

Community Empowerment of KWT Rajawali for Economic and Food Security Enhancement through Aquaponic and Green Water Systems

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Abstrak: KWT (Kelompok Wanita Tani) Rajawali berlokasi di Desa Ciomas Rahayu, dimana 70% lahannya adalah pemukiman. Salah satu upaya untuk memaksimalkan lahan yang tersisa agar dapat produktif adalah dengan mengintegrasikan pertanian dan perikanan dengan metode akuaponik. Kegiatan pengabdian masyarakat ini difokuskan untuk menciptakan peningkatan ekonomi dan ketahanan pangan bagi KWT Rajawali yang kondisi awalnya hanya mampu menghasilkan omzet sebesar Rp. 410.000 dari hasil penjualan ikan lele dan kangkung. Hasil pengabdian ini membuktikan bahwa dalam tiga bulan terakhir, KWT Rajawali telah memperoleh omzet sebesar Rp. 2.375.000 dari olahan lele bumbu kuning yang dijual dengan sistem pre-order melalui Aplikasi WhatsApp dan tingkat kematian pada budidaya lele di KWT Rajawali turun dari sebelumnya 30/hari menjadi hanya total 100 ekor dalam 1 kali masa panen, begitu juga dengan kangkung yang dapat menghasilkan 3 kg dari kolam akuaponik dengan menggunakan setengah ukuran kolam.

Kata kunci: akuaponik, ketahanan pangan, KWT Rajawali, lele bumbu kuning, peningkatan ekonomi

Abstract: The Rajawali Women Farmers Group (Kelompok Wanita Tani – KWT) is located in Ciomas Rahayu Village, where approximately 70% of the land area is occupied by residential housing. One of the efforts to optimize the remaining land for productive use is by integrating agriculture and aquaculture through an aquaponic system. This community service program focuses on enhancing the economic capacity and food security of KWT Rajawali, which initially generated an income of only IDR 410,000 from the sale of catfish (*Clarias gariepinus*) and water spinach (*Ipomoea aquatica*). The results of the program demonstrate that within the last three months, KWT Rajawali successfully increased its revenue to IDR 2,375,000 through the production and sale of catfish in yellow spice sauce, marketed via a pre-order system using the WhatsApp application. Furthermore, the mortality rate in catfish cultivation decreased significantly, from 30 fish per day to only 100 fish per harvest cycle. Similarly, the cultivation of water spinach yielded up to 3 kilograms per aquaponic pond using only half of the pond's total capacity.

Keywords: aquaponics, economic improvements, food security, KWT Rajawali, yellow spiced catfish

1. Introduction

A high population will have an impact on the high demand for land for residence. As happened in Ciomas Rahayu village which has an area of 88,450 ha, with land used for settlement of 61.52 ha or 70% of the total land used for settlement. This condition makes Ciomas Rahayu Village very congested and there is limited land for agricultural and fishing activities. With these dense residential conditions, various efforts have been made to maximize the remaining land so that the land becomes productive and can produce crops. One effort that can be made is to carry out integrated agriculture and fisheries on limited land using the aquaponic cultivation method (BPS Kabupaten Bogor, 2019)..

Aquaponics is a cultivation method with the concept of mutualistic symbiosis. In concept, vegetables using the aquaponics method get nutrients from fish waste and leftover feed while the fish get clean water full of oxygen (Pratopo & Thoriq, 2021). Apart from not requiring a large area of land for cultivation, aquaponics has the advantage of not requiring a lot of water because the existing water will continue to be processed without reducing the water quality by means of the water in the pond being channeled into the plant media as a vegetation filter which can clean toxic substances in the air (Widyatmoko *et al.*, 2019).

Previous studies have highlighted the benefits of the aquaponics system. For example, research by Alfatihah *et al.* (2023) found positive results based on observations of water quality parameters such as temperature, pH, and ammonia levels. Furthermore, observations indicated that in the aquaponic system, water spinach exhibited better growth performance, measured by plant height, number of leaves, and leaf length, compared to pak choy (Gandhy *et al.*, 2025b).

