

Empowering Waqf Land with SMART-K and Vertiqua in Muhammadiyah Sukabumi City

Amalia Nur Milla^{1*}, Ujang Dindin², Yana Fajar FY. Basori³

¹ Fakultas Pertanian, Program Studi Agribisnis, Universitas Muhammadiyah Sukabumi, Sukabumi, Indonesia

² Fakultas Pertanian, Program Studi Akuakultur, Universitas Muhammadiyah Sukabumi, Sukabumi, Indonesia

³ Fakultas Ilmu Sosial, Program Studi Administrasi Publik, Universitas Muhammadiyah Sukabumi, Sukabumi, Indonesia

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Corresponding Author:

Amalia Nur Milla

amalia.nurmilla@ummi.ac.id

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Abstract: This community empowerment is carried out through the utilization of waqf land in the form of two large ponds with an area of about 500 m², then 5 classrooms that have not been used for a long time so that their condition is neglected. The purpose of this activity is to overcome the existing problems, namely the water channel to the pond that has not been repaired, the quality of the pond that is not adequate to be used as a cultivation pond, the manager, namely the group formed by the PDM, does not have experience and knowledge in fish farming. The method carried out as a solution to the existing problems is in the form of fish farming management training by improving the quality of ponds for cultivation through SMART-K (Aquaculture Management System and Technology Engineering). Training on vertiqua, land-saving fish farming and utilizing empty space as a place for fish farming. The results achieved were the quality of the pond was improved and koi fish cultivation was carried out through SMART-K, the empty room was used for catfish cultivation using tarpaulin ponds, vertiqua gen 2 was made as a technology for land-saving fish farming. The sustainability of this activity has the potential to be used as a place for fish farming training for the general public and education for the younger generation such as school children.

Keywords: Empowering; SMART-K; Vertiqua; Waqf land.

Introduction

The application of technology in agriculture aims to increase food production through the substitution of traditional farming systems with modern farming systems by utilizing more advanced technology. This has an impact on the use of chemical fertilisers and pesticides, which can cause environmental damage and ultimately reduce agricultural productivity (Mukhlis et al., 2024).

The community service partner is the Muhammadiyah Regional Leadership (PDM) of Sukabumi City, which is one of the community, religious and social organizations that receives waqf land to manage. The waqf land is located in Balandongan, Jayamekar Village, Sukabumi City. The definition of waqf land is to perpetuate the benefits of land for the public interest (Christianto, 2022). In order for the waqf land to provide benefits, it is necessary to empower the

waqf land. Currently, the waqf land is still not optimally utilized.

Empowerment is a way of strengthening the social community as a process of increasing awareness and abilities to achieve success (Nasution & Ramadhani, 2022). Empowerment of waqf land in Muhammadiyah can be cooperated with other institutions with the aim of benefit, in its management, a board is needed that is considered capable of utilizing waqf land for the benefit of the organization (Setiadi & Pradana, 2022). The partner condition, namely the Muhammadiyah waqf land empowerment group in Sukabumi City, manages 5600 m² of waqf land. The potential of the surrounding area is still beautiful in a rice field environment, there is an irrigation channel that flows towards the river and on the edge of the paved road is a location that is irrigated all the time. There are two large ponds, each with an area of about 500 m². Another potential is the existence of a mosque building, 5 classrooms and a hall-like building.

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This location has not been used for a long time so that its condition has become neglected, even though waqf land must be managed for the benefit and interests of the organization (Nasution & Ramadhani, 2022). The existing problem is that the water channel to the pond has not been repaired, the quality of the pond is not adequate to be used as a cultivation pond. So that the water is not smooth to enter the pond and exit the pond. Another problem is that the managers, namely the groups formed by the PDM, do not have experience and knowledge in fish farming, so the fish planted in the ponds are just that, not cultivated intensively. Knowledge of land and pond management is inadequate. Similarly, the existing building can actually be used for vertiqua fish farming. Another potential is that it can be used for fish farming training for the general public. It is located next to a paved road and surrounded by irrigation channels, so fish farming is very appropriate to be carried out on the waqf land (Christianto, 2022).

