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Aquaponics In Improving The Economy And Food Security Of Urban Communities In South Meruya

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ABSTRACT

The application of aquaponics in South Meruya has dual benefits, both in terms of improving the community's economy and food security, which ultimately improves the welfare and quality of life of urban communities. Aquaponics is an integrated system between fish farming and hydroponic farming that utilizes fish waste as nutrients for plants and filters the water that is reused for fish. The application of freshwater fish aquaponics in South Meruya is an innovative solution to address economic challenges and food security for urban communities. Aquaponics assists communities in generating fresh revenue by producing fish and vegetables for local markets. The relatively low operational costs and limited space make aquaponics ideal for implementation in urban areas with limited land, such as in South Meruya. Aquaponics allows communities to produce food independently and sustainably. Community food security increases due to easier access to sources of protein and fresh vegetables.

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INTRODUCTION

Food is a primary need for every human being. The need for food will increase over time, but agricultural land is unable to meet these needs. Humans still depend on natural resources, especially land, to meet their needs. Humans use land for settlements, industry, livestock, and fisheries to improve their economy. Management of available resources must be able to be handled optimally. The products produced can be consumed by households or sold, but their social and ecological benefits are maintained. Along with population growth, the community's need for vegetables and meat that is consumed also continues to increase. Food availability by utilizing yard land can be done so that food security in the family can be realized.

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Food needs in urban areas increase along with population growth. Meanwhile, agricultural production is getting lower because agricultural land is getting narrower, there are fewer workers in agriculture, and there are high production costs with low output. The use of limited land, especially home yards, continues to be attempted to meet family food needs.

The economic life of the community in the midst of the COVID-19 pandemic has experienced a very sharp decline due to restrictions imposed to combat it. Reducing or restricting community activities outside the home means that life does not run normally as usual, thus weakening the family economy due to reduced income, while needs do not decrease and tend to increase. In addition to the health sector, the COVID-19 pandemic has also had a major impact on the economic sector, especially the sustainability of work and income. The problems faced by the community have resulted in a large number of unemployed and reduced jobs, resulting in reduced income. The termination of employment (PHK) has exacerbated the financial situation of laid-off workers, making it difficult to meet their various needs. The fulfillment of basic needs such as food no longer pays attention to quality but only pays attention to quantity, which is sometimes not met optimally.

Fish farming is an activity to maintain, raise, and/or breed fish and harvest the results in a controlled environment, including activities that use ships to load, transport, store, cool, handle, process, and/or preserve them (www.kkp.go.id). Large or narrow areas, both urban and rural, can host this fish farming activity. The limited land in urban areas still allows its residents to carry out fish farming activities in the form of aquaponic fish farming methods.

Aquaponics is an intriguing combination of aquaculture and hydroponics that is able to recycle nutrients while using a small portion of recycled water to allow for integrated fish and plant growth. This system requires simple and appropriate technological intervention. Aquaponic cultivation ensures water oxygen levels and suppresses ammonia toxins produced from fish waste (Nugroho, 2012). Combining hydroponics and aquaculture mimics natural ecosystems, allowing plants and fish to thrive together harmoniously. Plants in aquaponic cultivation systems can function to improve water quality by reducing the concentration of inorganic nitrogen such as ammonia (NH_3), nitrite (NO_2), and nitrate (NO_3). The biofilter process carried out by this plant unit will also improve other water quality conditions, such as oxygen, and reduce turbidity. Another benefit is that nitrogen produced from fish feed will provide a large wet mass for vegetable plants (Damanik, 2018). Fish produce ammonia, which is a nutrient

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for plants (Wahyuningsih, 2015). Plants will mineralize or reduce ammonia that can poison fish. Water recycling through the existing system maintains oxygen levels.

One type of freshwater fish that is widely used in this aquaponic method is catfish and tilapia. Limited land and water sources can cultivate both types of freshwater fish. Cultivation of freshwater fish is also economical because it does not require complicated care and has a high selling price. In addition, both types of fish also have high protein value, so they are excellent for nutritional fulfillment (Primaningtyas, 2015).

DKI Jakarta is one of the provinces in Indonesia that contributes the most pollution; in addition, green areas are also increasingly limited. Based on data from the Ministry of Environment and Forestry, DKI Jakarta only has 34 percent of its area of green open space, 33 percent of which is in the Seribu Islands. West Jakarta City is the area with the least green open areas, especially Meruya Selatan Village, which has the second smallest area compared to other villages in Kembangan District (2.8 km^2) with a population of 50,735 people and is dominated by residential, mixed, public, and social service zones.

