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Product Quality Characteristics for the Standardization of Traditional boats in East Java, Indonesia

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Abstract

The problems want to be solved in this study is the standardization of traditional boats in Indonesia. We described all the characteristics of traditional boat quality in the dimensions of durability, performance, reliability, service ability, features, aesthetics, perceived quality, and conformance. We also did the normality test of GT size and load capacity based on the sampling and found that they were normally distributed with mean 23 GT and 15 ton, respectively. Furthermore, we found that there were three types of traditional boat which all have U-shape hull construction. We also provided the three types of traditional boat including the real picture and the lines plan. By using these lines plan, the new shipbuilding can be re-built in the same size.

Keywords
Product quality characteristics, traditional boat, standardization

1. Introduction

In the ASEAN free trade area, Indonesia could drive economy because we have a huge population for more than 240 millions. Domestic products must be competitive to imported products. Ministry of Research, Technology, and Higher Education encourages civils to make standardized product to fulfill market demand. Surabaya city and Lamongan regency which are determined as a cluster of shipbuilding industry in East Java province have a responsibility to make standardized boats. The previous research on shipbuilding industrial cluster workshop showed that there were some improvements needed in components standardization, such as: 1) there is a need to standardize ship components by government, and 2) there is a less development in Lamongan because it lacks of human resources and design center (Asmara et. al., 2016).

In this study, we limit our research object to traditional boats which are made from wooden. Wooden boats or traditional boats are used by the most of fishermen in Indonesia. However, the production of traditional boats has not been well standardized yet. The technique of traditional shipbuilding is a heritage technique from their ancestors (Jokosisworo and Santosa, 2015; Trimulyono et. al., 2015). There are no standardized calculations which implied to variations of shape and design of traditional boats in Indonesia. The standardization aims to increase local content and reduce imported components. Therefore, the ship production cost will be lower. Furthermore, most of the traditional boat workers are graduated from junior high school and senior high school. If there is no standardization, it will impact on worker and boat safety. A research to analyze factors which influence standardization of traditional

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boats is needed to improve the performance. This research will contribute to find some factors that are critical to the quality of traditional fishing boats and then make standardization. We will refer to the Ministry of Trade, Ministry of Transportation, and Indonesia Classification Bureau that published rules of shipbuilding construction.

The remaining of this paper is organized as follows. Section 2 presents research methodology including sample, design, and proposed hypotheses. Section 3 discusses the results of several factors that are critical to standardize traditional fishing boats, whereas Section 4 finally presents the conclusions, limitations, and future research directions derived from this paper.

2. Research Methodology

2.1 Research sample

Sampling is taken randomly by 10 traditional boats in Lamongan regency. The sample profiles are described in Table 1.

Table 1. Sample profile

No	Vessel name	Size (Loa × Bm × Hm)	Size (GT)	Load capacity (Ton)	Type
1	Pincuk	8m × 2.5m × 1.5m	3	0.6	Pincuk
2	Karya Jaya	9m × 3.5m × 2m	7	6.0	Ijon-Ijon
3	Aqilla Jaya	10.5m × 2.8m × 1.5m	5	4.0	Ijon-Ijon
4	Golek Untung	11m × 5.6m × 1.8m	13	10.0	Ijon-Ijon
5	Mekar Jaya	13m × 5m × 2.5m	19	15.0	Perahu
6	Permata Jingga	14m × 6m × 3m	31	11.0	Ijon-Ijon
7	Semut Ireng	16m × 6m × 3m	35	20.0	Ijon-Ijon
8	Wirausaha	15.7m × 6.4m × 2.8m	34	30.0	Perahu
9	Titipan Illahi	17.55m × 6.7m × 2.8m	40	30.0	Ijon-Ijon
10	Qatar	16.5m × 7.5m × 2.8 m	42	27.0	Ijon-Ijon

We compute the GT size by the following formula (Abu Jami'in et. al., 2016):

$$GT = k_1 \times V$$

Where:
$k_1 = 0.2 + 0.02 \times \text{Log}(V)$
$V = LOA \times Bm \times Hm \times 0.5$
LOA: Length over all
Bm: Breadth molded
Hm: Height molded

The overall length of the vessel is measured from the rear of the boat to the very front. Meanwhile, breadth molded is the width of the boat from the inside and height molded is the height of the vessel measured from the top of the keel to the inside of the deck. In this study, there are three types of vessel, namely pincuk, ijon-ijon and perahu. All those types of vessel have U shape hull construction. The difference is on the shape of pole. Both Pincuk and ijon-ijon do not have taper pole. Moreover, Pincuk has the smaller pole. Meanwhile, Perahu has a high taper pole.

