



**Asia-Pacific
Economic Cooperation**

Guidelines on the Reduction of Seafood Waste and Loss

APEC Ocean and Fisheries Working Group



Phase II

Guide on valuing fishery by-products:

Promotion of sustainable artisan activities and women empowerment;

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Background

About one third of the food produced in the world for human consumption (approx. 1.3 billion tons per year) is lost or wasted (FAO, 2016). This means that food loss must be addressed urgently and jointly by the economies due to its important direct impact on food and nutritional security of the communities. This also affects how they can face situations of catastrophes like epidemics for example COVID-19. The circular economy view offers this new way, where its main objective is to have a positive effect on the ecosystem and to counteract the overload and exploitation of the environment and its resources. Its main pillars are the recycling and reuse of products, waste, and the optimization of energy sources. This new way to see and act follows to concrete actions for the adaptation to climate changes of these communities.

The problem of marine biological waste is transversal in economies with artisanal fishing activities in the Asia-Pacific, where beaches and landing areas are receiving diverse types of residues from such activities. 60% of such fishing residues are eliminated to the sea or becomes part of the household waste. This generates a gap due to the waste of resources that could be used as food or fertilizer susceptible to commercialization (Young, 2016). Facing this challenge, in 2018, Chile organized an international workshop (OFWG 03, 2017), attended by representatives of 9 economies, who shared 15 projects related to the development of new products from biological waste from artisanal fishing and aquaculture. It was agreed that in order to continue with the work, an instrument should be available to replicate the most successful experiences presented and to develop intermediate products that generate value to what does not have it. The product of this Phase II will be a **“Guidelines on the Reduction of Seafood Waste and Loss”**. This new project will build up on the previous work and will benefit APEC economies with artisanal fisheries to strengthen the economic activity of coastal communities, generating labor and new opportunities for higher incomes. This is especially important for women in the fisheries sector, and to introduce the circular economy view and this activity as a way to act collaboratively to adapt for climate changes.

The general objective of the project is to increase the reuse of these biological wastes from artisanal fisheries in the coastal communities of APEC Economies, allowing the creation of new business units that improve their income and quality of life. For this, the project will make available to the APEC economies a “guide” tool, which the economies will be able to find the necessary inputs (technical, economic and social) to replicate, and/or improved these projects.

Foreword

“The projects selected in this guide, certainly contribute to the economic growth of the artisanal fishing communities and their public-private partnerships, promotes the circular economy, contributing to the care of the oceans by reducing waste thrown into the sea and thereby ensuring adaptation to climate change. In a special way, the participation of women is promoted by considering the production of marine by-products as a strategy to increase their income and strengthens the role of women as an agent of diffusion and transfer of inheritance in work on the coastal border and good practices for the welfare of families”.

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Replicable project ideas

The guide was structured to contain a list of relevant topics agreed upon with the invited economies, where each of them completed the information through a Data Collection Sheet. This information considered minimum information to replicate each of the identified projects, mentioning technical, economic and social aspects, necessary to take into account.

The criteria for their selection were: 1) their feasibility of implementation together with coastal communities, 2) they have an important component of work with women, and 3) they promote new opportunities to innovate and add value to waste products from small-scale fisheries and aquaculture.

On the following pages, we present the list of economies in alphabetical order and their selected projects:



Supporting Local Feed Self-Sufficiency for Inland Aquaculture in Indonesia

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The aquaculture production sector in Indonesia is dominated by small farmers, who are generally governed by basic economic criteria such as income generation, productivity and production. Aquafeeds, used in aquaculture in Indonesia, account for 50-70 commercially manufactured feeds, estimated at 1.1 million tonnes per year, but heavily dependent on imported feed ingredients (according to the Association of Feed Mills of Indonesia (GPMT)). To overcome these gaps, a domestic program known as Gerakan Pakan Mandiri (GERPARI) or the Aquatic Feed Self-Sufficiency Movement was initiated, which focuses on providing low-cost aquaculture feed that is made from locally available ingredients for the inland aquaculture production sector. The broader goal of the programs is to reduce smallholders' reliance on imported ingredients and/or expensive commercially manufactured aquafeeds.

General background

Project summary

Develop a program to supply low-cost aquaculture feeds, manufactured with locally available ingredients for the inland aquaculture production sector.