The development of public areas in this sub-district is very low compared to other sub-districts. This is because the area is included in the commercial area located in the administrative city center of West Jakarta. Meruya Selatan Sub-district has 5 RPTRAs. Each RPTRA has productive activities that are characteristic of each RPTRA. One of these RPTRAs still does not have productive activities that can improve the economy. The large amount of unused/empty land owned by the Meruya Selatan sub-district can be utilized for productive activities.

In addition, people have experienced a decrease in income due to the COVID-19 pandemic, so the fulfillment of basic needs, such as food, no longer pays attention to quality but only to quantity, which is sometimes not optimally fulfilled. The economic life of the community has experienced a very sharp decline. The net income or wages per month received by residents of Meruya Selatan Village who work in the industrial and service sectors is between IDR 3,220,445.00 and IDR 3,747,102.00 (BPS, 2021). The average net wage per month is still below the DKI Jakarta UMP's IDR 4,641,854.00 in 2022.

The purpose of this community partnership empowerment activity is formulated in line with the Merdeka Belajar Kampus Merdeka (MBKM) program, namely, lecturers and students together are involved in empowering partner communities in developing hydroponic fish and vegetable cultivation in order to produce food independently and

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sustainably, and the next goal is to improve the welfare and quality of life of urban communities in the South Meruya area.

METHOD

The Community Empowerment Program activities by the Mercu Buana University Community Service Team are carried out in 4 steps, including:

1. Preliminary Step; This step begins with the formation of a team, the implementation of a location survey, and information regarding community problems conveyed by partners of the Meruya Selatan sub-district, PKK, and RPTRA administrators, which is then continued with socialization to the Meruya Selatan sub-district community as prospective training participants.
2. Implementation Step: At this step, socialization and training are carried out in 2 sessions. The first training is about the practice of hydroponic plant cultivation and aquaponic systems as well as the socialization of catfish cultivation and marketing. In this first training, participants get simple hydroponic tools in the form of rockwool, net pots, flannel wicks, pok choy plant seeds, and AB mix nutrients for plants. With the hydroponic equipment obtained, participants practice directly to cultivate pok choy plants using rockwool as a planting medium. The second training is about the socialization of catfish cultivation and the marketing of fish and vegetable products.
3. Harvest and post-harvest step: Fish and vegetable crops are harvested and packaged in plastic packaging with brand designs for a more representative appearance. After packaging, the products are marketed through social media, exhibitions, or bazaars.
4. Evaluation Step: This evaluation step is carried out after all stages have been implemented. This evaluation aims to assess system performance and identify areas that need improvement. Based on the evaluation results, feedback and recommendations for improvement are provided to improve system performance. This activity is expected to be carried out continuously with community self-help funds. Participants complete a questionnaire form as part of one of the evaluations.

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RESULT AND DISCUSSION

The activity was carried out at RPTRA Mahkota and Manuver, Meruya Selatan Village in two ways: materials were delivered, and people worked together to learn how to use hydroponic planting methods, aquaponic system materials, and grow catfish. Community service activities were carried out in two sessions.

Training Session 1

Session 1 training took place at the Mahkota RPTRA, Meruya Selatan Village, on Friday, July 12, 2024, at 08.00-11.45 WIB. The event was attended by the Head of the Village, M. Ghufri Fatchani, S.M., Vice Chancellor for Academic Learning and Research and Technology UMB, Dr. Erna Setiany, M.Si, Dean of the Faculty of Economics and Business, Dr. Nurul Hidayah, SE., Ak. M.Si, Chief Executive Fransisca Listyaningsih Utami, SE, Akt, M.Ak, and all team members, external speakers, and students. Opening of the activity and remarks from the Vice Chancellor 1, Dean of the Faculty of Economics and Business Universitas Mercu Buana, and the Head of the Village of Meruya Selatan Village. Furthermore, the team leader presented material from external speakers about hydroponic vegetable cultivation and aquaponic systems. The number of participants attending from partner representatives was 30 people.

In this hydroponic training, participants get simple hydroponic tools in the form of rockwool, net pots, flannel wicks, pokcoy plant seeds, and AB mix nutrients for plants. With the hydroponic equipment obtained, participants practice directly cultivating pokcoy plants using rockwool as a planting medium.

Figure 1. Socialization and Practice of Hydroponic Cultivation by Hydroponic Practitioners

Training Session 2

Session 2 training took place at the Manuver RPTRA, Meruya Selatan Village, on Friday, August 16, 2024, at 08.00-11.45 WIB. The event was attended by the village head, M. Ghufri Fatchani, S.M., Dean of the Faculty of Economics and Business, Dr.