2.2 Research design

The standardization process of traditional boat is started by survey to the traditional shipyards, boat owner, and boat user in Lamongan regency, East Java. We interviewed people on how to design and to do wood bending, what kind of material and component used in shipbuilding. The research design is shown by Figure 1. In technical specifications, we refer to Ministry of Trade, Ministry of Transportation, and Indonesia Classification Bureau that published rules of shipbuilding construction. Meanwhile, in human and material resources, we asked people about shipbuilder/worker, their component and material suppliers (Son and Kim, 2014; Sharma and Gandhi, 2017;

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Montwill et. al, 2018). Furthermore, in quality indicators of product, we use 8 dimensions to analyze, i.e.: 1) performance, features, reliability, conformance, durability, service ability, aesthetics, and perceived quality (Nasution, 2015; Praharsi et. al., 2015).

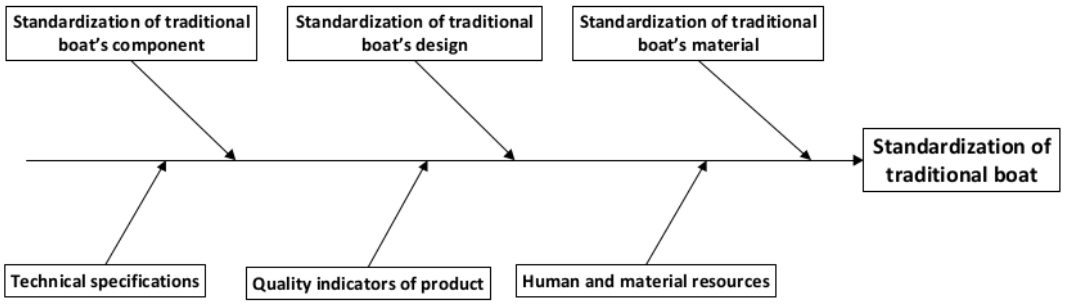

Figure 1. Standardization diagram of traditional boat

Performance is related to the functional aspect of product and the main characteristics to be considered by customer as they want to purchase the product. Features are the second aspect of performance to add the basic function which is related to choices and development. Reliability is related to the probability that the product works successfully in the certain period and condition. Conformance to requirements is related to the product appropriateness to the prior defined specification. Durability is the measurement of the length of product usage. Service ability is characteristics which are related to speed, courtesy, competence, convenience, and accuracy in maintenance. Aesthetics is characteristics related to splendor which is subjective to the individual preference. Perceived quality is also subjective related to the personal feeling in using product. All the technical specifications, material, design, and component of the traditional boats are integrated in 8 dimensions of product quality (Nasution, 2015). The integration of dimension and indicator is shown by Table 2.

Table 2. Quality indicators of product

Dimension	**Indicator**
Durability	The length of product usage Size (Loa x Bm x Hm)
Performance	The number of Machine Gear box ratio Engine power (Horse Power/HP) Rotation Per Minute (RPM) Brand & type of machine Inboard or outboard machine The diameter of propeller The speed (full capacity, empty) The capacity of fuel Generator Accumulator
Reliability	The travel distance The boat load/capacity The capacity of fish The capacity of ice block
Serviceability	Machine supplier Propeller supplier Wood supplier The number of boat crew
Features	The type of catch tool

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Dimension	Indicator
	Net capacity Equipment
Aesthetics	The shape of hull construction
Perceived quality	Quality control by ship owner
Conformance	Product assurance to the prior defined specification by supervisor

Based on Table 2, the durability is reflected in the length of product usage and the size of Gross Tonnage. The performance is presented by the number of driving machine, the gear box ratio, the engine power, the RPM, the brand and type of machine, the machine position (inboard/outboard), the diameter of propeller, the speed of boat, the capacity of fuel, the number of generator and accumulator. The reliability is stated by the travel distance, the boat capacity, the fish capacity, and the ice block capacity. The serviceability is described by the supplier's place of machine, propeller, and wood and also the number of boat crew at the time of each sail. The features is discussed by the type of fish catch tool, the capacity of net, and the additional equipment such as lamp, multimedia, and GPS. The aesthetics is shown by the shape of hull construction, and the perceived quality is reflected by ship owner's quality control. Finally, the conformance is described by the product assurance to the prior defined specification.