Project team

Two aquaculture nutrition and feed development experts, four female fisheries officers from local area, two female extension workers, 6 small scale feed manufacturers.



Basic training

- ★ Training for small scale aquaculture feed manufactures and government extension workers on feed manufacturing and feed formulation.
- ★ Training on Best Management Practices (BMP) for feeding and on farm feed management (handling, storage, feeding strategies/Tables).
- ★ Training on operationalization of the feed manufacturing machines.



Project objectives

- ✓ Improve self-sufficiency in the local manufacture of aquaculture feeds, using Palm Kernel Meal (PKM) (the seed of the African palm from which oil is extracted) and fish silage from low-value/trash fish as an ingredient.
- ✓ Identify low-cost processing technologies to improve the nutritional quality of PKM and fish silage from low-value/trash fish.



Technical background

Specie(s) used:
Walking catfish (*Clarias sp*), trash fish that cannot mention the species.

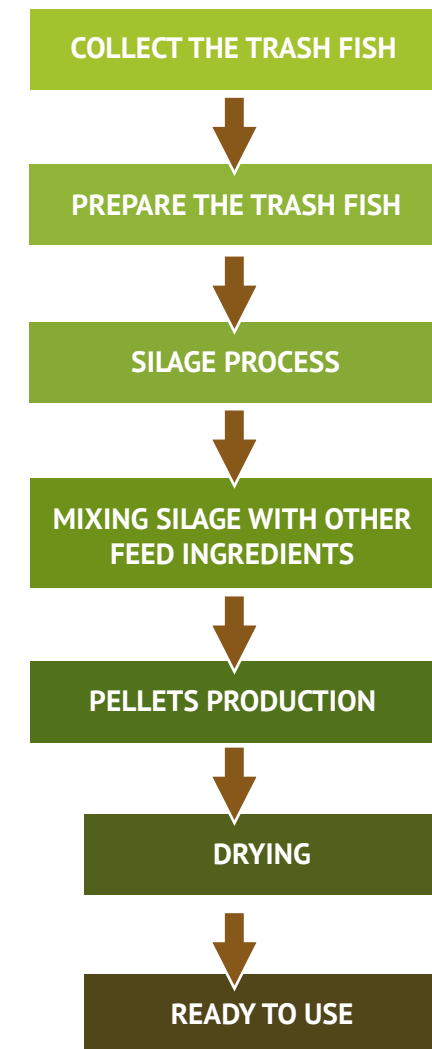
Type of waste:
All part of the fish

Final obtained Product:
Animal feed (feed ingredients).

Conditions for the execution of the project:
The availability of local raw material.



Steps of the production process



Economical background



Learned lessons

- Adoption of new food formulations so that small manufacturers can improve the effectiveness of GERPARI.
- Creation partnership with related stakeholder to support small producers' access to PKM.
- Design of low-cost food manufacturing and ingredient processing technologies (including fish silage technology) that are simple to install, maintain and operate.

Total cost : 250,000 USD.

Financing source : grant from FAO).

Approximate cost of infrastructure and equipment : 60,000 USD.

Expected production: 60 kg / group (fish).

Minimum production (ton): 75 kg / group (fish)

Profitability (percentage / years): Based on the farm trial result, we are able to calculate the feed cost comparison between FAO Formula with the Group Formula. Feed cost for FAO Formula is around IDR 7200, while feed cost for feed that use group formula was IDR 8900.



Fundamental elements for the sustainability of the project

- Market access.
- On-going technology assistance for the small scale feed manufacturers.
- Continuous technical training for people.
- Access to get raw feed ingredients.

Peru



Artisanal Composting Silver: The AproCompost, a model of Sustainable Communities

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The pilot experience of APROPISCO is inspired by the fertilization technologies of our pre-hispanic ancestors, who did it on corn plantations with anchovies and sardines. The project seeks to close the productive circle of the fishing industry in innovative, socially and environmentally responsible way and, above all, generating value for coastal towns, creating a ecological product 100 % that will restart a new life cycle.

General background

Project summary

Organic fertilization (APROCOMPOST) is made with fish waste from Pisco fishing plants and complementary inputs of organic waste from dining rooms and pruning of green areas. A circular production model called “The APROCOMPOST: A model of sustainable communities” is formed, with actions to generate and strengthen environmental awareness in citizens, which acts as a trigger for social development. It also proposes to strengthen knowledge and capacities on environmental issues in public institutions at the local, regional and national levels. Therefore, a productive circle is developed in an innovative, socially and environmentally responsible manner, generating value for coastal towns by creating a 100% ecological product that will restart a new life cycle.