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Nurul Hidayah, SE., Ak. M.Si, Chief Executive Fransisca Listyaningsih Utami, SE, Akt, M.Ak, all team members, external speakers, and students. Opening of the activity and remarks from the Dean of the Faculty of Economics and Business UMB and the Village Head of Meruya Selatan Village. Furthermore, the delivery of material by external speakers regarding catfish cultivation and marketing of hydroponic fish and vegetable products by team members. The number of participants attending from partner representatives was 29 people. The material presented in this second session was pond preparation, seed selection, feeding, water management, pest control, and harvest time. The aquaponic system's fish and vegetables will be eaten and sold.

Figure 2. Socialization of Catfish Farming by Fisheries Practitioners

In the socialization of marketing of fish and vegetable products, it was explained about the identification of potential consumer segments as well as market needs and preferences so that the products sold are in accordance with consumer desires such as quality, types of fish and vegetables, and the packaging used. Participants were also socialized with brands with names, logos, and slogans that reflect the quality and sustainability of aquaponic products and marketing of aquaponic products through social media and exhibitions or bazaars. With good planning and management, catfish farming can be a profitable business.

Aquaponics installation

The aquaponic installation created is a DFT (Deep Flow Technique) system. The DFT system sources most of the plant nutrients from waste-filled pond water. To flow pond water to the paralon above it, a water pump and hose are needed so that the pumped pond water will flow to the plants. A water pump is utilized to transfer water from the fish pond to the plants and vice versa. This system can be set to operate as needed, saving energy and ensuring optimal water circulation.

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Figure 3. The creation of a DFT aquaponic system

The water pump is installed and channeled to the hydroponic plant pipe. This hydroponic plant pipe is installed at a suitable slope so that the nutrient solution can flow properly. To hold the channel in the right position, a bracket or stand is used.

Hydroponic Fish and Vegetable Harvesting Activities

The harvest period for the catfish seeds and hydroponic vegetables has finally begun. Both activities were attended by the Head of Meruya Selatan Village, M. Ghufri Fatchani, S.M., the Head and members of the Community Service Activity Team, representatives of the RPTRA Manuver management, participants of the activities, and students involved.

This aquaponic system significantly increases productivity in the form of increased fish and hydroponic vegetable production. The time needed for harvesting is only 3-6 months; the number of fish harvested per cycle has increased to 20-30 kilograms. The quality of the fish has also increased. The harvest weight per fish is 200-250 grams; the survival rate of fish ranges from 85% to 95%, so the number of fish that die has decreased.

Table 1. Fish Production in Aquaponic System (6 Month Period)

Types of Fish	Harvest weight per head (grams)	Total Production (kg/m3)	Survival Rate (%)
Lele	200-250	20-30	85-95
Nila	250-350	18-25	85-90

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Table 2. Comparison of Fish Production between Aquaponics and Conventional Ponds

Parameter	Aquaponics	Conventional Ponds
Harvest Time (month)	4-6	6-8
Harvest Weight (grams/head)	200-350	150-250
Mortality (%)	5-15	15-25
Feed Efficiency (FCR)	1,2-1,5	1,5-2,0

Table 3. Water Use Efficiency in Aquaponics

System	Water Consumption (L/kg fish)
Aquaponics	10 - 20
Conventional	100 - 500

The sustainability of this program can be a sustainable business model by generating sufficient income to cover operational costs, such as sales of aquaponic products (fish and vegetables), provision of training services, or educational tours. In addition, from this program, product diversification can be developed from the aquaponic system, vegetables, and fish so that it can improve food security and the family economy. The involvement of the Meruya Selatan community has a positive impact, namely increasing community empowerment through increasing community knowledge and skills in this aquaponic program.

With a holistic approach and the right strategy, an aquaponics program can be a sustainable agricultural solution that is economically profitable, environmentally friendly, and beneficial to society.

CONCLUSION

The application of the aquaponics system for the Meruya Selatan community shows significant potential in improving the economy and food security. The aquaponics system allows the production of freshwater fish and vegetables on a household or community scale, providing a sustainable and high-quality food source. By producing fish and vegetables simultaneously, aquaponics offers food diversification that increases nutritional diversity and helps meet the nutritional needs of urban communities. In addition, the application of the aquaponics system opens up new business opportunities for the community that can increase household income and increase economic independence.

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SUGGESTION

Suggestions for further development include the need for technical support and training to improve management capacity and build partnerships with government agencies, non-governmental organizations, and the private sector to support the development and sustainability of aquaponics programs.

With the right support and solutions to existing challenges, aquaponics can be an effective tool for achieving food security and sustainable economic development goals in urban areas.

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