2.3 Normality test

Normality test is done by Anderson Darling equation and Minitab software. We formulate two hypotheses as follows:

I. H_0: The GT size of traditional boats follows Normal distribution VS.
   H_1: The GT size of traditional boats does not follow Normal distribution
II. H_0: The capacity of traditional boats follows Normal distribution VS.
   H_1: The capacity of traditional boats does not follow Normal distribution

With 95% confidence interval, the null hypotheses will be accepted if probability (*p*-value) is larger than 0.05.

3. Results and Discussion

3.1 Normality test of GT Size

Based on Figure 2, the GT size of traditional boats showed in Table 1 follows Normal distribution. The null hypothesis is accepted because *p*-value (0.201) is larger than 0.05. Based on Figure 3, the histogram of GT size distributed normally with mean 23 GT. It is in line with the data based on our interview to the former chief of fisherman group in Lamongan regency. It is recorded that there are 275 fishermen members, consisting of 70 boats are less than 5 GT, 50 boats are in the range of 5-10 GT, and 155 boats are larger than 10 GT.

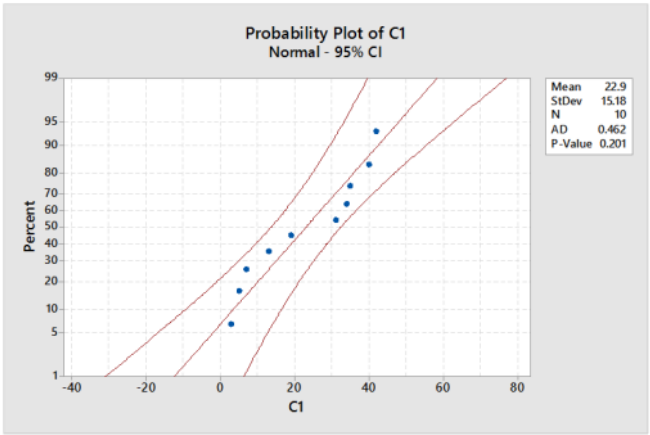

Figure 2. Normal probability plot of GT Size

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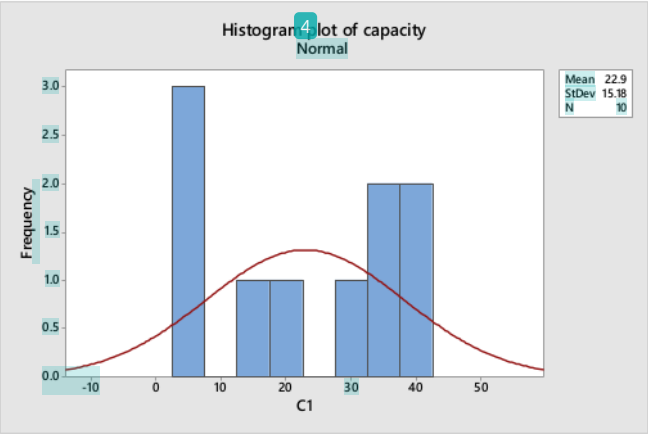

Figure 3. Histogram plot of GT size

3.2 Normality test of capacity

Based on Figure 4, the capacity of traditional boats showed in Table 1 follows Normal distribution. It can be seen that *p*-value (0.451) is larger than 0.05. Therefore, the null hypothesis is accepted. Based on Figure 5, the histogram of capacity distributed normally with mean 15 ton. Subsequently, we compare three types of boat by representative in each group. It is summarized in Table 3.

