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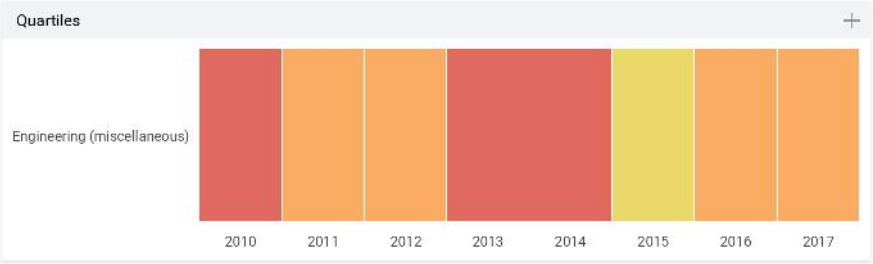

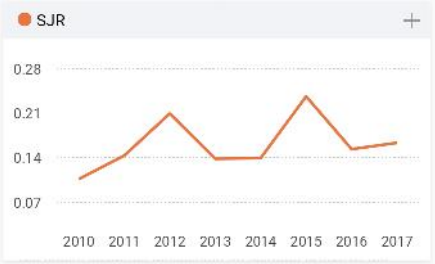

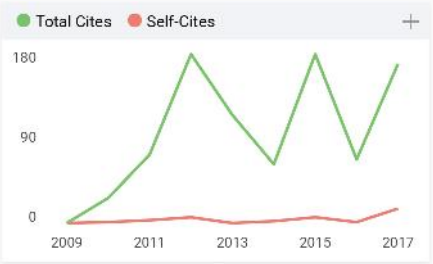

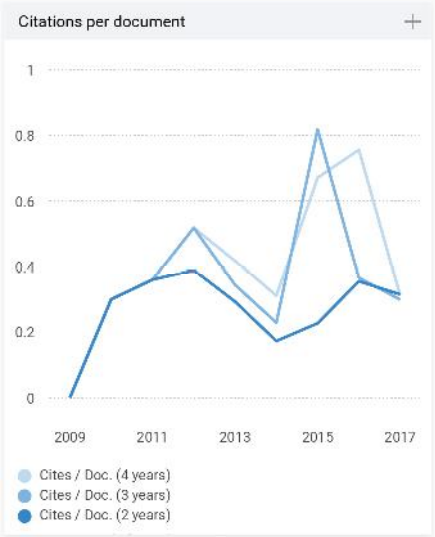

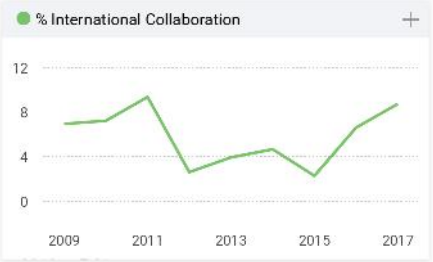

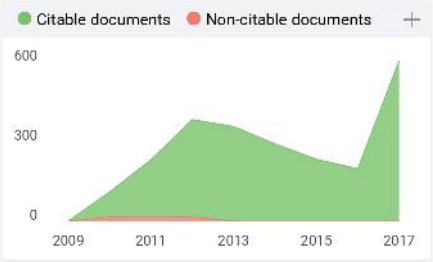

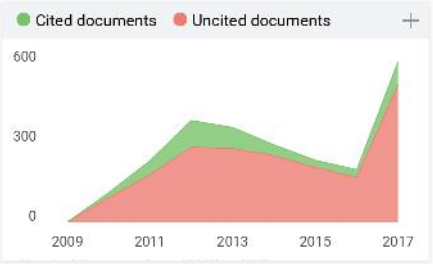

D **Dr. Farah** 4 days ago

Hi Elena

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Designing the Katinting Traditional Boat by using the Renewable Energy as the Main Motor Engine

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Abstract: This research aims at designing the katinting traditional boat which previously used the fuel oil to use the renewable energy as the main motor engine through designing and creating the prototype. This research is conducted by using measuring the traditional boat, redrawing of the boat using the MAXSURF application to determine the size of the boat. This research reveals that the redesigned traditional boat using the 2 m length to 0.4 m width and 0.2 m depth ratio. The traditional electric boat using the wind power and solar power which later converted into the electricity as the main engine of the boat. This designed boat fits into all type of boats according into its operation method. Therefore, this electric boat can be used to operate the static gear, encircling gear, towed/degreed gear and multipurpose gear.

