Market Value Chain Assessment

Annex B of the Pre-Feasibility Study for the GCF SAP Funding Proposal for Project *"Building Flood Resilient Community through Adaptive Livelihood and Runoff Management in Petanglong Area of Central Java Province of Indonesia (BRAVE)"*

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Table of contents

List of figures, tables, and boxes

1 Introduction

This study aims to analyze the supply chain, value chain, and value-added characteristics of six commodities i.e. Coffee, Carrot, Corn/Maize, Milkfish, Processed Milkfish and Groupers. The study was conducted in June and July 2025 in three regions: Pekalongan City, Pekalongan Regency, and Batang Regency in Central Java Province, using a qualitative analysis approach and quantitative data collection. The results indicate that the value chain is a value-added activity divided into two types: primary activities and supporting activities. The main actors in the value chain analysis include farmers, local collectors/traders, middlemen, processor, and consumers. Commodity value-added is the added value of a commodity due to processing, storage, and transportation during the production process. The value-added calculated in the value chain analysis is the value-added obtained by each value chain actor involved in the harvest: farmer value-added analysis, local trader/large collector value-added analysis, and other actors value-added analysis.

Value chain analysis is a strategic analysis tool used to better understand competitive advantages, identify where producer, processor and product customer value can be increased or costs reduced, and better understand all related actor's relationships with suppliers, customers, and other companies in the industry.

The value chain concept provides a suitable framework for explaining how actors or organization can manage substantial considerations in allocating its resources, creating differentiation, and effectively managing its costs. The value chain is a tool for identifying ways to generate added value for consumers. A value chain framework consists of primary and support activities. Primary activities are those involved in the physical creation of the product, marketing and transfer to the buyer, and providing after-sales service. Support activities are those that support the actor as a whole by providing the infrastructure or input that enable the primary activities to be carried out continuously.

By conducting the Value Chain Analysis, the following benefits could be obtained:

- Cost Reduction: By evaluating each activity, actors can identify inefficiencies or areas of unnecessary cost and eliminate them.
- Differentiation: By improving the quality or uniqueness of specific activities, actors can offer superior products or services and create differentiation in the market.
- Competitive Advantage: Understanding how value is created helps in building sustainable competitive advantages, whether through cost leadership or differentiation.
- Strategic Focus: It helps to focus on areas that deliver the most value to customers and contribute to profitability.

Market value chain is oftenly referred to as all of the span of activities along the line from the initial production, processing in the middle, distribution stages, and reaching the market/final consumer. In the case of commodities related to crops and livestock it would involve activities from its initial extraction or cultivation to the final consumption by consumer. Analyzing a commodity value chain would require gathering a combination of qualitative and quantitative information to evaluate the production, distribution, and consumption processes. By analysing these processes, it would help in understanding the complexity of network of

actors and process undertaken by each of them, role of related stakeholders, and value of transactions that add value to such commodities as it moves from upstream to downstream, along the supply chain of commodities.

Using Market System Development (MSD), an integrated approach to analyse and understand a market system, identifying key actors and the constraints, in order to improve the functioning of the market system itself this study will explore all the potential and opportunities provided by the local context. All Actors for those six (6) commodities within the Core Function of the value chain, namely the inputs providers, the production actor, product processors, product distributor, until reaching the market/the final consumer are analyzed. Actors that plays the supporting function, that potentially contribute to the functioning of the market system such as Research institution, Extension services, transport providers, storage companies, financial institutions (e.g. Banks, Insurance company, Rural banks, cooperatives, credit union, microfinance institutions, BUMDes etc), inputs provider/nursery (seeds, seedling, fertilizer, pesticide, herbicide etc), IT companies/Digital Marketing etc are also analyzed; and finally the MSD approach would also investigate the role of factors that may contribute as enabler such as policy, laws and regulation, association, existing norms within the communities etc.

This study will mainly employ the following tools of analysis in making analyses of the value chain of the market system across all commodities:

1. **Value Chain Stream Mapping**
   Visualize/putting into diagram of all key players and processes involved, the flow of commodities from production to the final consumer.

2. **Profit Margin Analysis**
   Analyzing profit margins at different stages of the value chain, therefore we could understand where the most value is captured and where margins are squeezed/least.

3. **Cost Benefit Ratio Analysis**
   Analyzing the costs of each stage or activity in the value chain, relative to the benefits they provide (financially).

4. **SWOT Analysis**
   Analyzing Strengths and weaknesses (which focus on internal capabilities and constraints) as well as Opportunities and threats (focus on external market conditions)

5. **Benchmarking/Comparative Analysis**
   Comparing the value chain activities with standards (local competitor or local industry standards) to identify best practices and areas for improvement

6. **Institutional Analysis**
   Analyzing the institutional aspect of the group within the communities or existing institutions that play roles in the market value chain

7. **Stakeholders Analysis**
   Analyzing all key stakeholders (e.g., government agencies, NGOs, associations) and their influence on the market chain, understand their interests, objectives, and how they interact with each other.

