Improving Skills Through Training in Freshwater Fish Farming and Crystal Guava Jam Production (Bantarjaya Village, Bogor Regency, West Java)

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Abstract Fish farming is a type of fishing that involves cultivating various fish on land. Site characteristics, water quality, fish suitability, and care can influence fish farming success. Crystal guava processing is a production utilization innovation. This has the potential to raise the value of crystal guava commodities, which can be consumed directly but are also processed into various derivative products. The community groups will be divided into two foster groups: the MSME group that makes crystal guava jam and the foster group that grows fish in irrigation ponds. This empowerment approach involves the creation of supporting infrastructure, such as ponds in irrigation canals and the production of crystal guava jam. Then, using the t-test on the dependent mean and Principal Component Analysis, integrated training was carried out, including knowledge sharing and field practice, to quantify statistical development in abilities. As a result, the target community's understanding has increased. The target group (community) can improve their abilities in fish cultivation, the production of novel products (commodity derivatives), and marketing across various phases with the creation of supporting infrastructure.

1. INTRODUCTION

Efforts to enhance community welfare in Indonesia primarily revolve around the development of villages. Village development can be done in various ways, one of which is developing the agricultural potential in the village. In a broad sense, agriculture is the scope of work carried out in various sectors such as agriculture, animal husbandry, forestry, and fisheries (Soetrisno & Suwandari, 2016). Village development is often carried out, focusing on existing agricultural land and small to medium-scale fish farming.

Fish farming is a fishery activity that utilizes land to cultivate various types of fish. Fish farming can be a source of livelihood for the Indonesian people and help to provide fish for consumers. The success of fish farming can be influenced by site conditions, water quality, fish suitability, and care. As with the farm's location, it is a requirement for fish to live and breed. Poor aquatic environments and water quality can make fish vulnerable to disease and stress, or waste pollution will support the development of pathogenic bacteria that can attack fish (Ezraneti & Fajri, 2016). The type of fish that will be cultivated also needs to be considered to adjust the suitable water conditions for the fish. Fish care must be considered by maintaining water conditions, pond cleanliness, and fish feeding. Water sources full of ammonia and animal waste can make it difficult fish to breathe. Excessive ammonia levels threaten

organisms that can disrupt oxygen binding in the blood, alter blood pH, and affect membrane stability (Royan et al., 2019).

Apart from fish cultivation, community economic development can also be carried out through the utilization of agricultural production using new technological methods that can provide added value to agricultural products. Commodities from each agricultural product, such as guava, can be created and disseminated throughout the region. Utilization of commodities from each agricultural product can be produced and distributed throughout the region, for example, guava. Psidium guajava L. is the scientific name for guava. Crystal guava is one of the many types of guavas. Crystal guava is a massive fruit with thick flesh and a sweet flavor. This crystal guava can be made into a variety of items, including chips, dodol, juice, and jam. Crystal guava processing is a production utilization innovation. This can raise the commodity value of crystal guava, which can be used directly or processed into other derivative goods. Djajati et al. (2022) even produced burger products from processed crystal guava as a consequence of counselling and mentoring. Therefore, the successful development of village communities can be achieved through new business development programs and by increasing the added value of agricultural commodity products in a broad sense.

Bantarjaya Village is one of the villages in the Rancabungur District, with a land area of ±267.40 hectares and a population of 10,240 people. The village's population consists of 5,200 male residents and 5,040 female residents. The village, with a population of 2,936 families, is traversed by two Setu, namely Setu Moyan and Setu Babakan. Bantarjaya Village is known for its agricultural products based on crystal guava and derivative products, such as guava chips and dodol. The crystal guava the village produces can reach 300 tons annually, and each farmer produces 6 tons yearly. Through using existing resources, crystal guava cultivation in Bantarjaya Village is still carried out individually. The processing of crystal guava derivative products carried out by Micro, Small, and Medium Enterprises (MSMEs) also uses available local resources. The lack of general information, facilities, and infrastructure related to production and marketing makes it difficult for MSMEs to develop in this village.