Key words: Designing, boat, energy, electricity, multipurpose gear

INTRODUCTION

Fishing boat is defined as boat or ship or other floating devices that can be used to conduct fish capturing activities including the fisheries survey or fisheries exploration. These type of fishing boats consist of boat and small boats or boats without engine which is operated by paddle or mast, boat with attached motor made from wood, up to big fishing ship made from woods or fiber glass or steel which used the diesel engine. Traditional boat katinting is one of traditional boats in Indonesia and is often used by the fishermen community in the eastern part of Indonesia. This type of traditional boat is very popular in Indonesia. In 2005, the raise of the world's oil price to $70/barrel has put many of this type of fishing fleet out of business due to the high operational cost. Wahyudin (2012) in his research showed that 40% of per unit cost of the production cost is due to the fuel oil cost. Hence, it is clear how big is the cost that has to be spent by the fishermen due to this fuel cost. Further, Wahyudin (2012) stated that the increase of the fuel oil price has positive correlation with the increase of the production cost per unit. The high production cost is not followed by the increase of fish price and capture fish volume hence, it can be predicted how small the fishermen family income from this fishing activity would be and whether this income would be sufficient for their family. In addition, it is not impossible for fishermen with limited working capital will be put out of business. On the other hand, Gorontalo Province has been blessed with abundant renewable energy sources such as wind power and solar power. Habibie *et al*. (2011) said that the average wind speed for Gorontalo is 1.2226 m/sec with the speed frequency of 2.5 m/sec per day which amounted for 5.7%. This is a promising condition for the implementation of the renewable energy technology implementation as the solution for the increase of the fuel price. Therefore, this research is aimed at innovating on the usage of renewable energy as main power for the engine of the traditional fishing boat. Therefore, it is expected to solve the problem due to the raise of the fuel oil price which has diminished the chance to fish for the traditional fishermen community.

Theoretical review

Boat/ship definition: Boat is a construction shape that can float on the water and has ability to load people and or things and its movement is due to the existence of the paddling power, wind power or engine power. In fishing business, fishing fleet has a very important role in human lives (Ahmadi, 2010).

General arrangement: This general arrangement is the continuation of the lines plan. This general arrangement refers to the lines plan, thus, it needs to be carefully planned. General arrangement deals with how to properly designed a boat. The general arrangement of planning the boat design consists of:

- Determining the rooms in a boat
- Determining all the equipment needed and to arrange them accordingly
- Determining the walking space to each rooms in the boat

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There are several things to be considered in this general arrangement:

- The holding capacity to be determined and adjusted according to the holding space available
- Efficient interior design and in observance of the regulation
- The motor power used in certain method hence, the resistor capacity is known as well as the needed BHP and the power motor needed

The boat resistor is designed to be as minimum as possible thus, the friction between the body of the boat and the body of the water will become smaller hence, the boat efficiency can be maximized. Determine the holding tank/space by observing the safety and comfort and in observance with the regulation.

MATERIALS AND METHODS

Research object and tools: The tools and object of this research consists of writing equipment, rope, camera, computer (with Microsoft Office 2010 and MAXSURF application), measuring tape and katinting boat.

Data collection method: Data collection method in this research are primary and secondary data collection method. The primary data are collected directly from the size of the boat and the size of the boat hull. The secondary data are supporting data collected from literature review.

Technique of drawing the boat hull: Boat measuring data which were collected from the field are later corrected then used in drawing the boat hull. This boat hull drawing used the Free!Ship 3.37 version application. The drawing produced from this activity then used to obtain the boat hydrostatic parameter by using the MAXSURF application. The design of the concept is an initial effort to change the mission requirement or the needed data into the technical characteristics and the ship construction. This initial concept design consists of main measure of the boat such as the length the breadth the depth the volume the block coefficient the power and the alternatives to meet the required speed, cruising distance, shipload volume and dead weight. It also includes the initial light weight estimation of the boat obtained from the formulas, curves and experiences.

Data processing: Based on the data obtained from the field which consist of the main measurement of the boat, boat stationary measure and the height of the bow and the stern of the ship the next step is to put these measurements into the MAXSURF application. The data of the boat were analyzed by using the ratio values of the main dimensions of the boat. Fyson stated that in designing a boat, this ratio characteristic is a thing that has to be considered. The ratio consists of ratio of Length to Breadth (L/B) ratio of Breadth to Depth (B/D) 3) ratio of Length to Depth (L/D). The field data of these measurements are then processed using the MAXSURF application to obtain the hydrostatic parameter.

Ship designing method: In ship designing process, one of the significant factors to be considered is ship designing method as one of the effort to produce optimum and required criteria design. The method used in this design is the comparison method. This comparison method is a boat designing method which required the existence of a comparison ship with the similar type and this comparison ship has to meet the criteria of the design (stability, boat strength, etc.) and try to produce a better boat than the one that currently exists (comparison ship). The main size of the boat are obtained by multiplying the main size of the comparison ship with the scale factor (Santoso and Sudjono, 1983).

