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Implementation of Aquaponic Technology in Fish Cultivation Groups in Ngemplak Hamlet, Kapanewon Turi, Sleman Regency

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ABSTRACT

Post-pandemic society is required to become a food-independent society, capable of producing raw food sources through agriculture, animal husbandry, and fisheries. Through aquaponics technology, people can apply effective new technology to increase food security and independence. Aquaponic technology is a technology in aquaculture and plant cultivation combined with increasing the effectiveness of cultivation and the quality of crop yields to accelerate the growth of fish and plants. Ngemplak Hamlet, Donokerto Village, Turi Sub-district, Sleman District is a hamlet with potential for fish cultivation. There are a lot of fishery business actors because the water is clean and abundant, so until now, there are 17 business actors in the fishery sector. However, they move independently in developing their business. There is no fish farming community in this village. The district also does not yet know and apply aquaponics technology. The implementation method in this service is FGD with hamlet equipment for forming fish farming groups and increasing knowledge and skills of aquaponics technology; counseling and training are carried out with this theme. As a result, a fish farming group and its organizational structure has been successfully established. All members of Ngemplak hamlet fish farming know Aquaponic Technology, and 90% of them have been able to implement Aquaponic Technology in their respective ponds.

KEYWORDS
aquaponics technology;
fish farming group;
counseling;
training;
Ngemplak Hamlet

1. Introduction

The Covid-19 pandemic has weakened all sectors, including the food sector [1]–[3]. Indonesia is a vast country and has very rich and abundant natural resources. The potential for meeting food needs is wide open in this country. However, when a pandemic outbreak struck, everything was affected and people began to decline in production activities for food security [4]. Society looks sluggish because psychological impacts also appear, not only physical impacts that arise [5], [6]. After the pandemic in 2022, people are starting to return to their enthusiasm in working on all production activities in the framework of increasing food security and efforts to provide motivation and also innovate new skills provided by non-governmental organizations and educational institutions (universities) through assistance programs and community service [7] –[9]. The community empowerment carried out is intended so that the community is ready to wade through the post-pandemic period in terms of food security and independence [10], [11].

Society during this post-pandemic period is demanded to be able to become a food-independent society, capable of producing food raw sources through agriculture, animal husbandry, and fisheries [12]–[14]. Fishery is one of the areas that is the focus of the community to develop their potential to increase food availability towards food independence specifically in fulfilling protein, especially freshwater fish that are cultivated individually or in groups [15]–[18]. Communities can meet food needs independently even in fish farming communities or at the household level.

The longer the land used for aquaculture is decreasing because the increasing population causes the expansion of settlements to increase as well. Current narrow land problems can be handled with the

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Aquaponics system. Aquaponics technology is a combination of aquaculture technology with hydroponics in an integrated integrated system that aims to optimize the function of water and use space as a medium for plant maintenance. According to a research that has been conducted, the aquaponics system has a very positive effect on improving the water quality of nursery media or rearing all types of freshwater fish such as tilapia, catfish, gourami, and so on so that in the end you will get increased yields with improved fish quality. .

Aquaponics has been researched by previous researchers to be used as a reference in this community service. The Integration of Low Cost Digital Tools for the Preservation of Sustainable Agriculture Systems was researched by Serrano-Trujillo [19]. Identifying the knowledge level of aquaponics adopters was investigated by Greenfeld [20]. The efficiency of pumpkin (Cucurbita pepo), sweet wormwood (Artemisia annua) and spinach (Amaranthus dubius) in removing nutrients from a small-scale recirculating aquaponic system was investigated by Gichana [21]. Consumer Acceptance of Aquaponically Grown Basil was studied by Yue [22]. Application of Aquaponics on Pakcoy (Brassica Rapa L) and Tilapia (Oreochromis Niloticus) Concentrations on Ammonia, Nitrite, and Nitrate was studied by Deswati [23]. Nitrogen recovery through aquaponics in Nepal: current status, prospects and challenges was investigated by Adhikari [24].

The application of aquaponics technology can also reduce waste, both organic waste produced by fish through urine and faeces as well as non-organic waste in the form of glass mineral water or used bottles used as containers for plant media which are applied in this system[25]–[28]. This can play a direct role in the reuse of goods that are not used (reuse) which are then called waste into goods of use value in the framework of increasing food security.

