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Implementation of Reuse and Recycle Models as an Effort to Fulfill Fish Feed for Fisherman's Cage in Kedung Ombo

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Abstract

The purpose of this service is the development of the fishery sector by utilizing the remaining production (reuse and recycle) as an effort to preserve the environment and increase the circular economy. These objectives are derived in specific objectives: 1) Development of processed fish food to fulfill the needs of independent fish feed; and 2) Making fish feed based on local potential and recycling fish processing residue. The service uses training and mentoring methods. The training is expected to provide skills to the community, especially in the manufacture of fish feed made from leftovers. The training was continued with mentoring by involving elements of students on an ongoing basis. Another method used is Focus Group Discussion (FGD). The result of this service is the growing independence of aquaculture fishermen and empowerment in improving their welfare.

***Keywords**: fish feed, fisheries, keramba, processed food*

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Introduction

The Indonesian economy after Covid-19 slowly but surely experienced a significant increase, year on year economic growth in 2021 increased by 7.09%, all economic sectors began to rise, including the fisheries business. BPS data shows that the Gross Domestic Product (GDP) in the fisheries sector reaches Rp. 188 trillion or 2.83% of the national GDP. In the first half of 2021, the export value of fishery products reached USD 2.6 billion, an increase of 7.3% compared to the same period in 2020 (BPS RI, 2020). Fishery business is divided into marine fisheries, namely marine fisheries, namely fishing business or fish cultivation carried out in the sea, coastal areas and shallow fisheries. Inland fisheries, namely the business of catching or cultivating fish carried out on land such as rivers, ponds, ponds, cages and so on Law No. 45 of 2009 concerning Fisheries, 2009 (Undang Undang Republik Indonesia No.45 Tahun 2009 tentang Perikanan, 2009).

The current fishery business has turned to business, namely activities carried out in the fishery business including pre-production, production, post-production, processing and marketing activities according to Government Regulation of the Republic of Indonesia Number 27 of 2021 concerning the Implementation of the Marine and Fisheries Sector, 2021 (Peraturan Pemerintah RI No.27 Tahun 2021 tentang Penyelenggaraan Bidang Kelautan dan Perikanan, 2021). The important point in this business is production, which is the process and activity of producing fish, and post-production, namely the treatment of fish according to the type and quality, processing of fresh fish, and into processed food and treatment of residual production waste.

Sragen has potential in the field of fisheries, especially freshwater fisheries and aquaculture. One of the main fishery potentials is in Kedung Ombo Reservoir , so that Sumberlawang sub-district where Kedung Ombo Reservoir is located has the highest number of fishery products in Sragen. Types of fish cultivated in Sragen also vary with the largest number being catfish and red tilapia. The sub-district with the highest number of fisheries is Sumberlawang because of the availability of cages that number in the hundreds scattered around Kedung Ombo. The hundreds of tons of tilapia hatchery has made Kedung Ombo one of the largest fish producers in Sragen Regency.

Sumberlawang sub-district consists of eleven villages (kelurahan) with relatively affordable locations even though there are several villages located in remote areas. Natural potential, pre-historic and cultural heritages encourage the emergence of various tourist sites. Tourism of Mount Kemukus with religious heritage and Kedung Ombo Reservoir with potential for fisheries and waters creates economic growth. Eleven villages/kelurahan located in Sumberlawang sub-district include 1) Cepoko Village; 2) Hadiluwih Village; 3) Jati Village; 4) Kacangan Village; 5) Mojopuro Village; 6) Ngandul Village; 7) Ngargosari Village; 8) Ngargotirto Village; 9) Pagak Village; 10) Pendem Village; 11) Tlogo Tirto Village.

Sumberlawang, which is directly adjacent to Purwodadi district, has a natural environment that is still beautiful and well-maintained. Various flora and fauna that are characteristic of, among others, Branjangan birds and fish cages, guava and longan plants that thrive into non-rice agricultural potential that are feasible to be developed. On the other hand, traditions and customs can be seen in various cultural heritages that are unique and are still being preserved. An important feature that cannot be missed is the joglo roof structure, in housing especially in the interior of the Sumber Lawang sub-district which is a characteristic of traditional Javanese architecture, which is the main attraction because of its beautiful characteristics.