RESULTS AND DISCUSSION

Research findings

The casco shape: The prototype of the electric boat is the V round bottom and V bottom shape and then these two types of shapes then tested. Both body plans can be seen in Fig. 1.

The test result from these two shapes above then linked to the maximum GZ values in the main dimension measures of the comparing boat, the following values are obtained Table 1: based on Table 1, it is clear that the V

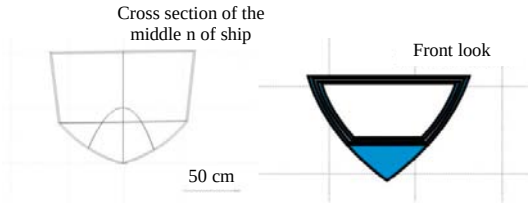

Fig. 1: Body plan prototype of the electric boat: a) V round bottom and b) V bottom

Table 1: Maximum GZ values in each shape of casco shape

	Angle of heel in maximum GZ		
Casco shape	Reiteration 1	Reiteration 2	Reiteration
V bottom with outrigger	28	30	27
V round bottom with outrigger	34	34	32
V bottom without outrigger	3	2	3
V round bottom without outrigger	10	10	12

Processed data, 2016

Table 2: Intrnational marine organization regulation on the comparison of the main dimension of the boat

Type kapal	L/B	T/B	B/H	T/H	L/H	Cb	Cm	Cw
Kapal capat besar (Vd = 22 knot)	8.50-9.90	0.37-0.43	1.45-1.55	0.58-0.66	12.8-14.9	0.59-0.63	0.93-0.96	0.72-0.76
Kapal barang besar (Vd = 15-18 knot)	8.90-9.00	0.40-0.50	1.50-1.70	0.64-0.80	13.30-15	0.67-0.75	0.94-0.97	0.78-0.84
Kapal barang besar (Vd = 10-15 knot)	7.0-8.500	0.40-0.50	1.50-1.80	0.66-0.82	11.6-14.0	0.75-0.82	0.96-0.98	0.85-0.87
Kapal sedang	7.0-8.500	0.40-0.50	1.50-1.80	0.66-0.82	11.6-14.0	0.75-0.82	0.96-0.98	0.85-0.87
Kapal cepat Jarak pendek (Vd = 16-23 knot)	7.50-8.50	0.25-0.35	1.55-2.20	0.70-0.99	11.0-15.4	0.73-0.80	0.95-0.99	0.83-0.87
Kapal lkan	5.00-6.00	0.40-0.50	1.50-1.80	0.74-0.84	8.5-10.00	0.45-0.55	0.72-0.82	0.72-0.78
Kapal tunda samudra	4.50-6.00	0.37-0.47	1.65-1.85	0.65-0.82	7.90-10.5	0.55-0.63	0.80-0.92	0.75-0.85
Kapal tundan pelabuhan	3.50-5.50	0.37-0.46	1.73-2.20	0.73-0.90	7.80-10.0	0.44-0.55	0.54-0.77	0.68-0.79
Kapal-kapalkecil	6.00-8.50	0.35-0.45	1.50-1.70	0.56-0.72	9.60-13.6	0.45-0.60	0.76-0.90	0.74-0.80
Kapal-kapal motor kecil (layer)	3.20-6.30	0.30-0.50	-	0.60-0.30	6.00-11.0	0.50-0.66	0.89-0.94	0.72-0.82

Table 3: Specification of the electric boat prototype

Parameter	Specification
Length (m)	2
Breadth (m)	0.4
Depth (m)	0.2
L/B	5
L/D	10
B/D	2
Displacement (ton)	18381
Volume (m^3)	17861.25
Cb	0.433
Cp	0.729
Cw	0.800
C	0.594

round bottom shape boat with outrigger has the bigger angle of heel in maximum GZ than any other shape of Casco. It means that the V round bottom ship with outrigger is more stable than another type of Casco boat.

Boat specification: In order to determine the main measurement for the boat that will be used for electric boat the researchers used the size of boat that are generally used by the majority of fishermen in the field that consist of the length, the breadth and the depth of the boat. In general, the general dimensions of boat in Gorontalo Province is as follows: length 5-10 m, breadth 0-1 m and depth 0.4-0.8 m. The average length, breadth and width of boat, respectively are 7.39, 0.73 and 0.64 m. For safety reason of the boat, determination of the main dimensions of the boat followed the international marine organization regulation as follow Table 2.