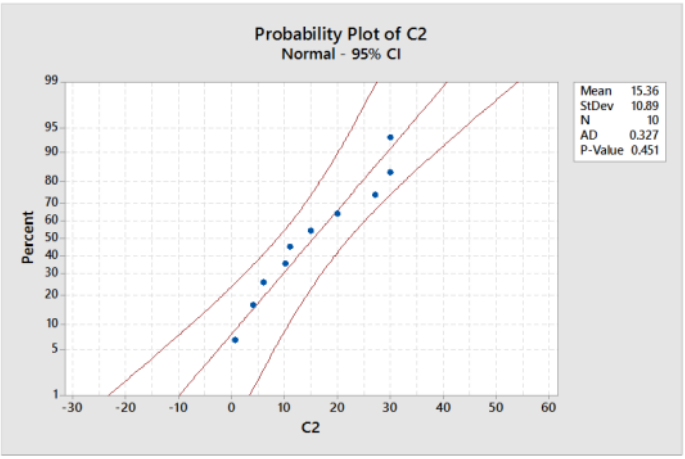

Figure 4. Normal probability plot of capacity

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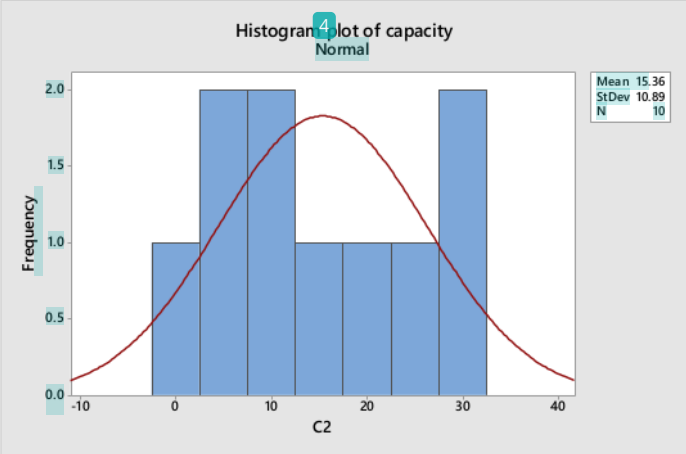

Figure 5. Histogram plot of capacity

3.3 Quality product of traditional boat

Table 3. The Comparison of boat types

Indicator	**The type of Ijon-Ijon (Vessel: Qatar)**	**The type of Perahu-Perahu (Vessel: Mekar Jaya)**	**The type of Pincuk (Vessel: Pincuk)**
The length of use	-(Built in 2018)	21 years	-(Built in 2018)
Size (loa x Bm x Hm)	16.5m x 7.5m x 2.8m	13m x 5 m x 2.5m	8m x 2.5m x 1.5m
GT size	42 GT	19 GT	3 GT
Boat capacity/load	27 ton	15 ton	0.6 ton
The number of Machine	4	3	2
Gear box ratio	3:1	3:1	3:1
Horse power (HP)	@30 HP	@30 HP	@23 HP
Brand/Type	Fuso	Mitsubishi; Yanmar	Yanmar
Inboard or outboard machine	Inboard	Inboard	Outboard
Diameter propeller	30 cm	29 cm	20 cm
The speed (full capacity, empty)	9 miles/hour	Full: 9.8 knot/miles/hour Empty: 7.5-7.7 knot/miles/hour	7-9 knot/miles/hour
The capacity of fuel	10 drum	6 drum	30 L
Generator	2	2	Battery 220 V AC
Accu	4 accu (@120 AH)	4 accu (125 AH (2), 200 AH (2))	1 accu (70 AH, DC 12 Volt)
The travel distance	250 miles	175 miles	5 miles
The capacity of ice block	600 blocks	600 blocks	20 blocks
The machine supplier	Lamongan regency	Lamongan regency	Surabaya city
The propeller supplier	Surabaya city	Lamongan regency	Surabaya city
The wood supplier	Bojonegoro regency (teak) Tuban regency (mahogany)	Bojonegoro regency	Bojonegoro regency Tuban regency
The number of boat crew	13-15 sea men	7-9 sea men	2 sea men
The type of catch tool	Cantrang automatically	-(transshipment)	Net manually (1 set, length 45m), 20-30 nets

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Indicator	**The type of Ijon-Ijon (Vessel: Qatar)**	**The type of Perahu-Perahu (Vessel: Mekar Jaya)**	**The type of Pincuk (Vessel: Pincuk)**
The fish catch size	20 ton (max) 15-17 ton (average) 10 ton (min)	15 ton (max)	600 kg (max) 450 kg (average) 30 kg (min)
Equipment	Lamp, audio, TV	Lamp, water pomp (3)	Lamp, radio, magnetic compass

