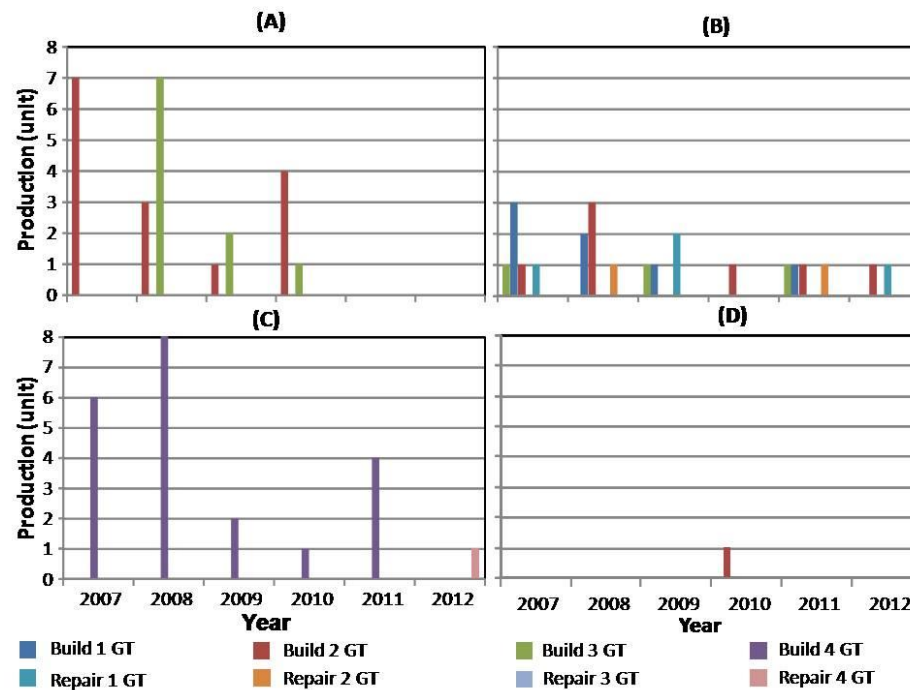


Figure 4. Production of traditional wooden dockyard last six years in Bagan Siapiapi; (A) The Zainal Abidin dockyard; (B) Saparudin dockyard; (C) Amiruddin dockyard; and (D) Daeng Budiman dockyard.
 Source: *Nofrizal dan Ahmad (2012)*

Figure 4 shows that the production of wooden boatbuilding and boat repair were decreased in four traditional dockyards. Even the dockyard was not working in 2011 and 2012, because there are no getting job orders. Then they also stop the ship repair activities. This is mainly due to the difficulty also get wood, so that the shipyard owners can not give assurance to the customer about how long the ship can be prepared. Thus, the change of the ship's main material has a strong durable class I-II and replaced with durable and strong class II-IV. This replacement can reduce the quality of wooden boat, which was produced by this traditional dockyard. Fourth traditional dockyard owner was claimed that the problems in boat production is the difficulty of getting good wood materials and appropriate for boat's construction. Therefore, they expect any concessions to get permission obtain a wooden boat materials from the forestry agency. Although it is almost impossible to be granted, however they still pinned their hopes.

Quality production of the wooden boat. Efforts of the owners of traditional a wooden dockyards to improve the quality of artificial boat them by using qualified a wooden material. Nevertheless they never give warranty to the buyer after boat handover. To satisfy the buyer desires on the quality of the boat, the owner of the shipyard traditional boats performance testing it. The boat performance test, such as 1) Testing of boat performance in waters. Testing the look of this boat performed to determine the stability of boat in the waters or when sailing; and 2) the leakage test. If there is a leak in the boat, then immediately the owner of dockyard will be repaired by conducting re-plug and re-putty before the handover conducted.

The dockyard owners also do not have a policy of ensuring the quality of the resulting vessel. There has been no attempt to provide a guarantee to the customer on their boat product. There is also no agreement with the company's risk guarantor such as insurance companies, both public and private for the newly created boat. Nevertheless, the traditional owners of the dockyard were satisfied with the results of their homemade boat. If there is no "complaints" from the buyer after the ship was handed over, it is both an indicator for the owners of dockyards that they make qualified or competitive enough.

The owners of traditional dockyard expectations to government, especially local and central government in order to give special attention to the business of making wooden boats in the traditional dockyard in Bagan Siapiapi. It is expected that traditional wooden boat building business is still guaranteed maintained its existence and sustainability. So that, in the future not only live a longer story only. According to them the worst risks they may encounter and occurs in traditional dockyard business is going to close due to scarcity of raw materials that they need not be obtained.

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