Similar research was also carried out by Fauza *et al.* (2021) which shows an increase in urban community knowledge in cultivating fish and plants with aquaponic technology. The public has a better understanding of the manufacturing process, maintenance, and results that will be obtained from the application of aquaponic technology, especially using catfish and water spinach commodities.

As well as research conducted by Rahmadhani *et al.* (2020) which concludes that water spinach shows 29.12% higher production in the aquaponic system than in the hydroponic system, indicated by significant values in plant height, number leaves, root volume, and leaf fresh weight. In contrast, pak choy production showed an increase of 17.03% in the hydroponic system than in the aquaponic system. However, lettuce production was not significantly different between hydroponic and aquaponic systems. Lettuce production in the aquaponic

system is only 1.90% lower than the hydroponic system which shows that lettuce is suitable for cultivation in both agricultural systems.

The Rajawali Women's Farmers Group (KWT Rajawali) is an organization consisting of women and has activities and opportunities to advance in the fields of agriculture and fisheries (Ardiani & Dibyorini, 2021). KWT Rajawali still uses conventional farming and fishing systems so that the harvest yields are less than optimal. The harvests owned by KWT Rajawali are catfish and water spinach vegetables. The main problem that occurs is because all KWT members do not have a foundation in the fields of agriculture and fisheries, and there is no regular training, which results in major failures, such as at the beginning of its formation, this KWT failed to plant pak choy. After failing to plant pak choy, KWT Rajawali planted water spinach and it grew successfully but when it was sold it only got a turnover of IDR. 60,000. Apart from pak choy and water spinach, KWT Rajawali stocked 40 kg of catfish seeds, but the high mortality rate of catfish, reaching 30 per day, meant that the catfish harvest was not optimal, only 14 kg could be harvested and earned a turnover of IDR. 350,000. This has resulted in KWT Rajawali not being able to make a profit, all the turnover obtained has not been able to generate profits and increase income for members.

Based on the results of previous research, it can be concluded that the advantages of aquaponics are having potential to overcome the problems that occur and can create economic improvements and food security for the surrounding community. This community empowerment aims to foster economic improvements and food security by using an aquaponics system and processing catfish which were previously only sold raw into products that are ready to be sold in order to create added product value (added product value) to increase the selling value of catfish products and can become additional income for local communities by utilizing digital media to carry out digital marketing as a marketing medium (Yudha *et al.*, 2022).

2. Methods

The community service carried out at KWT Rajawali employed a social approach, which means an approach carried out by establishing good and sustainable communication in order to create participation and closeness with the community. With this social approach, it is hoped that a reciprocal bond of unity and good acceptance within the community can be created and collaboration can be created to achieve the goal of this community service, namely creating economic improvements and food security with aquaponics by means of observation,

interviews to find out initial conditions and then cultivation training. catfish, aquaponics, digital marketing, provision of aquaponics for training implementation materials, as well as trials, and monitoring and evaluation.

3. Results and Discussion

One of the points of the tridharma of higher education is providing community service, this point is the basis of the community service program carried out at Villa Ciomas Indah, Ciomas Rahayu Village, Ciomas District, Bogor Regency. This service aims to create economic improvements and food security by using aquaponic systems and green water, also known as a green water system (GWS). GWS is green water that contains microorganisms in the form of phytoplankton which is intended to stabilize water quality and as natural food for catfish (Utami, 2019).

The implementation of stage 1 which was carried out was conducting a survey and interview with the head of KWT Rajawali and producing information in the form of having a 2x3 meter pond stocked with catfish and 3 0.5x 3 meter grobogs planted with water spinach with these conditions Rajawali KWT got a total turnover in one harvest. catfish and water spinach as much as IDR. 410,000. The initial conditions of KWT Rajawali are shown in Figure 1.



Figure 1. Initial Condition of KWT Rajawali

The team began implementing phase 2 by forming a business ecosystem by providing knowledge to increase the insight and capacity of KWT Rajawali members with training as shown in Figure 2. The training materials include the following topics:

1. How to sow water spinach seeds using Rockwool media carried out by the Team.
2. How to cultivate catfish on a business scale by Mr. Aditya Prima Yuda, S.Pi., MM.
3. Aquaponics and urban farming by Mrs. Kristina Official Setiani, S.St.Pi., M.ESM. and Mr

Muh. Patekkai, S.St.Pi., M.Si. from the Research Center for Freshwater Aquaculture and Fisheries Extension.