Kedung Ombo Reservoir has an area of 6,576 Ha, which consists of a water area of 2,830 Ha and a land area of 3,746 Ha. This potential causes the main livelihood of the population as fishermen, both traditional and cultivation with the floating net cage (KJA) model. Fishery products are sold in the form of fresh fish or in the form of culinary foods that are opened along the banks of the Kedung Ombo Reservoir. One of the most popular fishing activities is fishing. The attraction of WKO is not only for local residents but also for fishing enthusiasts from outside Sragen district.

Sragen is the top ten fish-producing districts in Central Java with the highest production of Gurame, Value and catfish. Aquaculture in Sragen, especially in WKO which is now used as a medium for rearing tilapia. Tilapia rearing business in the reservoir applies an enlargement business using floating net cages (KJA) as one of the fish rearing facilities whose framework is made of bamboo, wood, paralon pipes or square iron that is given a net and a buoy to keep the container afloat in the water. KJA is one of the fisheries efforts in large reservoirs or locations with a fairly swift current, this model is intended to secure and raise fish in one place.

Fish cultivation using floating net cages is an alternative fish farming system that has the potential to be developed in Indonesia because the area consists of 70% fresh water and sea. Some of the advantages of the floating net cage system are that the technology used in cultivating fish with these cages is relatively inexpensive and simple, does not require land land to become new water bodies and is relatively easy to control, and can increase aquaculture production with the application of stocking density.

KJA is the main alternative for reservoir and seafront fisheries because of several advantages, including 1) Cheap and easy manufacturing materials; 2) Fish are in one place so that it becomes an effective fish rearing medium; 3) Suitable for fast flowing waters; 4) Can be a vehicle for marine tourism. This KJA model will improve the welfare of aquaculture fishermen. Net income of KJA fish farming business is influenced by many factors, one of which is social and economic factors. Data on fishery potential in Sragen can be shown in Figure 1.

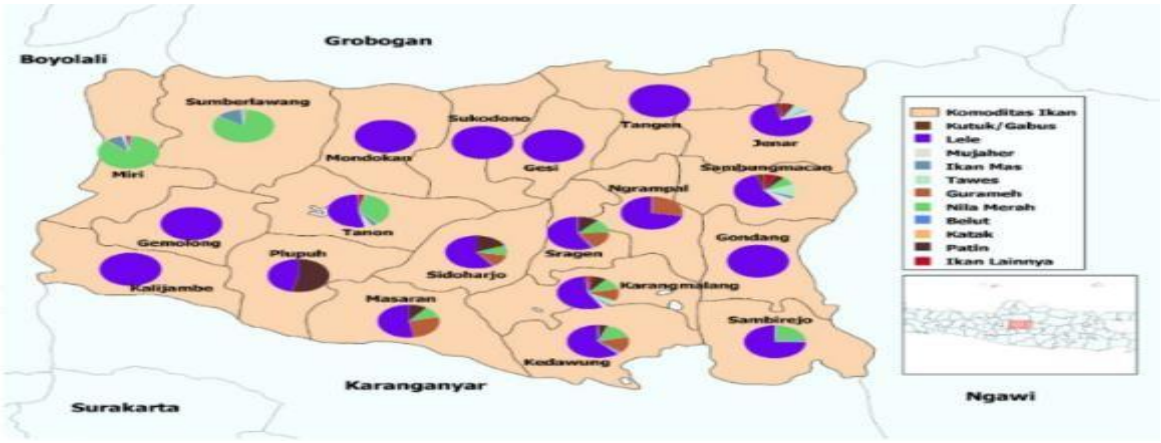

Fig. 1. Fishery products in Sragen

In addition to selling fresh fish, the next development is the manufacture of fish botok processed foods that are packaged in cans and are able to penetrate the export market.

Kedung Ombo Reservoir is located in Ngargosari Village.As an area adjacent to WKO, Ngargosari Village has advantages and disadvantages. Conditions of natural potential in Ngargosari include fisheries, because of its proximity to the Kedung Ombo Reservoir. One of the main livelihoods in Ngargosari Village is being a cage fisherman, especially in Dukuh Boyolayar. The largest fishery products in Kedung Ombo are tilapia and tombro fish with marketing reaching Sragen and surrounding areas. The model of aquaculture in Ngargosari is

to use cages, which are traditional fish breeding and cultivation sites that are similar to fish ponds but use wide waters such as reservoirs, rivers with floating net cage systems. This cage has several benefits including 1) the safety of the fish because they are in the net; 2) ease of maintenance; 3) increasing fishery potential.