The village traversed by the two lakes has irrigation streams that come directly from the springs and are used by the residents for daily life, especially agricultural activities. According to Azwarman et al. (2020), irrigation flow is a stream that connects water sources with rice fields that support water supply, collection, distribution, and use. However, this has become a big problem for Bantarjaya Village, namely that a lot of household waste crosses the irrigation and causes flooding at several points. Therefore, increasing resident's awareness of managing irrigation flows and understanding irrigation management technology is necessary to reduce household waste.

This skill development project aims to empower the Bantarjaya Village community by converting crystal guava commodities into derivative products such as jam and irrigation pond management for freshwater fish farming. New derivative products of crystal guava, such as jam, were created to increase the variants of processed crystal guava commodities, which are only chips and dodol. Training participants come from productive age groups in Bantarjaya Village, especially from the MSME community, commodity products, and groups of residents who have yet to work. Two assisted community groups will be formed: MSME groups making crystal guava jam and fish farming groups in irrigation ponds.

2. METHOD

We used a thorough and methodical approach in this study to identify and meet the needs of Bantarjaya Village. Our approach comprised a number of elements, the first of which was holding training sessions for the participants to guarantee they had the skills and knowledge required. After the workshop, we engaged with the village participants as part of a data collection procedure. To obtain important insights, the data collected from these exchanges underwent thorough study. A more thorough description of these activities can be found in the paragraph that follows.

2.1 Data collection

The activities of PPK Ormawa BEM FMIPA IPB in Bantarjaya Village began with an approach with the community there. Village officials and the people of Bantarjaya Village were invited to discuss the problems, potentials, and things needed in Bantarjaya Village. Subsequently, the team searched for suitable locations and targets for the ongoing PPK Ormawa BEM FMIPA IPB activities.

The formation of target groups was carried out by involving people from various walks of life. The target group was formed into two groups, namely the fish farming group and the crystal guava commodity utilization group. In the formation of target groups, there were several criteria needed to build stable coordination to support the sustainability of this activity, including good communication, awareness of the importance of coordination, participant competence, agreement, commitment, and incentives for coordination and continuity of planning (Apriliana et al., 2021).

Fish farming is carried out using one of the irrigation channels that pass through the RW 06 RT 02 area as a place for cultivation. Before fish farming, irrigation canals were revitalized. According to Danisworo & Martokusumo (2002), revitalization was an effort to revive an area that had experienced a decline by paying attention to and utilizing the potential, uniqueness of meaning, and image of the place. The revitalization process was done with assisted fish farming groups, such as development planning, land dredging, pond construction, and fish farming supporting infrastructure development. The implementation team conducted training to improve the understanding of target groups in managing flow ponds. The target group conducted a pre-test and post-test to examine the target group's knowledge of fish farming in the pond.

The implementation team conducted a trial and error in making a crystal guava jam before demonstrating it in front of the target group. The implementation team reviewed the results of trial and error and evaluated them in terms of taste, smell, color, and durability. Trial and error aim to explore by limiting certain parts to get maximum results and avoid unwanted events (Truskanov & Prat, 2018). The implementation team invites the assisted group to produce crystal guava jam on a small scale, carry out packaging and installation of product identity, and calculate production costs for profit. The implementation team held training on the processing potential of crystal guava commodities, crystal guava jam-making demos, packaging techniques, and product marketing strategies. Target groups and communities who attended the training conducted a pre-test and a post-test as a benchmark for understanding the target group and the community in managing crystal guava commodities into crystal guava jam products.

2.2 Data analysis

The data obtained through questionnaires were tested for reliability and validity using t-tests and Principal Component Analysis (PCA). Mishra et al. (2019) stated that t-tests are generally used to determine whether a variable significantly influences other variables. This study used the t-test to analyze data obtained through repeated measurements.

According to Schober & Vetter (2018), repeated measurements were used to see changes in results over time and compare those changes between treatment groups in the same experimental unit. Repeated measurements consist of a pre-test and a post-test on the same respondents. Analysis of the main components of the technique was used to test the interrelation of variables from the results obtained. Knowing the variables, this technique also aims to reduce dimensions and extract data sets by storing important information, as well as detecting and detecting the presence of outliers (Jolliffe & Cadima, 2016). This makes the data easier to interpret.