4. Digital marketing and calculation of cost of production (COGS) by Adi Surya Panji Gumilang and Ranti Audina Yuristianti.



Figure 2. Capacity development training for KWT Rajawali members

The initial activity carried out by the team involved conducting a training session and preparing kale (*Ipomoea aquatica*) seedlings to be planted in rockwool media. Kale was selected as the primary crop for the aquaponic system due to its short growth cycle of approximately three weeks and its dense fibrous roots, which serve effectively as a natural biofilter for catfish waste. This filtration process helps maintain water clarity within the pond (Rahmadhani *et al.*, 2020). Based on these advantages and with the aim of developing a sustainable aquaponic system with significant economic potential, kale was chosen as the main plant species to be cultivated in the system.

In addition to plants, in aquaponics there are also fish which are another commodity. In this service, the fish used are Sangkuriang Catfish. Catfish were chosen because they have high nutritional content, namely 17.7% protein, 4.8% fat, 1.2% minerals, and 76% water, making catfish very good for consumption by all ages (Soedibya *et al.*, 2019). The catfish seeds used are the best seeds because they are obtained from broodstock that have certificates from the Freshwater Aquaculture Research and Fisheries Extension Center.

The business-scale catfish farming training delivered by Mr. Aditya Prima Yuda, S.Pi., M.M., provided valuable insights and addressed several key issues faced by the KWT Rajawali. One of the main challenges identified was the high cost of feed, which was clarified during the training to have resulted from the group's lack of calculation of the Feed Conversion Ratio (FCR). The session also highlighted several other important aspects that KWT Rajawali needs to consider when managing catfish cultivation as an income-generating enterprise, including :

1. When spreading the seeds, the existing water must be settled for 3 days and given EM-4 and Fish salt to grow microbes in the water.
2. Before spreading catfish seeds, it is necessary to calculate the maximum stocking capacity, for 1 square meter of pond the maximum stocking capacity is 200 fish.
3. The catfish seeds that are spread must be of good quality as evidenced by quality broodstock and the number and initial weight are calculated.
4. Calculate FCR with the formula $FCR = \text{Amount of feed (kg)} / \text{total weight of fish at harvest (kg)} - \text{total weight of fish at the beginning of stocking (kg)}$

Following the session on business-scale catfish farming, the next training focused on the aquaponic system and urban farming, delivered by Mrs. Kristina Resmi Setiani, S.St.Pi., M.ESM., and Mr. Muh. Patekkai, S.St.Pi., M.Sc., from the Freshwater Aquaculture Research and Fisheries Extension Center. During this session, members of KWT Rajawali were introduced to the principles of urban farming and the integration of aquaponic technology. One of the key advantages of the aquaponic system is its water efficiency, as the same water can be reused throughout an entire production cycle without replacement (Pratopo & Thoriq, 2021). From this training, KWT Rajawali received several important recommendations regarding their aquaponic setup, including the need to slightly incline the structure to ensure smooth water circulation and to use multi-cell fluid additives to help maintain optimal water quality.

Subsequently, a training session on digital marketing and production cost calculation was conducted by Adi Surya Panji Gumilang and Ranti Audina Yuristianti. The digital marketing component aimed to equip KWT Rajawali members with practical strategies for promoting their products, both fresh catfish and catfish in yellow spice sauce, using simple digital tools, particularly WhatsApp, complemented with engaging content. This platform was chosen because the primary target market consists of local community members connected through neighborhood (RT/RW) groups. Under these circumstances, the use of WhatsApp with creative visual content such as videos and photos shared via stories and group chats was intended to enhance brand awareness and effectively reach potential customers. In addition to digital marketing, the participants also received training on calculating the Cost of Goods Sold (COGS) for the yellow spiced catfish business (Gandhy et al., 2025a). This session was designed to help KWT members accurately determine product selling prices based on cost analysis, minimize financial losses, and assess profit margins more precisely rather than relying on estimation.