The above conditions encouraged the community empowerment team of Universitas Muhammadiyah Sukabumi to help overcome the existing problems. The community empowerment team consisting of multi-disciplines, namely fisheries (Aquaculture) from the Aquaculture Study Program, Faculty of Agriculture, agribusiness from the Agribusiness Study Program, Faculty of Agriculture and administrative science from the Public Administration Study Program, Faculty of Social Sciences, Muhammadiyah University of Sukabumi, initiated to overcome the problem by implementing vertiqua and SMART-K. Vertiqua (Vertical Aquaculture) is one of the innovations from the Aquaculture Study Program aimed at cultivating on land and with limited water. Vertiqua is a form of cultivation media development that is carried out vertically utilizing a biological filter system to maintain water quality. Vertiqua has several advantages, namely requiring little land, saving water, easy to move, easy to monitor and control so as to minimize deaths due to stress and pests or diseases.

SMART-K is an aquaculture system developed as an effort to optimize aquaculture activities from the beginning of the activity (cultivation preparation) to the end of the activity (post-harvest). This system aims to ensure that each stage in the cultivation process is carried out in a structured, consistent and efficient manner, and in accordance with the quality standards of the Good Fish Cultivation Method (CBIB). The advantage of vertiqua is that through vertical extension it can utilize limited land and limited water can be utilized through biological recirculation in the form of kale plants. This system is registered by the UMMI Faculty of Agriculture Aquaculture Study Program with the creation number 000239108 issued by the Ministry of

Law and Human Rights. Vertical aquaculture or commonly called Vertiqua is an innovative design for the cultivation of consumer fish and ornamental fish such as koi, tilapia, comet, catfish, carp and others in limited land and water. Vertiqua is suitable if used indoors or on narrow land.

The solution to overcome the above problems is to empower the waqf land management group with vertiqua and SMART-K training. Not only for the management group, but also for the community around the waqf land location. So that empowerment through vertiqua and SMART-K training can be more beneficial to the wider community. This service is also expected to produce new innovations for the community service team. Through trials carried out in service activities.

The objectives of carrying out the activity are: (1) Empowering pond land with fish farming; (2). empowering the building with the Vertiqua fish farming system and as a training ground; (3). increasing the income of organizations and management groups to meet economic needs; (4). expanding the fish farming network by optimizing the existing land. According to Nugroho et al (2024), the extension session, farmers are invited to understand the process of fermentation and decomposition of organic matter in fertilisers, as well as how the microorganisms involved in the process can improve soil health and plant growth.

Method

Socialization

The initial stage of this activity is the socialization of activities that will be carried out to partners, like as: (a) Coordination of preparation for the implementation of activities; (b) Conducting program socialization to partners and the surrounding community with the person in charge of the entire proposing team accompanied by students; (c) Determining the time of implementation of each activity, with the person in charge of the head of the proposing team assisted by students and service implementers; (d) Carry out a series of activities, with all stakeholders in charge.

Training

SMART-K training for fish farming, pond quality improvement, aquaculture management and marketing through partnerships, like as: (a) Training on fish farming Aquaculture; (b) Vertiqua training.

Application of technology

Technology using SMART-K and vertiqua
S : System, fish farming is a system consisting of interrelated components, affecting the success of the aquaculture business.

M : Management, fish farming must implement management functions. Planning, organizing, implementing, supervising, controlling, and evaluating.

A : Aquaculture, is the cultivation of fisheries

R : Engineering; there needs to be engineering so that the pond or media where fish grow supports the success of the cultivation business, including using vertiqua, a technology that can save water and save space, very suitable for those who have narrow land.

T : Technology, by applying superior seeds, feed technology,

K : Partnership, business success will be achieved through good partnerships between producers/fish farmers and consumers/market. In addition, it can also partner with farmers who have ponds around the waqf land.