Project team

The project involved 6 professionals (3 man and 3 women) and more than a hundred fishermen trained in the subject.

Basic training

- ★ Recovery of municipal, agricultural and forestry waste.
- ★ Composting by bacterial fermentation.
- ★ Formulation of environmental projects.



Project objectives

- ✓ Valuing via composting the organic waste generated (APROPISCO).
- ✓ Raise awareness and sensitize the community by helping to form environmentally responsible citizens.
- ✓ Contribute to strengthening the capacities of community actors (municipalities, higher technical education students, universities, artisanal fishermen, small farmers, Regional Agrarian Directorate, etc.) and at the same time of the Local and National Environmental Management System.

Technical background

Specie(s) used:
Anchovy (*Engraulis ringens*).

Type of waste:
Flour production waste
fish (bones, scales, scrap).

Final obtained Product:
Compost, lombricompost.

Conditions for the execution of the project:
Place, electricity,
drinking water, transport.



Steps of the production process

STORAGE OF RAW MATERIAL



MIXIN & CONDITIONING



COMPOSTING STAGES



FINAL PRODUCT



SCREENING



PACKING & STORAGE



DISTRIBUTION



Economical background



Total cost : 32,000 USD.

Approximate cost of infrastructure and equipment : 4075 USD.

Expected production: 200 MT / year.

Minimum production (ton): 50 MT / year.

Profitability (percentage / years):
38% / 3.62 years.

Financing source : Public - private funds.

Learned lessons

- Standardize the production of fertilizers (compost, vermicompost and bioferments) with fish waste, allowing its replicability and scalability.
- To be a specialized technical reference for the fishing sector and the community, contributing to capacity development and knowledge transfer, reinforcing SDGs (8, 9, 11, 14 and 17) of the 2030 Agenda.
- The composting plant has become a strategic ally, as a cross-cutting environmental education tool, strengthening practices for reusing production waste from the fishing sector.



Fundamental elements for the sustainability of the project

- Trained and organized people.
- Availability of raw materials.
- Lines of action (environmental, culture and capacities for development).



Technical guidelines for value added utilization of waste shells, Beihai city, China.

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In view of the problem of the accumulation of remains of shells, in the production of shellfish, which results in direct effects on the environment, public-private alliances have been developed together with coastal communities, especially with the work of women, who give value added to the shells, they reuse them and thereby contribute economically to their families, reduce environmental pollution and promote the green and sustainable development of the shellfish industry.

General background

Project summary

The project organized researchers from research centers and women dedicated to shellfish processing, to carry out research and development of alternatives for reusing shells, to give added value, focused on their use in handicrafts, health products (pharmaceutical use) and soil conditioners for agriculture.



Project objectives

- ✓ Develop value-added products from discarded shells.
- ✓ Increase the income of artisanal women engaged in shellfish production and processing.
- ✓ Propose a technical guidelines for value added utilization of waste shells.

Project team

Multidisciplinary group of 8 persons (2 man, 6 women), 5 university and research institute professionals, and 3 workers of shellfish aquaculture.

Basic training

1. Systematization of group work, bringing the world of fishermen closer to the academy and transferring the use of technology.
2. Raw material collection.
3. Use of equipment (using the cell phone as a model of equipment use)

Technical background

Specie(s) used:
Flower snail (*Babylonia areolata*)
Pearl shell (*Pinctada martensi*).