Based on Fig. 1, the specification of the electric boat prototype that would be used is as follow Table 3: the L/B ratio is used to analyze the movement and the speed of a boat. The smaller the L/B ratio the better the movement of boat and which brings down the speed of the boat. The L/B ratio was 5. This value categorized as high value because this boat is slender or the boat friction area is small hence, the boat will have high speed. The L/D ratio is the elongated strength of a boat. The bigger the value of the L/D ratio the weaker the elongated strength of a boat. The L/D ratio of this multifunction boat is 10 hence, it lessen the longitudinal strength of the boat. On the other hand, the B/D ratio is used to analyze the stability and the ability of the boat to push forward. The bigger the value of the B/D ratio the better stability of the boat, however, it also means the lesser the ability of the boat to push forward. In this prototype of the B/D ratio was 2 and it considered as high value. This high value of B/D ratio means that this electric boat prototype has good stability however its ability to push forward is less. In detail, the ratios of Indonesian fishing boat can be seen in Table 4.

Table 4: The range of Indonesian fishing boat ratios

Operation method	L/B	L/D	B/D
Static gear	2.83-11.12	4.58-17.28	0.96-4.68
Encircling gear	2.60-9.300	4.55-17.43	0.55-5.00
Towed/Dragged gear	2.86-8.300	8.69-17.15	1.25-4.41
Multipurpose gear	2.88-9.420	8.69-17.15	0.53-6.09

In relation to the criteria in Table 4, the values of this electric boat prototype fit into all the type of boat according to its operation method. Therefore, this prototype of the electric boat can be used to operate static gear, encircling gear, towed/dragged gear and multipurpose gear.

Construction and design: In general, this electric boat was design to fully show the electric boat as in real life. In detail, it can be viewed in Fig. 2 and 3, it is clear that the prototype of this electric boat has a V round bottom plan with outrigger and three fish hatch, 1 engine room and synergy. The distinctive feature of this boat was that it had solar panel and wind turbine as the main source of energy for the motor engine of the boat.

Lines plan: To determine the shape and the size of the electric boat, the drawing to produce the lines plan of the boat was made. Below was the lines plan of the electric boat prototype.

Body plan: The cross section in the middle of this electric boat has the V round bottom shape as previously mentioned. This was meant to increase the floating power of the boat and to boost the stability of the electric boat. The following figure explains this in detail (Fig. 3).

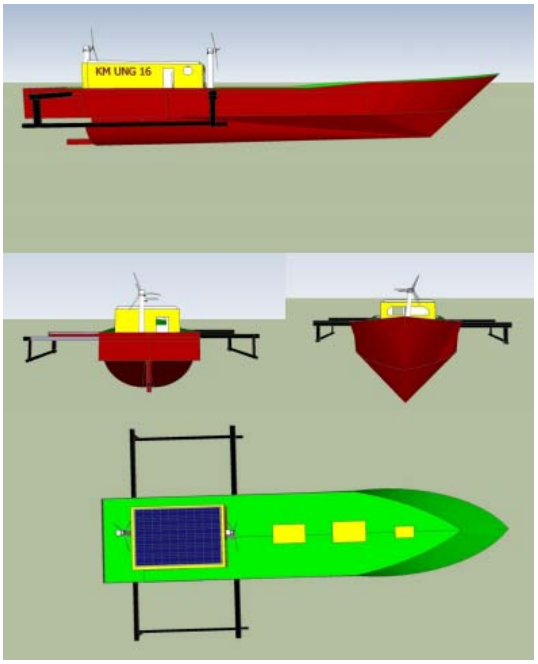

Fig. 2: The design of the electric boat

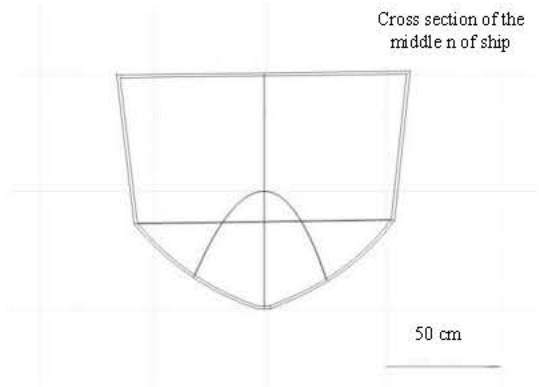

Fig. 3: Cross section of the boat

In Fig. 3, it is clear that the electric boat was built using the V round bottom shape. Hence, this condition was able to increase the floating capacity and the stability of the boat.

CONCLUSION

Based on this study, the following things were concluded:

- Traditional boat was redesigned using with the following ratio: 2 m length to 0.4 m breadth to 0.2 m depth
- This traditional boat used wind and solar power, which converted into electricity as its main motor of the engine
- The designed boat fits into all categoryof ships and their operation methods. Therefore, this electric boat can be used to operate static gear, encircling gear, towed/dragged gear and multipurpose gear

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