Ngemplak Hamlet, Donokerto Village, Kapanewon Turi, Sleman Regency is a hamlet that has the potential for developing fish farming. In this hamlet there are a lot of fishery business actors because the water is clean and abundant so that until now there are 17 micro business actors in the fishery sector. However, they move separately in the development of their business. Even though the fishing business will progress if there are groups or communities in it as a forum for developing their business. So it is necessary to form a fish farming group in this hamlet. Even though the agricultural land in this hamlet is large, the public interest in utilizing the empty land in the yard of the house or the space in the house for the use of fish ponds is very high. This is the basis for implementing aquaponics technology at this location. All of the existing agricultural land has implemented the Mina Padi concept, but no one has yet implemented an aquaponic system on agricultural land or yards or empty land in the houses of this hamlet community.

2. Method

Based on the background above, the method of implementing community service is directed at forming a fish farming group first, then carrying out the implementation of aquaponics technology in fish farming groups. The following is a flowchart of the implementation of community service in the Ngemplak hamlet shown in Figure 1.

This community service implementation method consists of several stages as follows:

1. Observation

This activity is intended to gather information about the potentials and deficiencies that exist in this hamlet.

2. FGD with hamlet officials and the formation of a Fish Cultivation Group

Focus Group Discussion (FGD) was held to determine community empowerment activities to be carried out in this hamlet. While the establishment of the Fish Cultivation Group is meant for the fishery business community to have a community as a forum for communication and organization for fish farmers and fishery business actors.

3. Extension of Aquaponic Technology

Aquaponic technology extension activities are carried out to increase public knowledge about aquaponic technology which they have never done before in their ponds. There are pre-test and post-test instruments to measure knowledge before and after this counseling is carried out.

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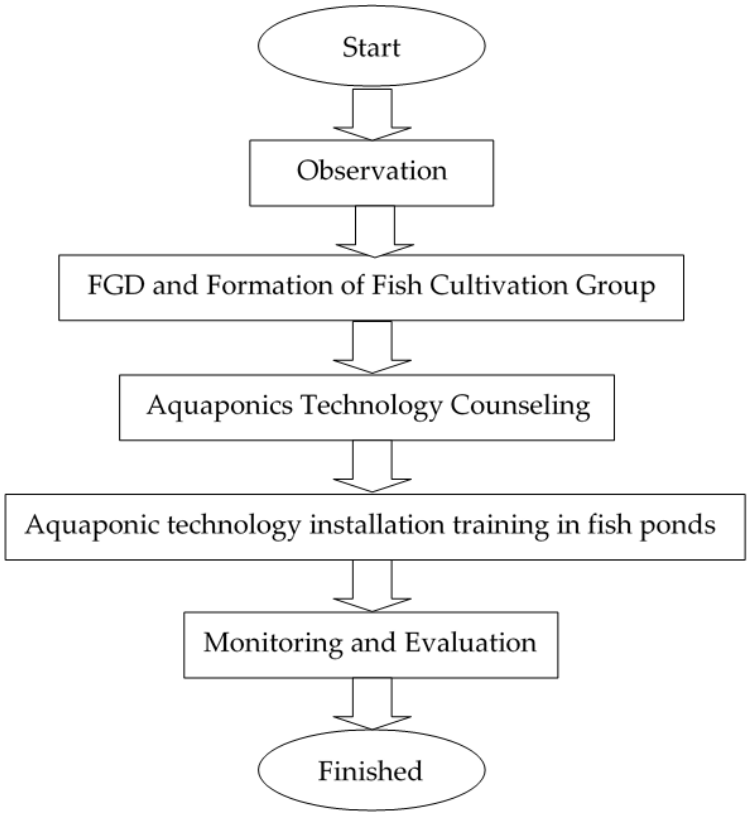

Fig. 1. Flowchart of the implementation of Community Service

4. Aquaponic System Installation Training in Fish Ponds

Aquaponic system installation training in residents' fish ponds was carried out to provide skills to the community on how to make an aquaponic system in their respective fish ponds. There are various kinds or types of aquaponic systems including Floating Aquaponics, Bucket System Aquaponics, Integrated Aquaponics with Biofloc, and Tidal Aquaponics [29][30][31][32][33]. Tidal aquaponics (Figure 2) is a type of aquaponic system in which plants are placed above or beside a pond (around the pond), water is pumped up and then filtered through a biofilter then flowed through perforated pipes to irrigate the plants in the container or a modified pot/bucket for this aquaponic system. The Tidal Aquaponic type was chosen to be applied in this community service because the residents' fish ponds already exist, all that remains is to add an aquaponic system to the pond [34][35].