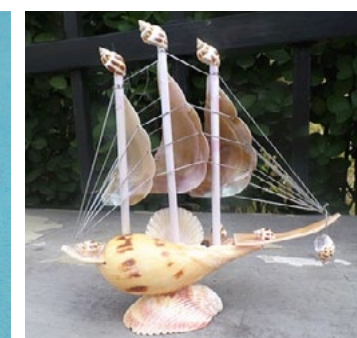
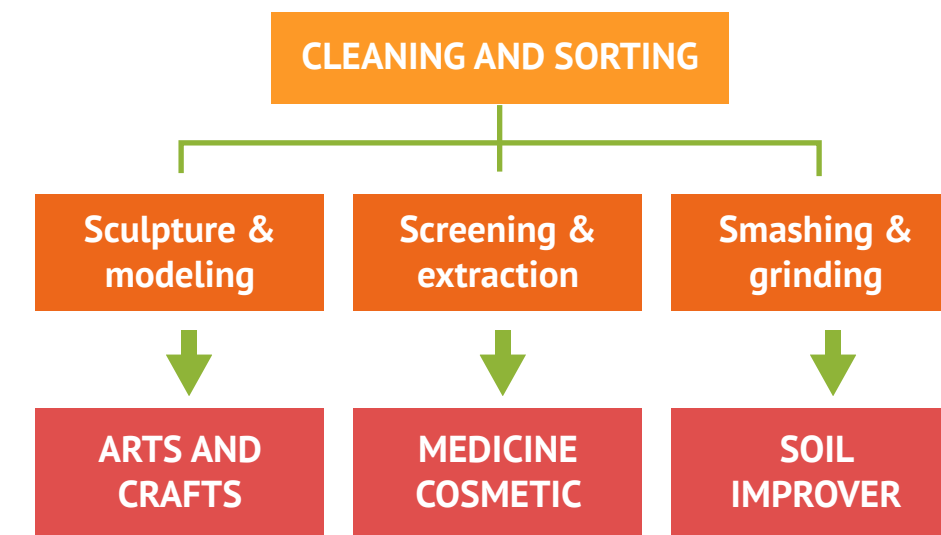
Type of waste: Shell

Final obtained Product:
Pharmaceutical use, handicrafts and agriculture conditioners.

Conditions for the execution of the project:
Place (physical space), electricity and tools.



Steps of the production process



Economical background



Total cost : USD 250,000.

Approximate cost of infrastructure and equipment : USD 170,000.

Expected production: 30000 (soil conditioner), 3 (handicrafts), 0.5 (peal powder).

Minimum production (ton): 10.000 (soil conditioner), 1 (handicrafts), 0.2 (peal powder).

Profitability (percentage / years): 20% (1st year), 40% (2nd year), 50% (3rd year).

Financing:

Private funds and others(subsidies for sustainable development of aquaculture industry).

Fundamental elements for the sustainability of the project

1. Awareness of turning waste into treasure.
2. Product output with good market prospects.
3. Executives with good training and professional knowledge.

Learned lessons

1. Cooperation with research institutes or universities can bring more technological innovation to the project.
2. The implementation of in-depth market research can ensure that the project is profitable.
3. Women's groups are full of hardship spirit and extraordinary creativity.



Promoting innovative fishery enterprises through development and commercialization of technology for shrimp waste utilization

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Shrimp processing industries produce large amounts of waste in the form of shrimp heads, shells and tails, comprising about 50% of raw materials. Improper disposal of this nutrient-rich waste can cause environmental problems if not managed properly. The utilization of shrimp processing by-products through technological development and commercialization is a promising waste reduction strategy and a livelihood opportunity for fishery-based MSMEs, constituting a great leap towards improving food security and the economic potential of the fishing industry.

General background

Project summary

The project promotes enterprise development through cascading of technology for shrimp waste utilization to stakeholders, particularly MSMEs and artisanal fisherfolk. This also aims to empower them in agribusiness development and management through provisions of training and production inputs, assistance with regulatory requirements, as well as product marketing and promotion.



Basic training

- ★ Production of shrimp head powder (SHP) and food products derived from SHP.
- ★ Compliance to Food Safety Standards and Regulations.
- ★ Agribusiness Incubation and Management.

Project objectives

- ✓ Development of food products from shrimp head wastes.
- ✓ Pilot-scale production of shrimp head powder and value-added products.
- ✓ Business incubation of shrimp head powder and value-added products.

Project team

Members from National Fisheries Research and Development Institute (NFRDI) and from the fisherfolk cooperative NASAMAPA (10 male, and 17 female).

Technical background

Species used:
Black Tiger Shrimp, *Penaeus monodon*
White-leg Shrimp, (*Penaeus vannamei*).

Type of waste:
Skin, head

Final obtained Product:
Condiments and flavoring intended for food application (such as chips, biscuits, and other snack foods).

Conditions for the execution of the project:
Place, electricity, drinking water, transport, internet connection, supplies and materials for trial productions.