This collaboration involving various stakeholders will support the increase in economic activity in the Kedung Ombo reservoir area. Departing from these problems, this service takes the main title Implementation of the Reuse and Recycle Model as an effort to fulfill fish feed for cage fishermen in Kedung Ombo. The main purpose of this service is the development of the fishery sector by utilizing the remaining production so as to increase the circular economy and increase the economy. These goals are based on the problems faced by partners.

Methods

Based on the background and literature review above, the concept of a sustainable aquaculture framework was developed. This concept collaborates aquaculture from upstream to downstream by involving natural systems that become fish ecosystems and the biophysical environment, human systems that include all business actors from the aspect of fishermen. Consumer communities and distribution elements so that they become a series of economic systems. The fisheries management system starts from aspects of planning, fisheries policy and fisheries management. In detail it can be described Figure 2.

Ngargosari Village has a Village Owned Enterprise (bumdes) Sarimulyo which has various businesses both in the financial and real sectors. The bumdes membership consists of farmers and fishermen. One of the businesses managed is the development of the Kedungombo area. The potential possessed by Ngargosari Village can be shown in Figure 3.

The potential of WKO has not been developed optimally, so it requires support from all stakeholders, namely pentahelix ABCGM (Academics, Business, Community, Government and Media). UNS is present as an academic who gives a deep touch to the production that will be carried out by fishermen through the Bumdes. The development model that is carried out requires planning, institutional development, and sustainability involving pentahelix stakeholders, namely government, academics, business actors, the public and the media.

Kedung Ombo Reservoir, especially for its Ecology and Agriculture, will be arranged in a commodification model, namely commodities and modifications which contain the understanding of the transformation of resource commodities in improving the economy. where when people are able to make their own fish feed they can make cost efficiency which must be removed. This is also a lever that can be synergized with the potential and uniqueness of an empowerment-based area capable of being a support for increasing welfare.