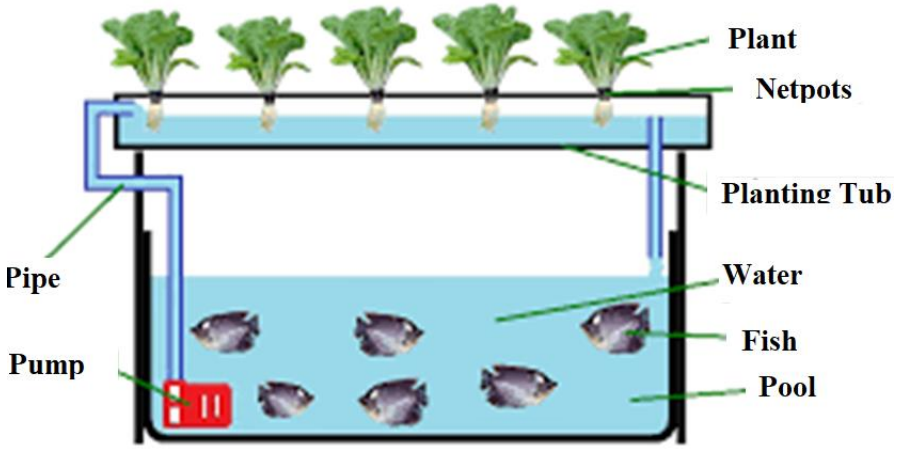

Fig. 2. Tidal Type Aquaponic System [36][37]

5. Monitoring and Evaluation

Monitoring is carried out as a control over the implementation of the activities that have been carried out whether they have resulted in increased knowledge and skills as well as the application of the aquaponics system to the fish ponds of the fish farming group in this hamlet. While the evaluation is carried out to look for deficiencies and follow-up plans for the implementation of this community service activity.

3. Results and Discussion

At the observation stage, data were found on a number of 17 fish cultivators in Ngemplak Hamlet. The average fish pond that is used is a cement pond. Some others use tarpaulin pools but the amount is not more than 10%. The two most important things in the implementation of this service are the formation of fish farming groups and the implementation of aquaponics technology in the people of Ngemplak Hamlet.

1. FGD with hamlet officials and formation of fish farming groups

The FGD was conducted by the community service team with Dukuh Ngemplak to record the number of potential members of the fish farming group. Then a meeting was held to form and develop the organizational structure of the fish farming group as shown in Figure 3.

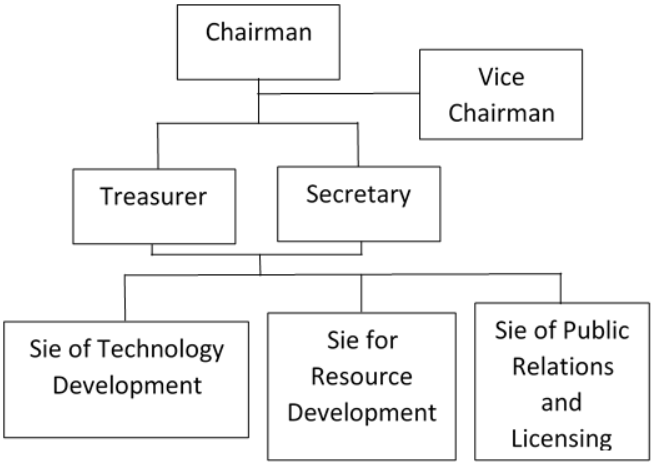

Fig. 3. Organizational Structure of the Management of the Fish Cultivation Group in Ngemplak Hamlet

2. Extension of Aquaponic Technology

After the fish farming group was formed, it was continued to provide Aquaponic Technology counseling to increase public knowledge about the application of the aquaponic system in fish ponds. The Aquaponics Technology outreach activities can be seen in Figure 4 below.