Steps of the production process



WASHING AND TRIMMING

GRINDING

COOKING

DRYING AND FLAKING

PULVERIZING

SIEVING (optional)

PACKAGING

Economical background

Total cost : USD 140.000

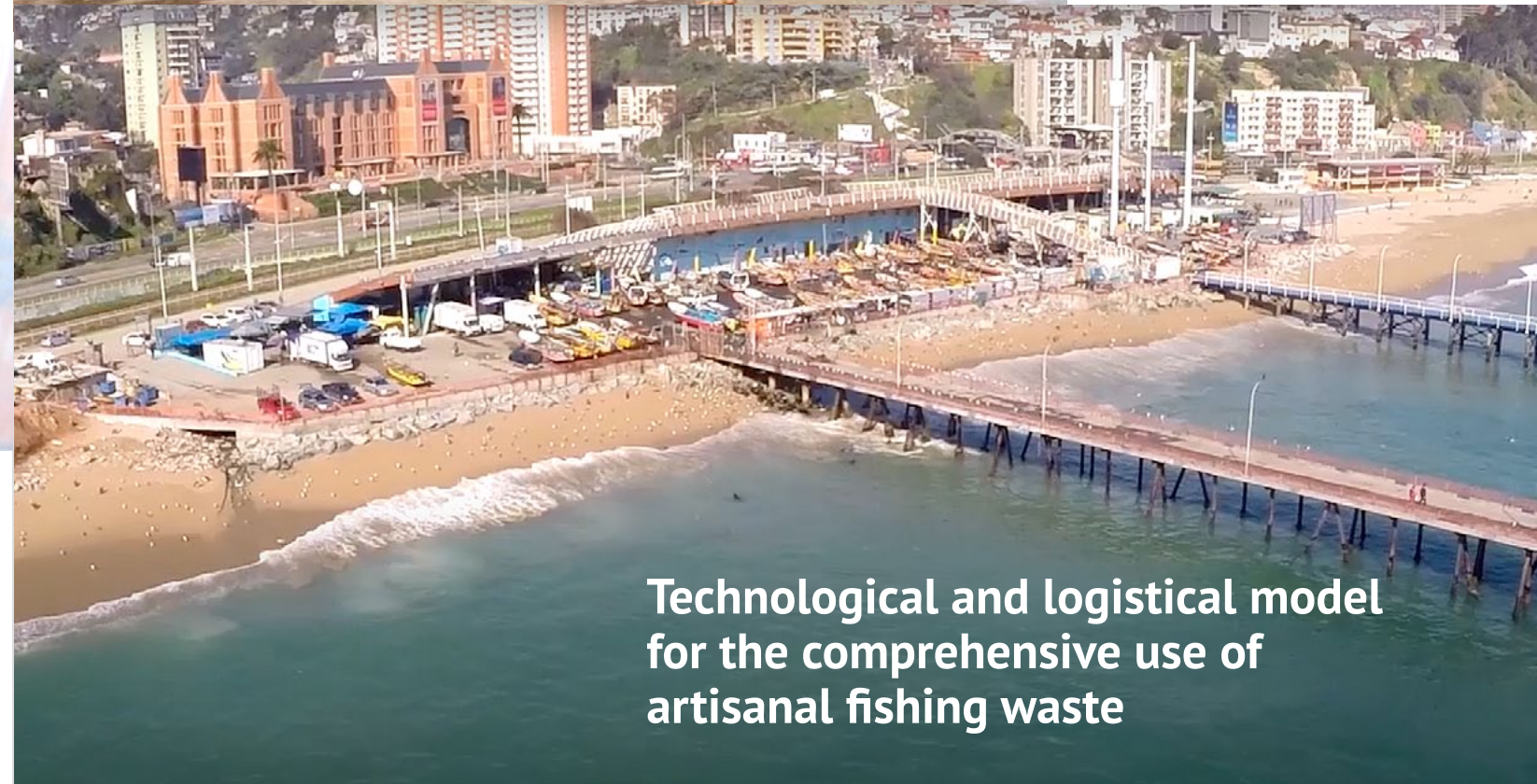
Approximate cost of infrastructure and equipment : USD 70.736

Expected production: 1.80 t/month (assuming a 20-day production/month).

Minimum production (ton): 0.07ton/day.

Profitability (percentage / years): 44.87% Return of Investment; 6,16 years payback period.

Financing: Public contributions.



