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INNOVATION TECHNOLOGY MODEL OF ELECTRIC BOAT FOR TRADITIONAL FISHERMEN IN GORONTALO PROVINCE - INDONESIA

EduartWolok eduart@ung.ac.id Faculty of Engineering, State University of Gorontalo ABSTRACT The soaring price of the fuel oil has put the traditional fisherman out of business. This research aims at finding an innovation technology in traditional fishing boat by using the renewable energy source like wind and solar heat. This research showed that the innovation technology model on electric boat was focused on the usage of wind turbine and solar panel as the main source of power in the main motor. This technology innovation has several advantages such as, it does not use fuel oil, has better stability value compared to similar type traditional boat, has bigger space including the fish hold space, and has more robust build. Keywords: innovation, technology, energy, boat

1. Introduction

Gorontalo province is one of the provinces in Indonesia, which surrounded by the sea. This condition has made Gorontalo rich with marine resources especially in capture fisheries. The growth of capture fisheries in Gorontalo province is largely due to the contribution of traditional fishermen in exploring these abundant marine resources. The raise of the oil prices in 2005, which had reached \$70/barrel, had worsened the condition for the traditional anglers (Umam, 2007). Many had lost the opportunity to fish because they could not afford the cost of the fuel. Wahyudin (2012) in his study showed that almost 40% of the cost per unit is cost spent for fuel. Hence, it is clear that the fishermen should spend large proportion of the production cost for fuel. Further, wahyudin (2012) stated that the increase of the fuel price has positive correlation on the increase of the cost per unit. This cost overrun is not followed by the increase of the price and volume of captured fish, thus, the fishermen income has become less and less. In addition, it is possible for fishermen with limited working capital to be put out of business or bankrupt. On the other hand, Gorontalo province has been blessed with abundant renewable energy sources such as wind power and solar power. Habibie (2011) said that the average wind speed for Gorontalo is 1.2226 m/s, with the speed frequency of 2.5m/s 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.

2. Design of the technology innovation

The solar power can be directly converted into electricity by using the solar cell or photovoltaic. The same also applies for wind movement energy that can be directly used through propellers to rotate the wind turbine. This rotation will produce electricity that will be stored within some batteries. Implementation of this type of innovation in the main engine of the motor will automatically eliminate the usage of fuel oil. The innovation in electric boat located in the usage of solar panel and wind turbine as the main power generators, in which the power will be later used to power the main engine of the electric boat. The following figure describes this innovation process. Figure 1. Technology Innovation in electric boat. Energy produced by the wind turbine and the solar panel will be stored in batteries through hybrid controller. Further, the stored energy in a battery will be used to power the main motor engine by previously converting the current through the inverter. In addition to the source of energy, other technology innovation in this electric boat also located on the shape of the boat. The boat used in this type of technology innovation is the V round bottom hull with short outriggers, which made this boat more stable than other types of traditional boat that are generally used by the fishermen. This has made the electric boats more stable and secured. In figure 1 above, it was clear that the placement of the wind turbine, solar panel, engine and other equipment. The placement is based on space efficiency factor and is also based on the stability of the boat consideration. Technology innovation of electric boat has several advantages and disadvantages compared with other similar types of boats. The advantages and disadvantages of the type of electricity boat in this research are presented in the following table. Table 1. Advantages and Disadvantages of technology innovation of the electric boat

Advantages	Disadvantages
1. Has wind turbine and solar panel as the main source of power for the main motor engine	2. Does not need the fuel oil
3. Has better stability value than other similar types of traditional boat	4. Has bigger rooms including the fish holding tank
5. Has more robust material	1. Has bigger resistor, hence it needs bigger propulsion system.

Based on table 1 above, it can be concluded that the presence of this electric boat technology innovation can yield bigger benefit. The biggest benefit for the community is that this technology innovation replaced the need for fuel oil with electric power produced by the wind turbine and solar panel. This will eradicate fishermen's dependency on fuel oil that consumed a large proportion of their production cost. In addition, this electric boat technology innovation has better stability than other similar type of boats that currently being used, hence, the safety and the security of the fishermen are guaranteed. Other benefit of this innovation is that it produces bigger fish holding tank compared to other traditional type of boats. Hence, it gives bigger chances for the fishermen to increase the number of fish that they can hold in their fish holding tank, which in turn will increase their income.

3. Wind Turbine Model

The type of wind turbine in the picture is the best type of wind turbine to be applied in this type of boat. This wind turbine has three angles and can be directed with a control panel located in the tail of the wind turbine. This wind turbine produces high speed and is highly efficient. The energy specification produces with this wind turbine is 300 w/ 24 v with the average charging speed is 30 minutes with the speed wind.

4. Model of the solar panel

a. Specification In order to support the efficiency of the work system, several components are assembled in one solar panel. The components in this solar panel are as follow: Table. 2 Specification of the solar panel power station

Solar panel	Inverter	Battery	Controller
Mono Polycrystalline	300 WP	DC to AC power capacity 500 watt/220 volt, 120 DC to 120 AC	24 Volt 80 AH 12VDC-10Ah

Source: Processed Data, 2016

b. Work system The electricity produced from this solar panel will be channeled into the controller to control the number of inbound and outbound electricity. The inbound electricity is channeled into the battery serially connected to the battery as shown in the following picture. The outbound current from the battery will be controlled by the controller and then later channeled into the inverter. In detail, this process is described in the following picture: Figure 2. the Work System of the solar panel power plant

5. The electricity system produced as the power plant for the boat

The solar panel and the wind turbine are the components that absorb the light and the wind, which later converted into electricity. In order for the electricity from the solar panel and the wind turbine to be used, these solar panel and wind turbine need what are called as hybrid controller to control the inbound energy. When the energy comes into the hybrid controller, it would be stored in the battery, which later will be connected into the inverter. This inverter changes the DC current from the solar panel and the wind turbine into AC current electricity to power the boat as appear in the following picture: Figure 2. the Work System of the solar panel power plant Figure 3. Power Plant

In addition, the battery also is also used to store the electricity surplus. The series of the controller within the electronic series regulates the battery charging process. This controller can also regulate the battery voltage in a 12 voltage range. If the voltage decreases to 10.8 voltage, then the controller will charge the battery with a solar panel or wind turbine as the power source. This charging process will happen during the day light or if there are winds. After several hours of charging process, the battery voltage will increase. If the battery voltage reaches 13.2 volt, the controller will stop the charging process.

6. Conclusion

1. Technology innovation model in electric boat focuses on the usage of wind turbine and solar panel as the source of energy in the main power engine.
2. This model has several benefits such as, the solar panel and wind turbine as the main power of the engine, doesn't need the fuel oil, has better stability than other traditional boat types, has bigger space including the holding space (fish holding space), has stronger material.

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