Based on Table 3, we have described the three types of boat according to the durability, performance, reliability, service ability and features dimensions. In durability dimension, the length of use of Perahu type is 21 years. This is already in maximum ideal period. In the performance, all types of boat have speed in 7-9 knot/miles/hour which the full capacity condition will be faster than empty one. In reliability, the load capacities are vary directly proportional to the GT size. In service ability, the supplier of machine, propeller and wood are from Lamongan, Tuban, Bojonegoro regencies and Surabaya city which are nearby from the shipyard. In feature dimension, fisherman uses cantrang automatically and net manually for catching fish. In perceived quality dimension, the quality control of shipbuilding process is done by ship owner. Whereas, in conformance dimension, the supervisor of shipbuilding workers gives assurance on the product appropriateness to defined specification. The supervisor will sort the material and component along the shipbuilding process. Finally, in aesthetics dimension, the traditional boats in Lamongan regency have a unique shape of hull construction. All types of vessel have U-shape of hull construction which is shown by Figures 6-8. In addition, there is no technical drawing in the traditional shipyard. The shipbuilders only used their intuitions and experiences. Consequently, they will produce in the different size as they scale up the number of vessels. Therefore, the lines plan of all types of vessel is created as shown by Figures 9-11. The lines plan presented the design engineering of each vessel, i.e.: Qatar, Mekar Jaya, and Pincuk. Therefore, the new shipbuilding showed in Figures 6-8 can be re-built in the same size by using these lines plan.

4. Conclusions

We have described all the characteristics of traditional boat quality in the dimension of durability, performance, reliability, service ability, features, aesthetics, perceived quality, and conformance. We also tested the normality of GT size and load capacity and found that they were normally distributed with mean 23 GT and 15 ton, respectively. In this study, we found that there are three types of vessel, namely pincuk, ijon-ijon and perahu. All those types of vessel have U shape hull construction. The difference is on the shape of pole. Both Pincuk and Ijon-ijon do not have taper pole. Moreover, Pincuk has the smaller pole. Meanwhile, Perahu has a high taper pole. The lines plan of each type of boat including their real picture has been arranged. By using these lines plan, the new shipbuilding can be re-built in the same size. The future research will be focused on the shipbuilding optimization process of material, component, and human resources.

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Figure 6. The type of Ijon-ijon (Vessel: Qatar)

Figure 7. The type of Perahu-perahu (Vessel: Mekar Jaya)

Figure 8. The type of Pincuk (Vessel: Pincuk)