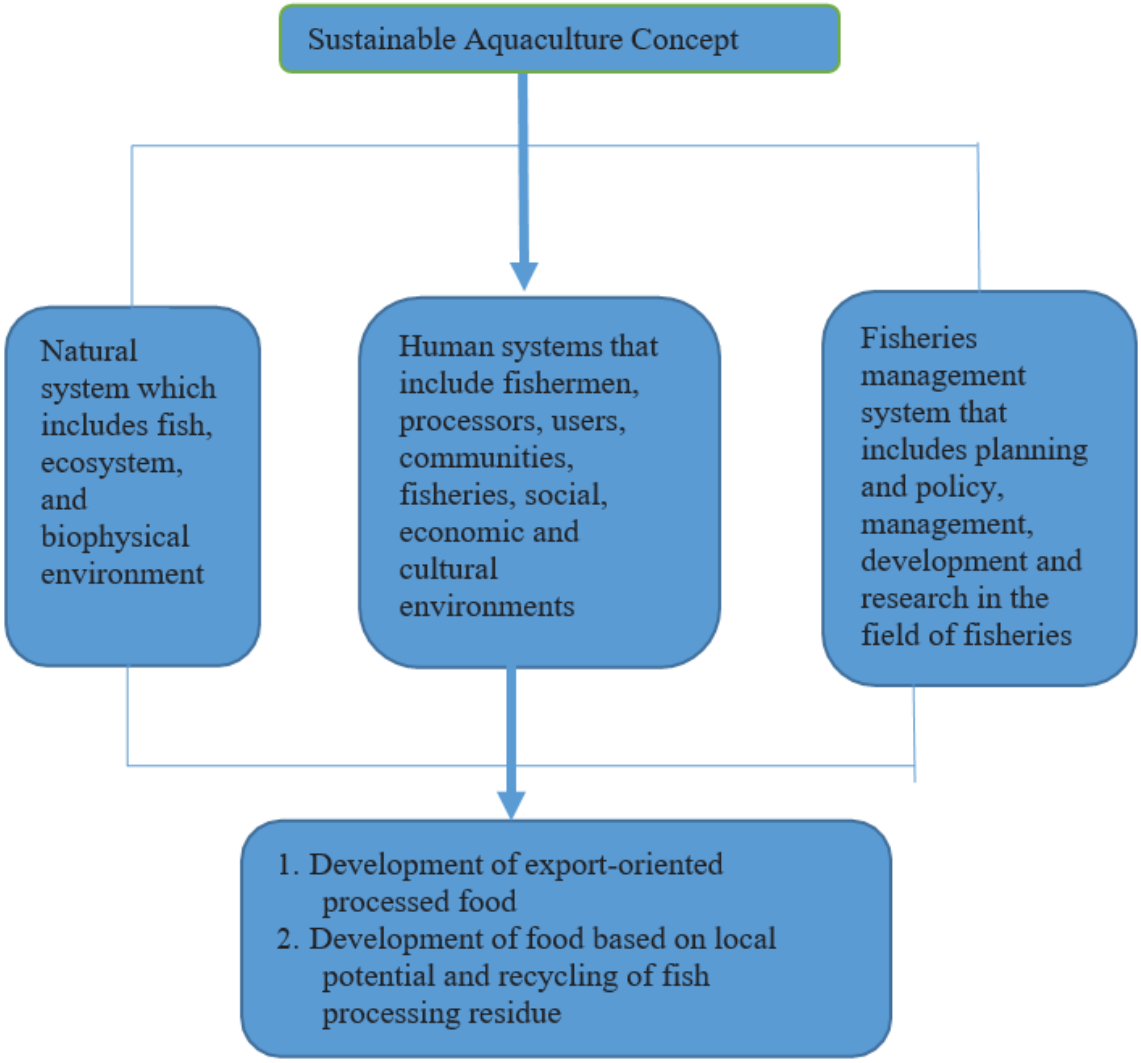

Fig. 2. Sustainable aquaculture concept

Fig. 3. Potential of keramba fisheries and the need for fish feed

This collaborative activity began last year with the preparation of a tourism roadmap in the Kedungombo area, and has received attention from the local government. The following is the intense collaboration carried out by UNS with Sragen Regency, especially in Ngargosari Sumberlawang Village (Figure 4).

Fig. 4. Cooperation between UNS and Sragen regency government

The approach method offered to solve the problems of program partners that have been mutually agreed upon for the two main aspects during the realization of Community Service is to use the training and mentoring method, technically the method used is the Focus Group Discussion Method, and the Assistance Method where in this activity Program Partner participants, namely BUMDes and Communities in Ngargosari village in the Kedung Ombo Reservoir Area, are the main actors in order to achieve the objectives of the training activities.

Whereas in the implementation of methods in the field, the community becomes the main actor in designing and analyzing their potentials and problems for the purpose of creating innovative products that will provide added value and higher competitiveness.

For this reason, it is necessary to carry out several analyzes to solve solutions to partner problems, including:

A. Production Analysis

The analysis carried out included an analysis of environmental conditions which resulted in the following findings

1. The location of the Kedung Ombo Reservoir is wide enough to make it possible to add cages as an increase in the quantity of fishery production;
2. Communities are still able to be empowered in cage management as an economic improvement
3. Supporting infrastructure in the form of roads shows that the road to Kedung Ombo Reservoir is still a rocky road and difficult to reach by large vehicles
4. The potential for tourist visits as one of the main markets in the development of sustainable fisheries potential.

B. Fish Feed Processing Analysis

One of the main problems in fisheries is the availability of fish feed so that feed prices can be stable. The cost of fish feed has a portion of 60% to 70% so fluctuations in the price of fish feed will affect the selling price of fish and harm fishermen.

C. Community Analysis

In this analysis it was found that there were no fishermen groups in Ngargosari village. Most of the people work as farmers and the mothers are housewives. Even so, the surrounding community is a society that is very open in receiving input. Villagers also feel that some improvements are needed so that the Kedung Ombo Reservoir can be more widely known. Based on the results of this analysis, the main partners of this activity are the residents of Ngargosari Village.

From the results of the field analysis that has been carried out, several programs that will be carried out by the HRG Service Program Team with partners include:

1. Fish-based food processing
2. Processing of fish feed based on fishery production residue

3. Assistance in strengthening human resources through increasing the quality and quantity of production, management, and motivation for entrepreneurship
4. Institutional improvement and empowerment of BUMDES as a legal umbrella for the development of tourist villages. The people of Ngargosari Village, Sumber Lawang, Sragen Regency have a high enthusiasm for developing a tourism village so that with planning for the development of a tourism village, it can be realized as expected by the community.