Mentoring and Evaluation

After receiving training, the cultivation group will also receive assistance to practice directly in the field, and will be evaluated regularly so that the success of the fish farming business will be successful.

Program sustainability

The program can be carried out sustainably if the application of SMART-K and vertiqua can be implemented properly, consistently so that fish farmer groups can continue and develop fish farming businesses.

Result and Discussion

Socialization Activities

Socialization was carried out at the beginning of the activity to the Muhammadiyah waqf land management team and invited other autonomous organizations in Muhammadiyah. The majority of autonomous organizations present were mothers, there were also IMM and Tapak Suci. In the socialization activity, the purpose and objectives of the community empowerment activities were conveyed. For more details of the socialization activities can be seen in figure 1.



Figure 1. Socialization of the Community Service Program

Training Activities

The training activities carried out were vertiqua training and SMART-K training.

Vertiqua Training

Vertiqua is aquaponic verticulture, aquaponics that is arranged in stages to save land. The aquaponic system is an integrated system between aquaculture and hydroponics where fish farming waste in the form of metabolic waste and residual feed is used as fertilizer for plants (Nasution & Ramadhani, 2022). The concept of aquaponic farming is no waste, which means that the waste from fish metabolism will be used by plants as fertilizer (Setiadi & Pradana, 2022). The benefits of aquaponic farming are that it can be done on a small area of land, is environmentally friendly, and is able to produce two products in the form of fish and vegetables in one cultivation cycle. Based on the discussion that has been mentioned, it can be concluded that due to the impact of abrasion, rob and covid-19, one of the useful activities is aquaponics. Aquaponics is suitable in Bedono Village which has a narrow land so as to maximize the potential of the existing land. The fish used are catfish and the plants used are kangkong (Setyati et al., 2020).

The extension and training, farmers were provided with an in-depth understanding of the use of these organic fertilisers, which resulted in increased quality and quantity of crop yields, improved soil structure, as well as reduced production costs. Thus, the use of sawdust and litter fertiliser supports environmentally friendly and sustainable agriculture (Ulma et al., 2024).



Figure 2. Vertiqua Training

SMART-K Training

SMART-K is an aquaculture system developed as an effort to optimize aquaculture activities from the beginning of the activity (cultivation preparation) to the end of the activity (post-harvest). This system aims to ensure that each stage in the cultivation process is carried out in a structured, consistent and efficient manner, and in accordance with the quality standards of the Good Fish Cultivation Practices (CBIB).



Figure 3. Before and after SMART-K implementation

Technology Implementation

The technology used was vertiqua and SMART-K. The vertiqua applied is vertiqua gen 2, which consists of 4 plastic drums arranged in such a way that it can accommodate 1000 comet fish. This fish was chosen because ornamental fish have a more economical selling value than consumed fish (Respati & Djumena, 2022).

Vertiqua has a good effectiveness value for tilapia cultivation, because it is seen from the water quality and feed efficiency as well as the growth value of fish length and weight. Water quality parameters in this vertiqua system have ideal values, especially in temperature, pH, and DO (Hotman, 2021).

Mentoring and Evaluation

Mentoring is carried out by lecturers and students after training activities and training implementation. The partner group was assisted in terms of cultivation practices. Both cultivation using vertiqua and cultivation in ponds by applying SMART-K. Monitoring and Evaluation (Monev) is carried out by LPPM and pemonev from Dikti.

Program Sustainability

For program sustainability, a Sustainable SMART-K SOP was designed, namely: This SOP aims to ensure that each stage in the cultivation process is carried out in a structured, consistent and efficient manner, and in accordance with the quality standards of Good Fish Cultivation Practices (CBIB) and the sustainability of the cultivation business. The stages carried out are based on the following Standard Operating Procedures (SOP): (1) Pond preparation; (2) Production Process; (3) Harvest; (4) Business Sustainability