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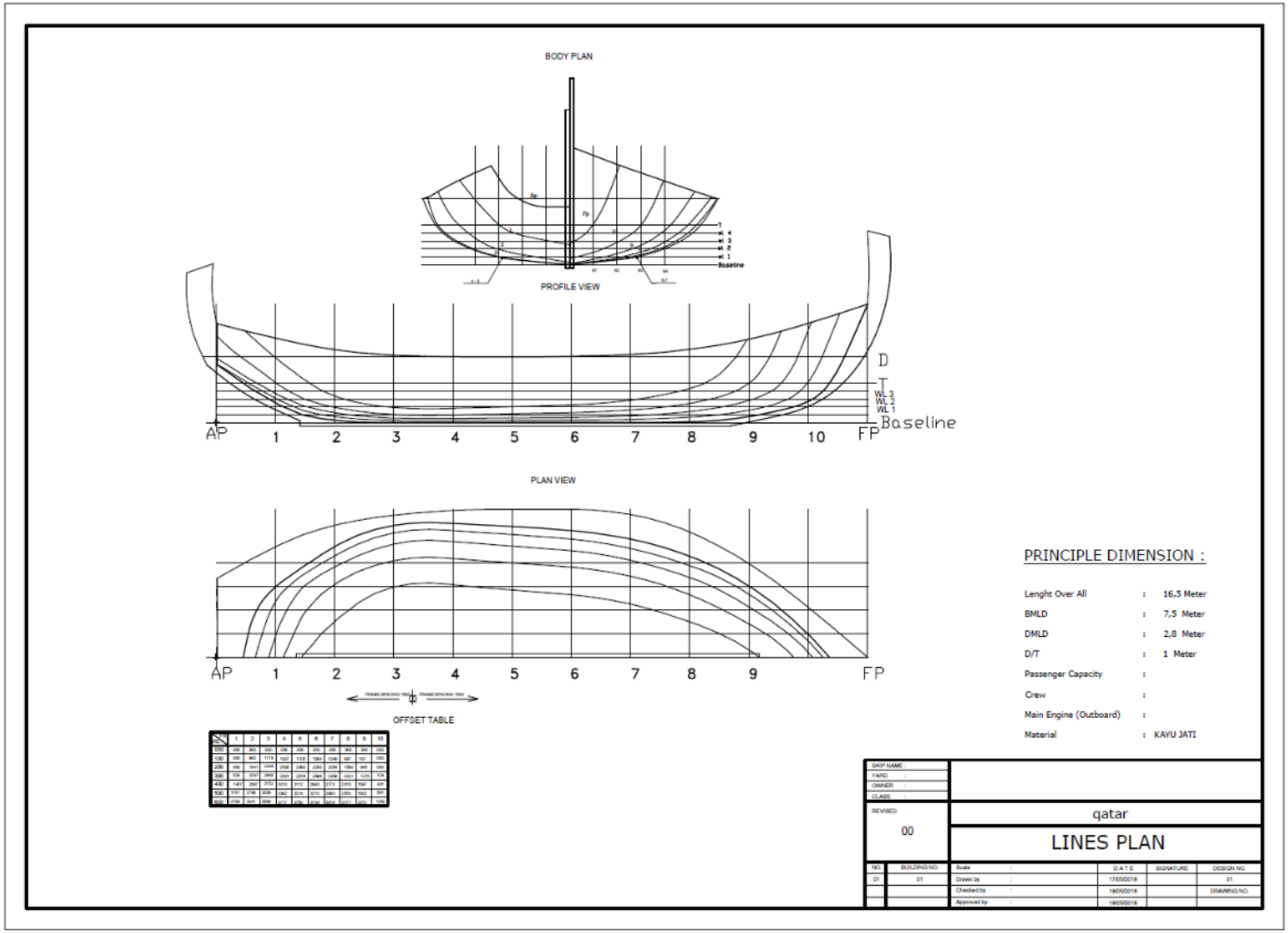