Fundamental elements for the sustainability of the project

1. Operational food processing facility for the production of the developed food products.
2. Established organizational structure and processing operations in Bulacan.
3. Identified suppliers of raw material, market demands and linkages.

Learned lessons

1. Importance of government's ground level communication with fisherfolk organizations.
2. Necessity for data on postharvest losses and waste monitoring.
3. Importance of inter-agency collaboration towards helping the fisherfolks.

Technological and logistical model for the comprehensive use of artisanal fishing waste

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The artisanal fishing of today is so different from the fishing of yesterday, the sea and its ecosystem was subjected to the indiscriminate depredation of industrial trawlers. This reality led us to seek new income alternatives for families, through diversification and improving quality, giving added value to fishing resources, this concept was not easy to insert into the mentality of the Portolino fisherman, because There is a deep-rooted work custom, so we worked for sixteen months to meet the challenges, in which the women of the community joined.



General background

Project summary

Develop a productive exploitation model that encompasses the possible processing alternatives for hake and pippin waste that is compatible with the reality of artisanal fishing, associated with a demonstration operation that allows the model to be validated and to operate as a dissemination nucleus.



Project objectives

- ✓ Give added value to artisanal fishing waste.
- ✓ Propose a simple technological solution available to Caleta Portales.
- ✓ Put a demonstration plant into operation.

Basic training

- ★ Systematization of group work, bringing the world of fishermen closer to the academy and transferring the use of technology.
- ★ Raw material collection.
- ★ Use of equipment (using the cell phone as a model of equipment use).

Project team

Multidisciplinary group of 15 researchers (between them a sociologist) and 10 women who participated in training and finally 4 women and a 1 man like operators.

Technical background

Specie(s) used:

Hake (*Merluccius gayi*),
Pippin (*Brama australis*)

Type of waste:

Skin and echelon

Obtained Product:

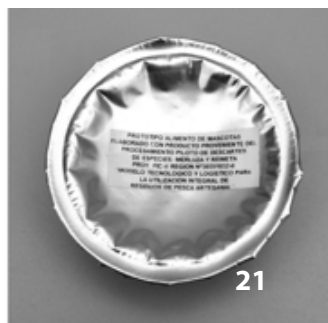
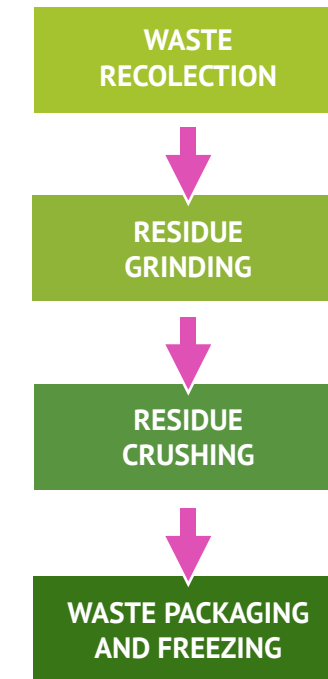
Animal feed (flavoring for the pet food industry).

Conditions for the execution of the project:

Place (physical space),
electricity



Steps of the production process



Economical background



Total cost : 150,000 USD.

Expected production: 1000 kg / day.

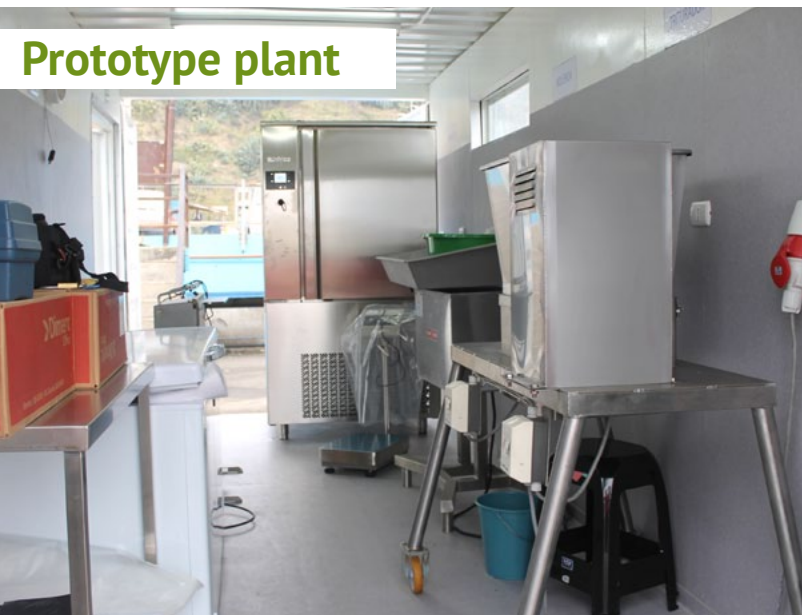
Minimum production (ton): 100 kg / day.