Results and Discussions

Results

A. Solutions to Partner Problems

WKO is one of the government's mainstays in overcoming the problem of drought in the dry season followed by flooding in the rainy season which has been experienced in several places in the area around WKO. Another purpose of the reservoir construction is for agricultural irrigation channels in water catchment areas, besides that it is also used for power generation and also for tourist areas. WKO is located in three districts, namely Grobogan, Sragen and Boyolali by sinking 37 villages, 7 sub-districts as many as 5,268 families lost their land and houses. The main dam is located in Geyer District, Grobogan.

The three regencies that are the locations have different focal points, Boyolali Regency has a development point in tourism through collaboration with Perhutani, the private sector and the community. One form of development is to build various kinds of existing infrastructure and go to the reservoir, this makes it easier for visitors or tourists to visit. Grobogan Regency develops from the point of agriculture. Sragen Regency as an upper area is not a DTA, so that the agricultural sector in the Sumberlawang area which is the main area cannot be utilized for rice food crops. Rice fields in the Sumberlawang area are mostly rainfed. Utilization is carried out by developing keramba fishery in the Ngargosari Region. The fishery business is one of the main focus points because there is still a lot of potential that can be developed. BUMDes is one of the main figures in the development of keramba.

The development of sustainable fisheries in the Kedung Ombo reservoir area will be more appropriate to be implemented across sectors and encourage higher community empowerment involvement. Environmental sustainability needs to be maintained at the same time optimal benefits for local communities, so cooperation between stakeholders is needed, strengthening

community institutions, increasing fishery potential around reservoirs and promoting tourism as a good and targeted support tool. Local governments can facilitate licensing for investors who will invest and use infrastructure. Guidance of fishing communities through BUMDes includes various elements ranging from improving the quality of production, capital, and opening up networks.

Optimal results in sustainable fisheries development can be obtained if they are supported by the development of three main elements, namely the biotic environmental ecosystem that affects fishery potential, human resources who are actors in fisheries development and fishery management systems which are the core of the institutional aspect. Some of the important issues in fisheries development in WKO are as follows:

1. The unavailability of complete facilities and infrastructure in fishery development
2. Lack of facilitation with adequate equipment in the development of processed food products
3. The low level of community human resources in the fisheries sector management system
4. Village institutional governance in the form of BUMDes that supports community empowerment
5. Low optimization of local products (food, crafts, arts)
6. There is no utilization of the rest of the fishery production.

Efforts to be made to re-optimize tourism in Kedung Ombo are, among others, described in the Table 1 below.

Tabel 1. Partner problem

Goal	Partner Problem	Problem Solution	Outcome Program
Development of independent fish feed	Fishery products are goods that are not durable so that if they are sold fresh/raw they will be at risk due to product damage • The price of fresh fish fluctuates, resulting in unstable fishermen's income • It is necessary to increase the competitiveness of fishery products by making processed food based on community empowerment	1. Sorting process for fresh fish based on type and criteria so that fresh fish will be sold directly, fish used for culinary and fish that will be used as processed food 2. Making fish-based processed food with a can model so that it will be able to last a long time 3. Licensing for processed foods	Academic Outcome Proceedings at national/international seminars Practical outside Fish processing video by type

Development of fish feed based on local potential and recycling of fish processing residue	• The need for fish feed in WKO is supplied from outside so there are often problems in the supply chain • The price of fish feed is 60% - 70% of production costs so that if there is a price fluctuation it will cause losses to fishermen • The remaining fish production in the form of thorns and fish innards makes it possible to make independent fish feed	1. Training on making fish feed made from fish waste products	Academic Outcome Same with the first objective Practical outside Guide / manual for the management of fish feed ingredients
Development of BUMDes potential through digitalization of management	• Development of village economic institutions requires proper initial planning in determining proposed programs or activities, especially for business groups in order to be able to increase community income, knowledge and skills through the implementation of training programs and digitalization of management as strengthening village economic institutions. • Development of the need for initial planning from the community to strengthen economic institutions in the village with various potentials possessed by the village and the community, as well as the need for socialization of the village government and related agencies in order to create new creative economic forces in the village.	a. Digital-based marketing management development training b. Training on the development of cooperation networks with various parties by utilizing digitalization in management and information c. Preparation of a roadmap for sustainable fisheries development	Academic Outcome - Book online Practical Outcome - News in online mass media about institutional strengthening

B. Production of Fish Feed

The manufacture of fish feed in this service is carried out by utilizing various leftover fish processing materials so that they use the concept of reuse and recycle. The stages in making fish feed can be arranged in 6 stages as follows:

1. Prepare and weigh the formulation of the materials to be used
2. Raw material mixing
3. Milling of raw materials
4. Printing
5. Drying
6. Packing.

