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IMPLEMENTATION OF SMART BIOFLOC POND WITH SOLAR CELL POWERED TO INCREASE THE INCOME GENERATING OF DARUL HIKMAH AL HASANI FOUNDATION

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ABSTRACT

The Darul Hikmah Al Hasani Foundation is an elementary Islamic school foundation in Malang City that has an educational tourism learning program about the world of fish. This learning program was stopped due to capital and operational cost constraints. The Malang State University Community Service Team provided a solution in the form of a smart biofloc pond system as another source of income generating for partners which can also be a learning medium for students. The main solution in the smart biofloc pond system is solar cell technology as an alternative energy source for generating electricity to drive water flow so that more oxygen is obtained. This system was chosen because of its various advantages, including greater harvest yields and environmental friendliness due to the optimal use of existing resources in the environment.

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INTRODUCTION

The Darul Hikmah Al Hasani Foundation, Malang City (with conditions as in **Figure 1**) is a foundation that has a Madrasah Ibtidaiyah education level with an akhlakul karimah program, based on the Al-Qur'an, as well as outdoor learning-based learning. This outdoor learning-based learning program is what triggered Darul Hikmah Al Hasani to create student educational tourism in the form of an orange picking area, a farming area, and a fish world area. This program was stopped because operational costs required a lot of money, especially in the flow of fish ponds which had to be kept clean. So far, these operational costs have been obtained only from the participation of Islamic boarding school trustees and donors. On the other hand, there is potential for the fish world to become a source of operational funds for the foundation, namely by developing the fish world it already owns into a smart biofloc pond system.

A biofloc pond is a pond with a waste management system in a cultivation system that does not require additional facilities with the advantages of saving water and land, increasing biosecurity, increasing water quality control, improving feed conversion, and reducing the influence of weather on the cultivation process (Zaidy, 2022). So, fish cultivation using bioflock ponds itself is fish cultivation with little or no water changes,

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utilizing microorganisms consisting of algae, zooplankton, bacteria, protozoa, and other organic materials to form flocs (Hargreaves, n.d.). Based on research conducted by Baihaqi, et al. (2020), production results through biofloc ponds from 100 kg/1000 fish seeds to 120 kg/1000 seeds in the harvest period from 90 days to 75 days and can reduce dependence on the use of manufactured feed from 100 kg /harvest cycle to 85 kg/harvest cycle (Baihaqi et al., 2020).

Figure 1. Conditions of Darul Hikmah Al Hasani Foundation schools and classrooms

However, biofloc ponds have a disadvantage in that the oxygen requirement in the water is very high (Sumitro et al., 2020). To run it, electrical energy is needed to drive the water flow to get more oxygen. So, an alternative power generator is needed that is more efficient and utilizes the energy available in the surrounding environment. In this activity, a solar panel-based power plant was chosen (Sunaryono et al., 2023; Mufti et al., n.d.; Nugrahadi et al., 2021; Diantoro et al., 2021) where electrical energy is produced from sunlight. The application of solar energy is also supported by Indonesia's geographical location at the equator, which always receives sunlight every year. The intensity of solar radiation received by the earth reaches 1000W/m^2 (Myori et al., 2019).

If we look at the use of electrical energy in Indonesia, electricity costs are calculated based on the amount of electrical energy used in Kilo Watt Hour (KWH) electrical energy units (Abbas et al., 2020). So, a bioflock pond system powered by sunlight can be profitable in terms of the cost of using electrical energy. Furthermore, for partners, it can also be a medium for student learning, as well as income generating from abundant harvests.

METHOD OF EXECUTION

Preparations

1 Equipment and Materials Needed for Service

The materials needed for service are prepared based on science and technology descriptions. The description of the science and technology that will be applied in this activity is a smart biofloc pond solar cell powered technology by sunlight as an

electricity generator. The system is equipped with two filters and a pump to circulate the filtered water again. This system can be made by preparing several pieces of equipment for ponds, including iron frames, tarpaulin, hoses, water barrels, taps, activated carbon, fishing nets, biofilters, pipes, galvanized steel, net pots, and electric drills. Meanwhile, a solar panel system requires PV solar cells, power cables, batteries, AC and DC inverters, and a controller.

2 Making a framework for smart biofloc ponds powered by solar cell technology

The design process for biofloc and aquaponic pond frames powered by solar cells was carried out at the Department of Physics, State University of Malang. The frame specifications of this system include:

a. The biofloc tarpaulin ponds used were two tarpaulin ponds with a height of 1 meter and a diameter of 2 meters.
b. The solar cells used were panels capable of storing 100 Wp of power with 2 panels of 50 Wp each.
c. The battery used is a battery with a capacity of 12V 45Ah.