Profitability (percentage / years): 20% / 2 years

Financing: Public - private contributions.

Fundamental elements for the sustainability of the project

1. Logistics.
2. Internationalization of the market.
3. Quality control.



Learned lessons

1. Professional facilitator of the social process (sociologist).
2. Team training with similes of everyday life.
3. Search for marketing.

Results from the selected projects

Principal key barriers

It is important resolved the minimal logistics to develop simple projects to reduced waste from the fisheries an small scale.

It is important a continuous training and accompaniment (on going techno-logy assistance) with communities in virtuous alliances.

It is necessary organized communities to face technological and commercial challenges.

It is important have availability of materials, market access and demand.



Learned lessons and recommended actions

Good communication with fishermen communities and being help with a facilitator professional of the social process (sociologist).

Training and awareness makes change possible in communities, but it is necessary executives with good training and professional knowledge, be part of inter-agency collaboration with fisher folks.

Joint creation and validated by the communities, of associations to support the access of small producers to fair, close and sustainable markets.

Design of low-cost feed manufacturing and ingredient processing technologies (including fish silage technology), as well as for fertilizer and other uses such as handicrafts, that are easy to install, maintain and operate.

Results from the workshop

Bali - Indonesia, 8 June 2022



Conclusions

One of the objectives of this project is to discuss the technical, social, and technological aspects of profitable projects that add value to by-products. Which was possible to develop during the workshop, since the five exhibitors concluded or stated the need to work on projects with a systemic or holistic view, where:

- ★ Thanks to technology, it is possible to transform solid waste into a powder, or where industrial technology is capable of being implemented on a scale for use by fisheries and aquaculture communities. As the use of different machinery, for cooking, grinding, crushing, among others, the operation is facilitated, production is optimized and new products can be generated based on totally solid waste, such as shrimp waste from the Philippines and the use of heads and other fish waste in the case of the Chile project.
- ★ Social aspects are paramount, since we are working with people from different educational realities, with digital, communication, and linguistic gaps, among others. Therefore, it is necessary to include sociologists and anthropologists in this type of activity.
- ★ Finding a key person who would be the bridge among the project idea (and the technology) and the community. To ensure that this technology is properly transferred to the fisheries and aquaculture community. Whether this person is an anthropologist, or a sociologist. On the other hand, finding a key person in charge in the community who would like to engage in a project of such nature, and be the person in charge.

- ★ Strengthening the relationship between the public sector, private sector, and civil organizations by finding mechanisms to encourage the sustainable promotion of circular economy. The key question APEC wants to cover is: why is it important to promote the circular economy? The answer: to improve the quality of life of these fisheries and aquaculture communities emphasizing women empowerment (on an environmental dimension, a social dimension, cultural dimension, and economic dimension).
- ★ The structure of the guideline proposed was socialized and approved during today's workshop by the attended economies.

Recommendations

- ★ We promote the economies to strengthen the regulation of the government policy to promote the circular economy and women empowerment and disaggregate data by gender in the fisheries and aquaculture communities.
- ★ Strengthening cooperation among the members of APEC economies through sharing best practices in valuing fishery by-products.



Results of the field trip

Bali - Indonesia, 9 June 2022



Exchange of experiences, views and cultures



Strengthened of networking on circular economics



Women and young participation



Acronyms

APEC: Asia Pacific Economic Cooperation
BMP: Best Management Practices
COVID -19: Corona Virus Disease -19
FAO: Food and Agriculture Organization
GERPARI: Gerakan Pakan Mandiri
GPMT: Gabungan Perusahaan Makanan Ternak (Association of feed milles of Indonesia)
IDR: Indonesia money (Rupia)
MSMES: Micro, Small and Medium-Sized Companies
NFRDI: National Fisheries Research and Development Institute
PKM: Palm Kernel Meal
SDG: Sustainable Development Goals
SHP: Shrimp Head Powder
t: Tones
USD: American dollars

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