Figure 9. The lines plan of Qatar

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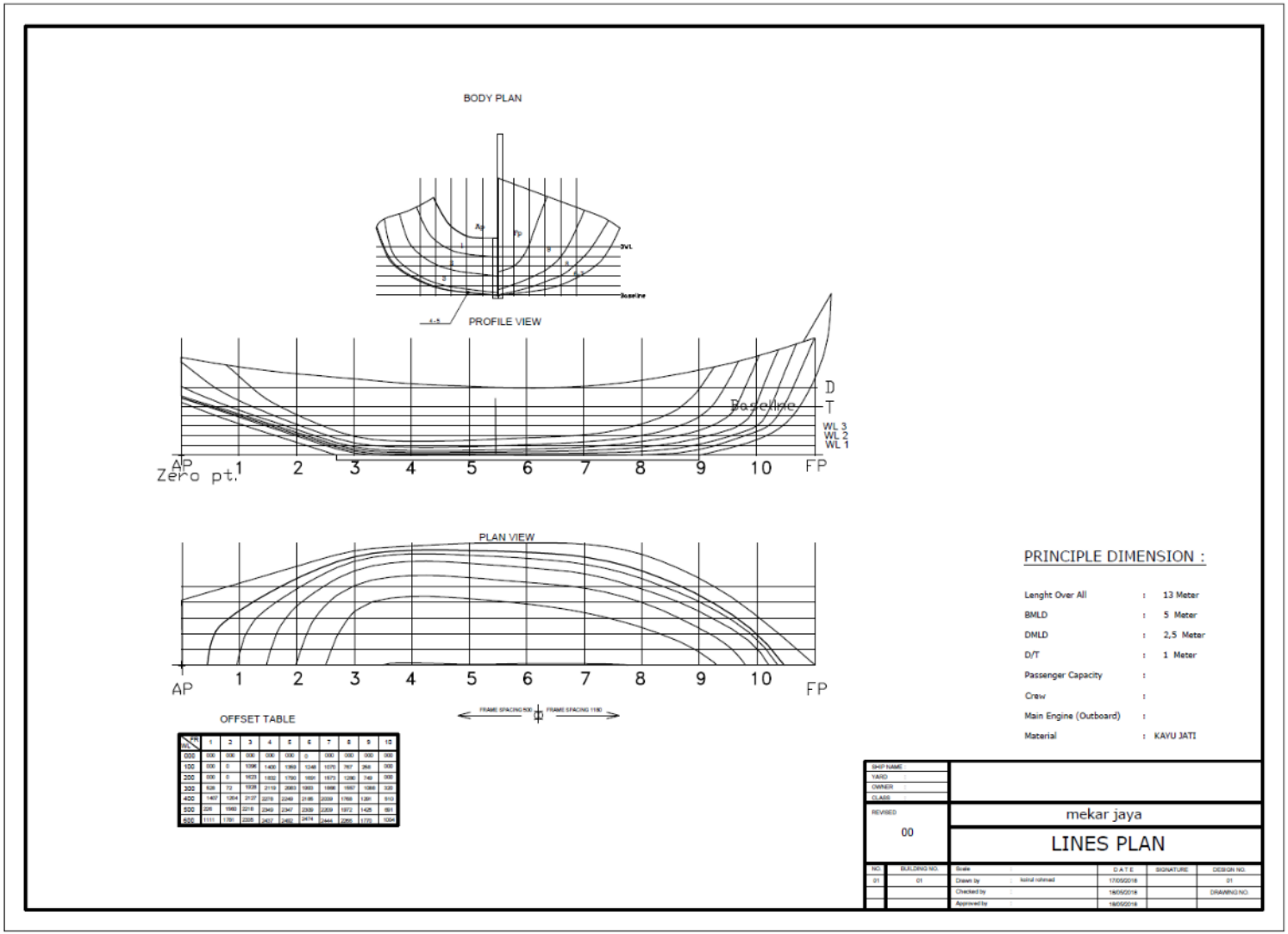

Figure 10. The lines plan of Mekar Jaya

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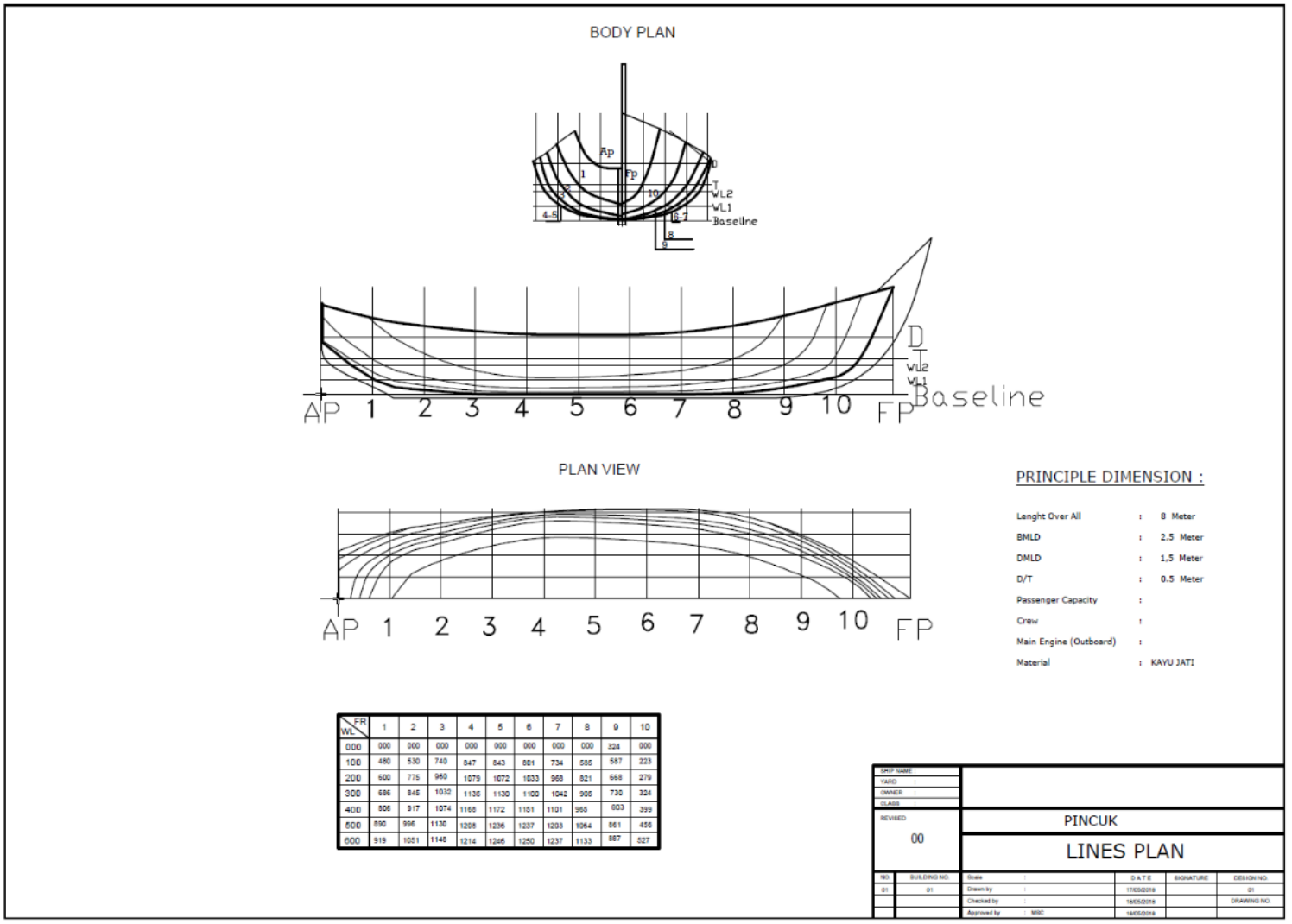