8. **Policy and Regulatory Analysis**
   Assess how policies and regulations impact the value chain

9. **Gender Analysis**
   Analyzing and evaluating the gender aspect within the value chain

10. **Sustainability and Social Impact Analysis**
    Analyzing the environmental sustainability and social impact of the market value chain.

11. **Other Analysis**
    Other analysis that is considered relevant for intervention consideration e.g. financial literacy, climate change, land status etc.

2 Value Chain Analysis for Coffee Commodity in Jolotigo and Silurah Village

This chaper will go into an in-depth analysis of the coffee commodity value chain in Jolotigo Village, (Talun District, Pekalongan Regency), as well as Silurah Village (Wono Tunggal District, Batang Regency). The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various source). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

Jolotigo and Silurah villages in Pekalongan Regency are mountainous areas suitable for coffee cultivation. The type of coffee planted is mostly Robusta. However, there are significant differences in cultivation practices, farmer knowledge levels, and value chain structures in the two villages. Climatic factors, such as high rainfall and humidity, as well as landslide risks, are common challenges for farmers in this area.

2.1 Value Chain Stream Mapping

Typical Flowchart of the coffee supply chain from upstream to downstream:

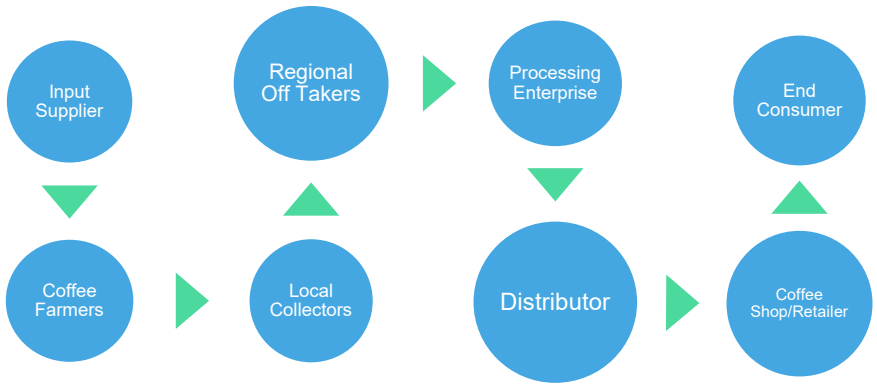


Figure 1 Typical coffee supply chain

Table 1 Coffee value chain actors and functions

Stages	Actor	Function
Inputs	Farmers, local labor, fertilizer retailers, local seeds	Land prep, Procurement of seeds, fertilizers, pesticides,
Planting & Cultivation	Farmer (additional labor if needed)	Planting, treatment & maintenance, harvest
Postharvest	Farmer	Drying, peeling (manual)
Coffee Collection	Collector	Purchase, additional drying, transportation
Sale of beans	Off taker (Temanggung Regency)	Bulk pricing, aggregation
Processing	Small scale or industrial roaster	Roasting, packaging
End Market	Coffee shop, marketplace (offline & online), export market	Consumption

While for the actual actors of the supply chain that we observed exist in the village from the field visit are depicted in the following simple diagram:

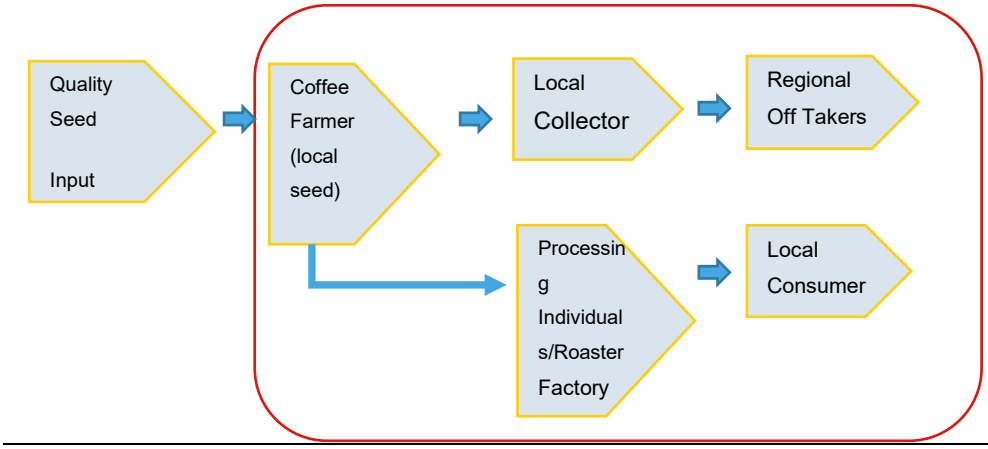


Figure 2 Existing coffee supply chain actors

As seen from the above diagram, the supply chain in both Jolotigo and Silurah Village is actually very limited thus the value creation which is only started from the coffee farmers and all the way to next 2 or 3 actors i.e. the collector & small processor.