These six steps will be trained for BUMDEs Sari Mulyo located in Ngargosari Village, Sumberlawang District. In detail these steps are described as below:

1. Prepare and weigh the formulation of the materials to be used. The principle of reuse and recycle is applied in this service by utilizing the following materials:

a. Fish silage (flour) made from fish processing residues such as fish heads, offal and fish bones. The remaining material is then ground to become fish meal. Fish meal ingredients are between 18% to 20%

b. Bran which is the remaining material of rice milling by 20% to 25%

c. Wheat flour by 8% to 10%

d. The remaining coconut cake is 14%.

These materials are raw materials consisting of leftover materials that are easily obtained around the village of Ngargosari. The percentage of ingredients to make the dough will be suitable to be eaten and provide nutritional value for fish. The suitability of the dose will also cause fish feed to be favored and become easier to float. Most tilapia or others with the floating net cage system (KJA) prefer floating feed.

2. Mixing of raw materials. The raw materials are then mixed and sieved before being added with water to make it easier for milling and printing

3. Milling of raw materials. The milling tool used is a TTG tool so it is easy to find. The tool is almost the same as the tool commonly used to grind noodles or various other foods

4. Printing. The milling tool is automatically a fish feed printing tool whose size can be adjusted in the tool. Fish feed will have a small size that varies according to needs, especially related to the size of the fish in the cage

Fig. 5. Milling tools for fish feed ingredients Milling is done when the material is still in a soft position so that it is easy to process and grind it into fish feed ingredients

Fig. 6. Results of milling and printing of fish feed

5. Drying. Fish feed that has been printed and dried in the sun must be dried with several benefits, including maintaining the durability of fish feed so that it can be consumed for a relatively long time, causing fish feed to float and making it easier to pack and ship feed.

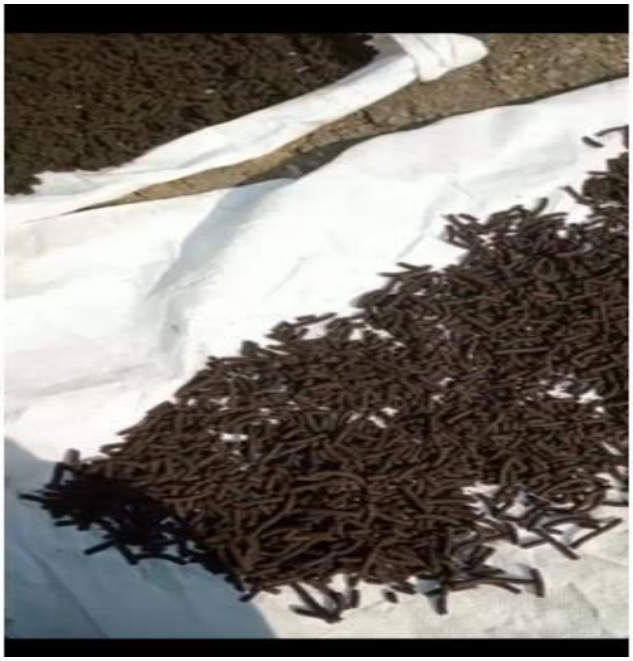

Fig. 7. The process of drying fish feed

6. Packing. Fish feed that has dried will clump together in an amount that adjusts to the size at the time of grinding, making it easier to pack.

C. Implementation of Training

The training on making fish feed was carried out by volunteers in collaboration with BUMDes and the Sragen Regency Government at the Regency level, in this case Bappeda and the Manpower Office, sub- district level and village government. The training was carried out in three sessions, namely a motivational session, a theoretical session and a practical implementation session for making fish feed as documented in Figure 8.

Fig. 8. Entrepreneurial motivation session

Discussions

Strategy is defined as a process of determining top leaders' plans that focus on the long- term goals of the organization, accompanied by the preparation of a method or effort how to achieve these goals, Marrus (Rahim, 2016). According to Chandler (Rangkuti, 2008), strategy is a tool to achieve company goals in terms of long-term goals, follow-up programs, and resource allocation priorities. The essence of strategy is the choice to perform different activities or to carry out activities in a different way from its competitors.