In the t-test, the confidence degree used is 0.05. If the p-value < 0.05 (α = 5%), it means that one variable significantly affects other variables. The significance value on the t-test was obtained through the following equation:

$$\frac{(\Sigma D)/N}{\sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{N}}{(N-1)N}}}$$

D = difference per paired value
N = number of samples

Analysis with PCA techniques was carried out using UnscramblerX software. The data obtained was projected so that a PCA chamber represents the direction of the maximum variance of the data. The PCA space consists of major orthogonal components (PCs) in the form of axes or vectors. PCA space will convert data from a high-dimensional to a lower-dimensional space, obtained by creating new uncorrelated variables and successively maximizing variance (Tharwat, 2016).

3. RESULT AND DISCUSSION

PPK Ormawa activities were carried out in the form of community service and empowerment programs in Bantarjaya Village, which have two main programs, namely fish farming ponds and crystal guava commodity processing. This service was carried out for nine months with several stages, namely the stages of infrastructure development and product manufacturing, as well as continuing with the knowledge sharing of freshwater fish cultivation with supporting infrastructure and product marketing training.

3.1 Training and construction of fish farming facilities

Activities carried out in community empowerment through pond revitalization in Bantarjaya Village have a role in reducing household waste. The water channel in the village was previously often used as a place for people to throw rubbish. The existing water flow has the potential for cultivating freshwater fish. The existence of flowing ponds that have not been utilized is another thing that this program does. Activities are carried out by paying attention to several stages, ranging from planning, cost calculation, implementation, monitoring and evaluation, finishing, and finalization (Figure 1). Implementation efforts to realize flow ponds for sustainable fish farming are carried out with the participation of the people of Bantarjaya Village every weekend for eight weeks. Routine maintenance, control, and evaluations were carried out every week as an anticipatory step to avoid errors and shortcomings in program implementation. Completion and finalization of pond construction and flow were carried out by painting to make the pond look attractive, re-checking, and testing. The community of Bantarjaya Village would then manage the pond that had been prepared as a place for fish farming (Figure 1).

Figure **1** . Testing of fish release at cultivation sites

Sharing knowledge about pond activities deepened the basic concepts of fish farming and ponds to all members of the partner team and communities in Bantarjaya Village (Figure 2). The material in this presentation was an essential factor in the sustainability of fishponds and farming, namely

Figure 2 . (a) Initial construction site (beside irrigation canal); (b) Infrastructure development process; (c) Sharing knowledge about fish farming

in how to care for fish and ponds, cultivate fish in irrigation water, and harvest fish. The training activity was carried out at RT 02/RW 06 and was attended by all members of the partner team. This training activity referred to the targets and objectives of pond development as a place for fish farming in Bantarjaya Village. In this training, the partner team learned how to cultivate freshwater fish properly and correctly. The training includes an explanation of site selection, types of fish and environmental conditions suitable for fish cultivation, type, amount, and frequency of feeding for each fish, sustainable water quality management, and how to monitor the condition of the fishponds being created. With careful planning and exemplary implementation, freshwater fish farming can be a productive activity and positively impact the economy and the environment.

3.2 Production training and marketing material for crystal guava jam

A superior product in the form of crystal guava jam that utilizes the potential of commodities in Bantarjaya Village, namely crystal guava, is one of Ormawa's PPK programs. Previously, crystal guava was only consumed directly by the public, and several processors made it into chips and lunkhead products only. This crystal guava can be further processed into other derivative products with higher economic value, such as jam. The community can certainly optimize This abundance of resources in processing products. This program results from discussions considering the village's potential for empowerment.

The implementation team and partners have carried out several stages in the production of crystal guava jam products (Figure 3). The steps taken are preparation of tools and materials, trial and error, evaluation, making small scale/size, making large enough scale, packaging, and installing product identity in the form of packaging labels.

The knowledge sharing was carried out twice in two different places. Namely, the first place in village deliberations is usually used as a gathering place for knowledge sharing activities. Second, the production house is a demonstration place to make products. The knowledge sharing conducted by the Ormawa PPK team was carried out at the end of the week, allocating two hours each for presentation and demonstration. The knowledge sharing was carried out to educate the guava jam partner team

about more managed and modern marketing. The material in presentation determines the marketing mix with the 4Ps of goods (products, prices, promotions, and places), conducts market tests related to taste, aroma, and texture, and maintains consumer loyalty by providing good product quality. This activity followed a question-and-answer session with the crystal guava jam partner team.