Pool Preparation SOP

(1) Pond Sanitization a. Clean the pond from the remnants of previous cultivation such as mud, garbage, weeds, and pests; (2) Pond Structure Repair: (a) Repair the bunds to minimize leakage during the cultivation process. b. Repair the cobbles to facilitate the harvesting

process; (c) Make sure the inlet and outlet systems are functioning properly to ensure smooth water circulation; (3) Drying the pond a. Dry the pond for 2-3 days so that pests and diseases die; (4) Water filling (a) Fill the pond with clean water until it reaches a height of 20 cm; (b) Leave the water in the pond for 1 day for the spawning phase and the nursery phase. Leave the water in the pond for 7 days so that it can grow natural food such as plankton and worms; (5) Fertilization a. Fertilize the pond using manure (chicken manure) at a dose of 25 grams/meter² in order to grow natural food for koi fish such as phytoplankton, zooplankton, and worms; (6) Water Quality Settings (a) The color of the water must be green; (b) Check the pH of the water and make sure it is within the appropriate quality standards for koi fish farming, namely pH 7-8; (c) Check DO so that koi fish survival is good with a minimum DO quality standard of 5 mg / L; (d) Check the temperature so that the fish conditions are stable. Check the temperature so that the condition of the fish is stable.

Production SOP

1) Seed Stocking a. Select quality fish seeds that are free from disease. b. Acclimatize the seeds by soaking the seed container in the pond for 15-30 minutes before the seeds are stocked. c. Seed stocking is done in the morning or evening when the temperature in the water is stable so that the fish seeds can adapt well; 2) Feeding a. Provide quality feed with the appropriate nutritional content for the type of fish being cultivated. Generally, we use megami type feed which contains 48% protein so that fish growth can be optimized. b. Feeding is done 3 times a day, namely at 9 am, 12 noon, and 3 pm using the adlibitum method (as full as possible); 3) Water Quality Management a. Perform routine monitoring of water quality parameters such as temperature, pH, and dissolved oxygen (DO) content. b. Ensure a smooth water cycle in the pond to minimize the accumulation of fish metabolic waste that can lead to the growth of disease; 4) Pest and Disease Control a. Regularly observe the condition of the fish to detect symptoms of disease

as well as pest or predator interference. b. Preventive measures are taken by providing probiotics or using natural ingredients to control pests and diseases. We generally use probiotics under the brand name Pastak; 5) Growth Monitoring a. Conduct regular fish sampling to monitor fish growth and health. We do fish sampling once a week b. Record the weight and size of the fish and adjust the feeding.

Harvesting SOP

1) Harvest Preparation a. Determine the harvest time based on size. We harvest the hatchery phase at the age of 14-21 days with an average fish size of 1-2 cm. For the fingerlings phase, we harvest at the age of 30-40 days with an average fish size of 5-7 cm. b. Prepare harvesting equipment such as; nets, buckets, lambit, rakes, fish bags, rubber, hapa, and oxygen cylinders. c. Remove part of the pond water 1 day before harvesting so that the harvest can be efficient; 2) Harvesting Process a. Remove the volume of water in the pond that was previously removed. This is done to facilitate fish harvesting. b. Harvest in the morning between 6:30-8:00 am to avoid stress and minimize fish mortality. c. Use the net carefully to avoid injury to the fish; 3) Post-harvest handling a. Move fish that have been caught into temporary shelters, namely hapa or waring so that the fish are not stressed. b. Clean the shelter from sediment carried during harvesting. c. Perform sorting based on the size, color, and quality of the fish; 4) Transportation and Storage a. Use pre-checked plastic bags to transport the fish to the marketplace. b. Ensure the condition of the fish is maintained during the transportation process to avoid death and damage. Use oxygen to prevent the fish from dying during transportation to the marketing location; 5) Recording and Evaluation a. Record the number and weight of fish harvested. b. Evaluate the

cultivation process and harvest. Evaluate the cultivation process and harvest results for improvement in the next stocking.