Wealth-based fisheries management (WBFM) aims to ensure that abundant fish stocks contribute to social welfare but do not exploit the environment and existing ecosystems (Cunningham, Neiland, Arbuckle, & Bostock, 2009). WBFM is to emphasize the need for the government to maintain the leaving residue (no waste economy). The amount of this contribution will vary according to the value of fish resources and the potential empowerment of society as a whole macroeconomic contribution that the fisheries sector can provide. The government becomes the determining variable whether the potential contribution of this sector is if it is managed properly. An important policy instrument is that if this sector is managed effectively then it will be able to return investment. In fact, on the one hand, it will push the circular economy model.

Feed is one of the main components in cultivation activities fish, one of the main obstacles in fish farming faced by farmers today this is a feed problem, where most of the feed needs are

met from commercial fish feed, in other words, fish farmers still depend on feed factory fish. Efforts to reduce dependence on commercial feed, The government created the Independent Feed Movement (GERPARI) program. Independence feed, which is part of the independence of production facilities, is currently being encouraged through GERPARI (Ministry of Marine Affairs and Fisheries (KKP), 2015). Program GERPARI seeks to reduce dependence on imported feed raw materials, by making greater use of local raw materials. GERPARI is expected to be able reduce dependence on factory or commercial feed.

The manufacture of fish feed must be in accordance with the procedure for the fish feed that is made to be given to the fish that are kept, from the selection of raw materials, calculations feed formulation, mixing of ingredients to the printing stage, training that has been carried out by the Department of Agriculture, Fisheries and Food Security of Landak Regency, still inaccurate in calculating feed formulations (Selvi, 2018)

Independent fish feed is directed to utilize various alternative ingredients local raw materials available around the cultivators. Another consideration is the material fish feed raw materials do not compete with food for humans so as not to endanger the food security of the surrounding community, and are not raw materials or used by other industries or sectors.

The existence of training in making fish feed based on local raw materials can assist local economic development in disadvantaged areas through the creation of the village's superior product, of course training on making fish feed based on local ingredients can trigger public interest in Ngargosari Village, Sumber Lawang sub-district in increasing business in the field of fishery.

Conclusion

Keramba fishery is an alternative in aquaculture that will increase fishery production so that it can meet the needs of fish-based food. In addition, high production will increase the income of fishermen, but so far the problem faced is in the fluctuating price of fish feed, causing losses because it is not proportional to the price of fish. Therefore, it is necessary to develop fish feed independently by empowering cage fishermen through training in making fish feed. The results of the training show that with increased production and relatively stable cultivation costs, it will encourage the fulfillment of the welfare of aquaculture fishermen.

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References

Adam, L. (2012). Kebijakan pengembangan perikanan berkelanjutan (Studi kasus: Kabupaten Wakatobi, Provinsi Sulawesi Tenggara dan Kabupaten Pulau Morotai, Provinsi Maluku Utara). *Jurnal Perikanan dan Kelautan, 2*(2), 115-126.

BPS RI. (2020). *Berita Resmi Statistik.* Jakarta: Biro Pusat Statistik Republik Indonesia. Retrieved from http://bps.go.id

Cunningham, S., Neiland, A., Arbuckle, M., & Bostock, T. (2009). Wealth-based fisheries management: Using fisheries wealth to orchestrate sound fisheries policy in practice. *Mar Resour Econ*, *24*(3), 271-287.

Peraturan Pemerintah RI Nomor 27 Tahun 2021 tentang Penyelenggaraan Bidang Kelautan dan Perikanan. (2021). Jakarta.

Rejeki, S., Hastuti, S., & Elfitasari, T. (2013). Uji Coba Budidaya Nila Larasati Di Karamba Jaring Apung Dengan Padat Tebar Berbeda. *Jurnal Saintek Perikanan*, *9*(1), 29-39.

Suryaningsih. (2008). *Pengenalan Bahan Baku Pakan Ikan.* Yogyakarta: Divapress.

Suryaningsih. (2010). *Makanan Ikan.* Yogyakarta: Divapress.

Suryono, S., Azizah, R., Kushartono, E. W., Ario, R., & Handoyo, G. (2017). Analisis Kelayakan Investasi Pada Budidaya Karamba Jala Apung (KJA) Ikan Kerapu Di Kepulauan Karimunjawa Kabupaten Jepara. *Buletin Oseanografi Marina*, *6*(2), 94. Retrieved from https://doi.org/10.14710/buloma.v6i2.16558

Undang-undang Republik Indonesia Nomor 45 Tahun 2009 tentang Perikanan. (2009). Jakarta, Indonesia.