Fig. 4. Implementation of Aquaponics Technology Counseling

The Aquaponics Technology extension program was attended by 17 members and administrators of the Ngemplak Hamlet fish farming group. The data shows that before the counseling was carried out, not a single person (0%) knew about Aquaponics Technology. After participating in this counseling, there was a 100% increase in Aquaponic Technology knowledge for all members of the fish farming group in Ngemplak Hamlet.

All members of the fish farming group were very enthusiastic about participating in this Aquaponics Technology extension program, they took part in the activity from start to finish. Seen in Figure 5 is a photo session of the fish farming members of Ngemplak Hamlet at the end of the event with hamlet officials and the community service team.

Fig. 5. Group Photo Session in Aquaponics Technology Extension Activities

Dukuh Ngemplah hopes that events like this can be sustainable even in other aspects to foster community productive activities in order to increase food production productivity and food self-sufficiency in the post-Covid-19 pandemic era.

3. Aquaponic System Installation Training in Fish Ponds

Community skills in implementing the aquaponic system in their ponds are the next important thing that needs to be trained so that they are used to and able to make this aquaponic system independently. First, training on installing the aquaponic system in fish ponds was carried out, an example was given of the stages of making an aquaponic system. Then assistance is provided by the service team to members of the fish farming group. After it can be released, the community can apply it independently in their respective ponds. It can be seen that one of the community service teams in Figure 6 gives an example of preparing planting media for an aquaponic system in a pond.

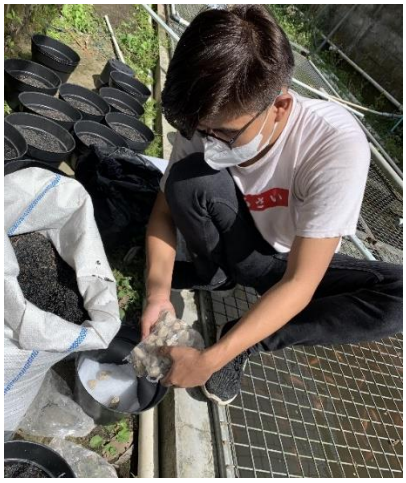

Fig. 6. Preparation of Planting Media for Aquaponic Systems

The aquaponic system of one of the cultivation members that has been made is shown in Figure 7 below. After this training activity, several members of the fish farming group in Ngemplak Hamlet immediately practiced it in their respective ponds. They were curious and motivated by this aquaponic system installation training.

Fig. 7. The Aquaponic System that Has Been Implemented in Community Pools [38]

4. Monitoring and Evaluation

Monitoring is carried out to see the progress of community members in fish farming in implementing Aquaponic Technology in their respective ponds. The results are 90% have applied to the pool in the yard of the house or in the room in their house. While the evaluation was carried out by the community service team with hamlet officials and fish farming group administrators. The hamlet officials and fish farming group administrators stated that the implementation had been running smoothly and the community had been able to benefit from the program provided by Muhammadiyah University of Yogyakarta. They hope that there will be further follow-up programs, for example institutional strengthening of fish farming groups and a training program for making fish feed independently so that they can reduce spending, especially on fish feed, which is the biggest expense in fish farming.

4. Conclusion

The formation of fish farming groups and their organizational structure has been successfully established. This community functions as a forum for communication and integration in improving fish farming business. It is hoped that in the future with the existence of a fish farming group in Ngemplak hamlet there will be many grants from the local government or other institutions to develop existing potential. With the end of this entire series of community service programs, it can be concluded that all fish farming members in Ngemplak hamlet have knowledge of Aquaponics Technology and 90% of them have been able to implement Aquaponics Technology in their respective ponds. As a follow-up plan for this community service program, in the future the hamlet officials and the community service team plan to continue with a program to strengthen institutions and train for independence in feed production for fish.

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Author Contribution

The activity plan is to form a group of fish cultivators first, then apply the application of aquaponics technology to the group of fish cultivators.

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Conflict of Interest

The authors declare no conflict of interest.

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