SOP for Cultivation Business Sustainability

1). Institutional Strengthening; 2). Consistent application of management functions (POAC), consist: a. Planning, b. Organizing, c. Actuating, d. Controlling; 3). Partnership, Partnership by implementing consist: a. Pentahelix, b. Other business actors (World of Business and Industry/Dudi), c. Government agencies (DKP3) and others related including the world of education (schools), d. Community Organizations (Muhammadiyah along with Ortom and educational charities), e. Academics, it is necessary to continue to establish cooperation with academics to continue to assist businesses, f. Mass Media (online, print and electronic)

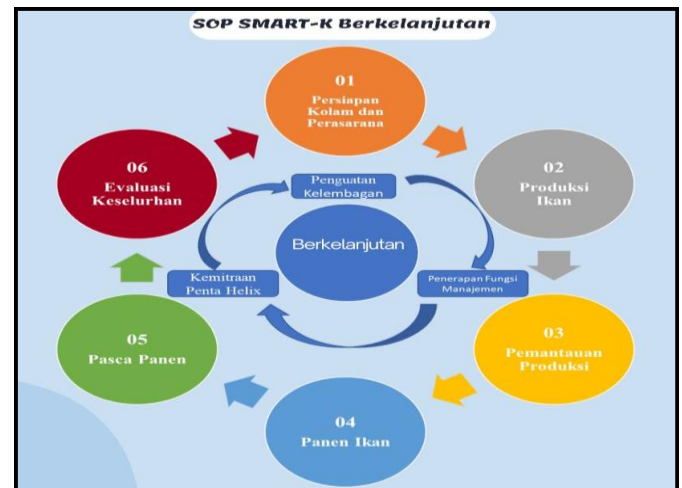


Figure 4. Sustainable SMART-K SOP

The results of the service carried out from August-December 2024, can be seen in the Table 1.

Table 1. The results of the service carried out from August-December 2024

Problem	Solution Offered	Target Output	Outcome Indicator	Activity Outcomes
Inadequate pond quality, low fish production due to lack of understanding of good aquaculture techniques.	Improving the quality of ponds for aquaculture with SMART-K, namely using the Aquaculture Management System and Engineering Technology (SMART) Providing fish farming training and assisting partners	- Ponds can- - There is an- increase in fish production	50% improvement in pond quality Production increased by 30%	- Vertiqua and SMART-K training conducted - Ponds and water channels to ponds have been repaired, ready to be used as cultivation ponds by applying SMART-K
Not yet understanding cultivation management/planting patterns and still not smooth marketing	Training on making SOPs, SMART-K implementation on Partnerships.	There is an SOP for- fish farming with a- partnership pattern	SOP in place Increased marketing	- Training on fish farming management has been conducted - Sustainable SMART-K SOP drafted

The stages carried out are based on the following Standard Operating Procedures (SOP), consist: 1). Pool preparation; 2). Production process; 3). Harvest; 4). Business Sustainability.

Empowerment of unproductive waqf land through the use of vertiqua and SMART-K becomes productive. Thus, with the fish farming training, the waqf land becomes productive. Productive waqf is very socially-driven. It is solely devoted to the benefit of the people. Productive waqf is one of the solutions in alleviating the problems of poverty, backwardness and ignorance.

Three main efforts in community empowerment are: 1) creating an atmosphere that allows the potential of the community to develop (enabling), 2). Strengthening the potential of the community (empowering) and 3) protecting and defending the interests of the lower community (protecting) appear to be 3 (three) main pillars of community empowerment (empowerment) as a people-based development model (Noor, 2011). The outputs of this service are Vertiqua Gen 2 and Sustainable SMART-K SOP.



Figure 5. Education to elementary school students

Conclusion

This service activity has empowered unproductive ponds to become productive by applying Vertiqua and SMART-K. Vertiqua is for indoor locations or on narrow land, while SMART-K is for empowering unproductive ponds. The resulting innovation output is the existence of Vertiqua gen 2 and Sustainable SMART-K SOPs that can be applied to partner groups and other communities. The sustainability of this fish farming business needs to be done with a partnership pattern and make it an educational tour.

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