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200	600	775	960	1079	1072	1033	968	821	668	279
300	686	845	1032	1136	1130	1100	1042	905	730	324
400	806	917	1074	1168	1172	1151	1101	968	803	399
500	990	996	1130	1208	1236	1237	1203	1064	861	456
600	919	1051	1148	1214	1246	1250	1237	1133	887	527

Figure 11. The lines plan of Pincuk

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References

Abu Jami'in M., Julianto, E., Mujiono, U., Hidayat, E.P., and Asmara, I.P.S., Data analysis of ship measurement in Brondong with Polynomial function, *Proceeding of the National Seminar on Maritime, Sains, and Applied Technology*, Surabaya, Indonesia, 21 November 2016.

Asmara, I.P.S., Santoso, M., Julianto, E., and Praharsi, Y., The innovation cluster development for increasing local shipbuilding industry, *Proceeding of the National Seminar on Maritime, Sains, and Applied Technology*, Surabaya, Indonesia, 21 November 2016.

Jokosisworo, S., and Santosa, A.W.B., Technical analysis of Putra Bimantara III according to the wooden boat regulation of Indonesian classification bureau, *Ship Journal-Diponegoro University*, Vol. 5, No. 1, pp. 6-14, 2008.

Montwill, A., Kasinska, J., and Pietrzak, K., Importance of key phases of the ship manufacturing system for efficient vessel life cycle management, *Procedia Manufacturing*, Vol. 19, pp. 34-41, 2018.

Nasution, M.N. *Total Quality Management*, Ghalia Indonesia, Bogor-Indonesia, 2015.

Trimulyono, A., Amiruddin, W., Purwanto, E.D., and Sasmito, B., The application program of traditional boat design in the shipyard of Batang regency, *Ship Journal-Diponegoro University*, Vol. 12, No. 3, 2015.

Praharsi, Y., Erni, N., and Sinambela, B.J., Factor analysis to influence customer satisfaction in mineral water product (A case study of CV. Oen Jaya company), *Metris Journal*, Vol. 16, No.1, pp. 35-44, 2015.

Sharma, S., and Gandhi, P.J., Scope and impact of implementing lean principles & practices in shipbuilding, *Procedia Engineering*, Vol. 194, pp.232-240, 2017.

Son, M.-J., and Kim, T.-W., Business process management-based job assignment in ship hull production design, *Ocean Engineering*, Vol. 88, pp. 12-26, 2014.

Biographies

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