Apart from developing the capacity of KWT Rajawali members, the Team also built facilities in the form of an aquaponics set complete with a roof and 500 seeds measuring 12-13 cm as a medium for implementing the material that had been delivered as shown in Figure 3.



Figure 3. Initial conditions for aquaponics as an implementation medium

At the end of the implementation period, the team combined the aquaponic conditions that had been established and found that the catfish were growing healthy and lively and the water spinach vegetables were very fertile. When harvested, water spinach grown using aquaponics in half a pond with 8 pipes produces water spinach with a total weight of 3 kg. And as many as 50 catfish that were stocked previously died due to the blockage of the aquaponics filter by mud from the catfish. The final stage implementation is shown in Figure 4.



Figure 4. Conditions at the final stage of implementation

Although the initial objectives of the community service activities at KWT Rajawali had been achieved, the team identified the potential to generate additional economic benefits. Consequently, the idea emerged to further process the catfish which was initially planned to be sold in raw form into a value-added product, namely catfish in yellow spice sauce (Wilistanti et al., 2025) as shown in Figure 5. Based on price calculations, raw catfish at KWT Rajawali was sold at IDR 25,000 per kilogram, whereas the processed product could be sold at the same price per 500 grams. After computing the Cost of Goods Sold (COGS), it was determined that

the production cost of the yellow spiced catfish was IDR 17,432 per 500-gram package (Gumilang et al., 2024; Wilistanti & Patra, 2024). To promote the product, KWT Rajawali implemented a simple digital marketing strategy by sharing photos and videos containing product information through WhatsApp status updates and Instagram posts. Within the first three months (Gumilang et al., 2024), KWT Rajawali successfully achieved sales of the yellow spiced catfish, as summarized in Table 1.

Table 1. Sales Data for Yellow Seasoned Catfish

Date	Number of Order	Price	Total Turnover
13 February 2024	17 Packaging	IDR. 25.000	IDR. 425.000
10 March 2024	34 Packaging	IDR. 25.000	IDR. 850.000
21 April 2024	44 Packaging	IDR. 25.000	IDR. 1.100.000
Accumulated Turnover for the first 3 months			IDR. 2.375.000

Over the past three months, KWT Rajawali successfully sold a total of 95 packages of yellow spiced catfish, generating a revenue of IDR 2,375,000. This figure represents a significant improvement compared to the group's initial condition, where the total income amounted to only IDR 410,000 from the sale of raw catfish and water spinach. The current turnover therefore reflects substantial economic growth and demonstrates the effectiveness of the implemented empowerment and product diversification strategies.



Figure 5. Trial of processing yellow spiced catfish

Finally, Universitas Pakuan conducted a monitoring and evaluation process, as illustrated in Figure 6, to consolidate and assess the various stages of implementation that had been completed. The outcomes of this monitoring and evaluation indicated highly positive feedback from the participants regarding the activities carried out. Additionally, the team received constructive suggestions to proceed with registering the product for Intellectual Property Rights (IPR) protection.



Figure 6. Monitoring and evaluation by Universitas Pakuan

4. Conclusion

The community service program implemented at KWT Rajawali successfully enhanced the group's knowledge, skills, and economic performance. Prior to the intervention, KWT Rajawali generated only IDR 410,000 in revenue from selling catfish and kale, with a high catfish mortality rate of approximately 30 fish per day. Following a series of trainings on catfish farming, aquaponic system management, digital marketing, and product processing, along with the construction of an aquaponic facility and the provision of 500 catfish fingerlings, a substantial improvement was observed. The kale cultivated through the aquaponic system yielded around 3 kilograms every two weeks, while the mortality rate of catfish decreased significantly. Moreover, KWT Rajawali began marketing its yellow spiced catfish products through a pre-order system via WhatsApp, priced at IDR 25,000 per 500-gram package with a COGS of IDR 17,432. Within the first three months, the group successfully sold 95 packages, generating a total income of IDR 2,375,000. These outcomes demonstrate that integrating aquaponic technology with digital marketing can effectively promote economic growth and strengthen food security, particularly in areas with limited land resources such as Ciomas Rahayu Village.

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