Training activities and mentoring in the production of crystal guava jam are carried out by actively involving the partner team in each training session so that the partner team learns and experiences every process during the training. Training activities include information on the nutritional value of crystal guava and its economically valuable processing potential, demonstrations and direct practices of crystal guava processing, as well as product packaging and marketing strategies.

Figure 3 . Crystal guava jam production

3.3 Data analysis

Before conducting a series of knowledge sharing and training, the implementation team filled out a questionnaire. The data obtained were then statistically compared with questionnaires completed after the knowledge sharing and training. The details of the data on each variable are as follows:

1. PRE-3 to PRE-9 and POST-3 to POST-9 have a scale of 1 (do not understand at all) to 5 (understand very well)

2. PRE-3/POST-3 is a variable of respondents' knowledge regarding the placement of fish in a pond/pond; Product processing (manufacture)

3. PRE-4/POST-4 is a variable of respondents' knowledge of the acclimatization process of fish in farming, Product processing (packaging)

4. PRE-5/POST-5 is the respondents' knowledge variable regarding fish feeding, Product processing (labeling)

5. PRE-6/POST-6 is the respondent's knowledge variable on handling sick fish; determination of product costs (operating costs, BEP, profit, product costs)

6. PRE-7/POST-7 is a variable of respondents' knowledge of the importance of water and

environmental conditions in fish farming, recording sales and capital purchases to generate profits.

7. PRE-8/POST-8 is a variable of respondents' knowledge about how to harvest, harvest age, and harvest time from fish farming gridlines.

The t-test for repeated measurements showed significant differences between the two conditions (PRE and POST) of the presentation and training. Table 1 shows the t-values and p-values. The greater value of t indicates that the difference between the two conditions is more significant. While a small p-value indicates that the chance of this difference occurring randomly / coincidentally is small. It also shows that the target group's knowledge difference in the program/training provided.

It also shows that the difference in knowledge in the target group results from the program/training provided (Figure 4).

Table **1** . The results of the t-test for repeated measurements were performed on the participants

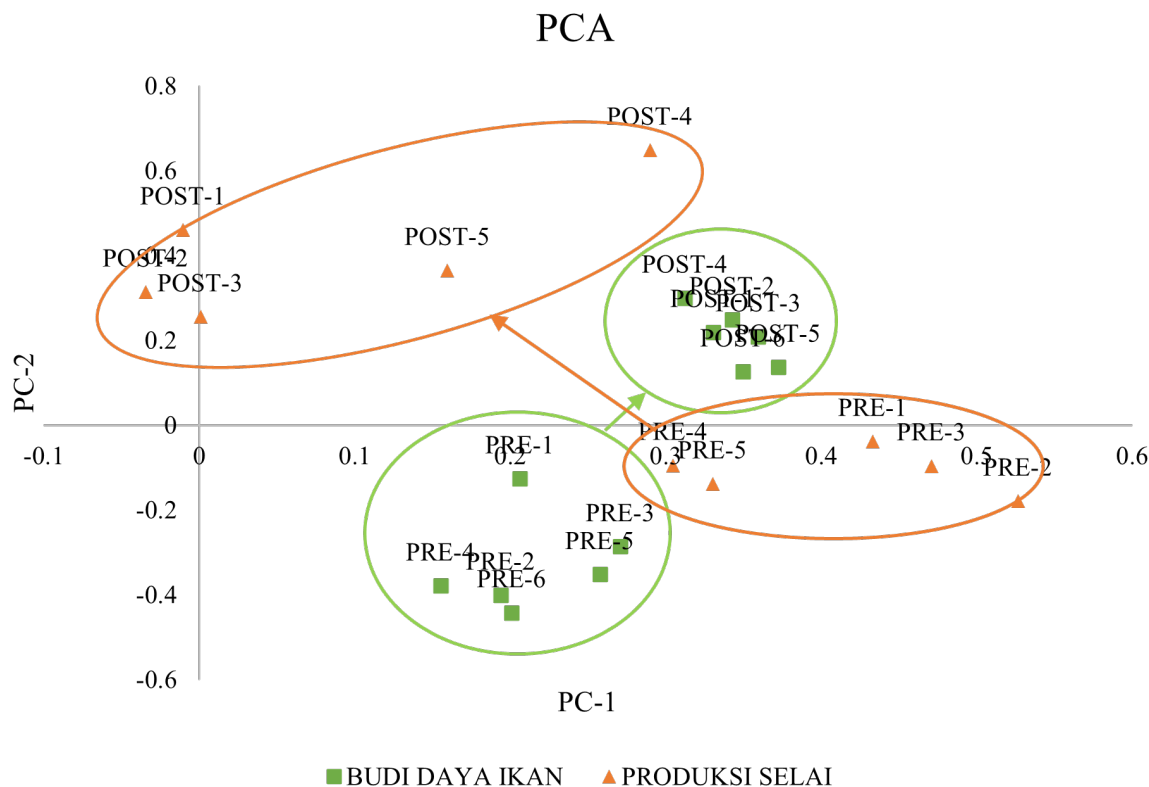| Variables (2 conditions)	Fish Farming		Jam Production	
	t Value	p Value	t Value	p Value
PRE-3/POST-3	7.129062	<0.00001	5.246231	0.00004
PRE-4/POST-4	6.157895	<0.00001	5.147461	0.00005
PRE-5/POST-5	4.420293	0.00014	6.480741	<0.00001
PRE-6/POST-6	5.728716	<0.00001	6.16794	<0.00001
PRE-7/POST-7	4.837355	0.00005	6.614378	<0.00001
PRE-8/POST-8	6.764655	<0.00001	-	-