Implementation of Community Service

1 Installation of smart biofloc pond technology powered by sunlight

The implementation phase begins with installing the entire solar-powered smart biofloc pond technology system. Which is carried out by the service team. This process is carried out by first conducting socialization regarding the technology that will be applied to partners.

2 Monitoring and Continuation of Activities

The next stage is assistance in cultivating aquaponic plants and fish from biofloc ponds. After that, design business opportunities resulting from the overall system so that partners are able to carry out business efficiently and effectively. The stage ends with an evaluation that provides assistance in cultivating catfish with biofloc and aquaponic systems and developing marketing for market expansion.

RESULT AND DISCUSSION

This service activity was carried out at the Darul Hikmah Al Hasani Foundation, Merjosari, Malang City. This location was chosen because it has an outdoor learning-based learning program that invites students to study outside the classroom. One of the activities carried out at this foundation is picking oranges, farming, and cultivating fish.

Fish cultivation in the city of Malang is also a very promising business opportunity so fish cultivation activities will also generate income for partners in addition to being a learning medium for students. In this case, the partners chose to cultivate tilapia fish. This cultivation activity cannot be separated from the need for electrical energy to drive the pump for water flow and oxygen in the water. So this service activity is very beneficial for partners. These benefits include saving land for ponds, saving operational costs for fish farming because the electrical energy used comes from solar panels installed by the service team, as well as developing student learning media.

On June 20, 2023, the service team carried out a site survey to measure the land and find the right location for installing solar panels. This activity was also carried out to collect data on the materials needed for installing fish ponds and solar panels. Then on July 10, 2023, the service team installed a fish pond and solar panels at the partner's location. This activity is carried out from 9.00 WIB to 16.00 WIB. The activity began with an explanation of Biofloc pond technology by Prof. Dr. Sunaryono, who symbolically handed over 2 sets of fish ponds and a set of solar panels to the chairman of the foundation.

The activity continued with the installation of a new fish pond and continued with moving the old pond already owned by the foundation to the same location as the pond installed by the service team. After that, the installation of solar panels was carried out, led directly by Prof. Nandang Mufti, Ph.D and assisted by other team members. After the solar panels were installed, the activity continued with an explanation of how solar panel technology operates in the Biofloc pond. The activities that have been carried out are documented in the form of photos presented in **Table 1**.

Table 1. Service activities at the Darul Hikmah Al-Hasani Foundation, Malang City.

No	Activity	Documentations
1.	Briefing regarding the concept of the Community Service (PKM) project by the head of the service team to the management of the Darul Hikmah Al-Hasani Foundation as the location for the service.	 
2.	Search for a location to install a solar-powered smart bioflock pond technology system within the Darul Hikmah Al-Hasani Foundation.	

3. Measurement of the installation location for the solar-powered smart biofloc pond technology system.

4. Biofloc pond installation at the Darul Hikmah Al-Hasani Foundation.

5.	The process of moving the old biofloc pond to the installation location for the solar-powered smart biofloc pond technology system.	  

6.	Proses to install the solar cell system.	  

7.	The smart biofloc pond technology system powered by sunlight has been installed at the Darul Hikmah Al-Hasani Foundation.	  

8.	The process of signing documents for the handover of solar sell powered biofloc pond sets.	

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CONCLUSION

The use of smart bioflock ponds with solar cell power has been carried out at the Darul Hikmah Al-Hasani Foundation, Malang City. The installed bioflock pool is a tarpaulin pool with a height of 1 meter and a diameter of 2 meters. The fish chosen for cultivation is tilapia. This was chosen because of the great opportunities in the economic sector. Apart from that, the solar cell system used in this activity is a panel with a total power storage capacity of 100 Wp. The solar cell operating system in this case is a hybrid system, which means that the use of electric current can adjust to conditions.

When the current is insufficient because the panels do not receive sunlight (such as during rain and at night) the current used automatically switches to PLN electric current. This activity was carried out to rebuild student learning media at the Darul Hikmah Al-Hasani Foundation. Apart from that, this activity also benefits the Foundation in the economic sector from the results of the fish farming harvest which is economical in feeding and saves electricity because the electricity used utilizes existing and abundant natural resources.

Author's declaration

Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

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