Figure **4** . PCA graph of projected increase in knowledge that occurs between variables (2 conditions)

Principal Component Analysis (PCA) is a statistical procedure for converting a set of observations of possibly correlated variables into a set of observations of non-linearly correlated variables. These changes are defined in such a way that the first component has the largest possible variance compared to the second component, and so on (Chen et al., 2020). By using this definition, the PCA method can be used to see significant differences between analysis results.

In this study, the results of the questionnaire in the form of a scale were treated as numerical data. The PCA then analyzed the data to visualize the differences/classification before and after the treatment (Zheng & Rakovski, 2021). The result is a grouping between before and after treatment, both in the fish farming group and jam production.

3.4 Benefits and impact of training

The fish farming training was provided by voluntary cooperation to empower productive age groups by employing human resources, specifically target groups, to increase knowledge about fish farming. The training has an impact on the target groups' knowledge by teaching them how to cultivate fish, acclimatization processes in fish farming, fish feeding, sick fish handling, the importance of water and environmental conditions in fish farming, how to harvest fish, and the age of old fish. When to collect fish and how to arrange them in ponds/ponds during cultivation. This training was witnessed and intended directly by young teenagers, young men, and others who have not previously received any training related to fish farming and management that is correct and in accordance with some environmental conditions.

The training in the marketing of crystal guava was carried out by voluntary cooperation to empower productive age groups by employing human resources (community) through learning to develop knowledge about product marketing, particularly crystal guava jam products. The knowledge sharing has influenced target groups' knowledge by teaching them how to develop a superior product in processing, packaging, and marketing. Furthermore, by optimizing the use of media, this knowledge sharing has an impact on increasing knowledge on how to determine target consumers or market segmentation, determine the right marketing mix, conduct the right market test to test the feasibility of products in the market and maintain customer loyalty and satisfaction with products. Social media and marketplaces were used to promote and sell the jam.

4. CONCLUSION

After successfully completing and running activities such as constructing freshwater fish farming infrastructure in irrigation canals, freshwater fish culture training, and processing crystal guava into jam, the group was given reasoning tests twice, namely pre-test and post-test. The t-test for repeated measurements yields a large t-value due to the more significant difference between conditions. A low p-value implies that the likelihood of this change is not random but indicated by this program's presence. The

measurement test, which is intended for the community, shows good progress compared to the previous one when the program was not conducted. Through this activity, the group can carry out product management and marketing in a sustainable manner, so that it can expand product recognition and form other fostered groups, to expand the benefits of the program The group is also advised to innovate other processed products that can become unique to the village by empowering the surrounding community. This suggestion is also expected to attract more people to also have more implications for needs and increased income, thus achieving prosperity.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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