Figure 3 Coffee in farmers' self-owned land (left) and in Perhutani's land (right)

The description below provides details of the flow for each actor.

1. Coffee Farmers (Jolotigo & Silurah):
    - Land Source: The majority of coffee farms are located in forest areas owned by PERHUTANI with a profit-sharing scheme (Jolotigo: 40% of the harvest for PERHUTANI) or social forestry concessions (Silurah). Some farmers also have smaller private plots of land.
    - Seedlings: Generally using local seedlings that are not purchased, grafted onto liberica coffee. Some farmers in Silurah have started buying premium seedlings from nursery
    - Agricultural Practices: Most are still self-taught, lack maintenance, and have not implemented Good Agricultural Practices (GAP). The use of fertilizers and pesticides is carried out, but knowledge of optimal doses and organic methods is still minimal.
    - Harvest: Harvest cycle once a year. Yields vary (200 kg - 1 ton of wet beans in Jolotigo). Average 0.5 kg of wet coffee per tree in Silurah. Farmers with superior seeds can reach 5 kg per tree.
    - Early Post-Harvest: Drying of wet coffee beans is done manually in open areas (roadside, yard), is prone to contamination and is very dependent on the weather. There is no grading . Some farmers in Silurah process waste for cattle feed. The drying process can take up to 2 weeks during the rainy season.
2. Local Collectors:
    - Buying wet or dry coffee beans from farmers. (In Jolotigo Village, there is only one collector. While in Silurah Village there are 5 collectors).
    - Pricing: The selling price to collectors is often set by the collectors themselves. The collectors themselves are only the recipients of prices from wholesalers.
    - Further Drying: Collectors can carry out further drying for the purchased wet coffee beans.
    - Lenders: Collectors like Mr. BC also act as loan providers for farmers (interest-free, but required to sell their crops to him).

3. Regional Wholesaler/Offtaker (Temanggung):
    - Purchasing: Buying coffee (mostly green beans) from local collectors in large volumes.
    - Local collectors sell the collected coffee to wholesalers in Temanggung Regency, Central Java.
    - Price Determinant: This wholesaler determines the selling price to collectors.
    - Storage & Standardization: Has a large warehouse capacity and has a maximum water content requirement (10%).
4. Coffee Roaster/Processor:
    - Purchase: Purchase green beans from wholesalers.
    - Processing : Roasting and grinding to produce coffee powder or roasted coffee beans.
    - Marketing: Selling finished products to distributors or directly to consumers. Further Processing & End Consumer:
    - There is a desire from some farmers in Silurah to process coffee beans into powder and sell directly to consumers through online orders, although marketing is still limited. However, most of the coffee seems to be sold as green beans to wholesalers, who then likely pass it on to other roasters or coffee processors before reaching the end consumer.
5. End Consumer:
    - Buy processed coffee products (powder, roasted beans) for consumption.
    - There is a desire from some farmers to sell coffee powder directly, but marketing is still very limited.

2.2 Profit Margin Analysis

Below is the summary of calculation of profit margin for each actor in value chain

Table 2 Coffee profit margin calculation

Actor	Purchase price	Operating costs	Selling price	Margin (%)
Farmer	N/A	Rp.2,000/kg (labor + input)	Rp.11,000/kg (wet)	±18%
Collector	Rp. 11,000/kg (wet) → dry Rp 54,000	±Rp.8,000/kg (transportation, drying)	Rp.56,000/kg	±20%
Off taker	Rp. 56,000/kg	Rp 5,000 (sorting, packaging)	Rp.70,000–90,000	±25–40%
Retail Roasters	Rp. 90,000/kg	±Rp 10,000	Rp.120,000–200,000 (estimate)	±50–100%

Note: The greatest value is captured on the downstream side (roaster and retail sales), while farmers catch the smallest.

Profit margin analysis at each stage of the value chain:

2.2.1 Coffee Farmers

- Income:
  - Wet coffee sales: IDR 10,000 - IDR 11,000/kg
  - Sales of dry coffee (regular grade): IDR 51,000 - IDR 54,000/kg
  - Sales of dry coffee (grade A): IDR 90,000/kg (only for farmers who apply GAP)
  - Waste sales (pulp): IDR 400/kg
- Main Costs:
  - PERHUTANI profit sharing: 40% of the harvest. This is a significant reduction in income.
  - Fertilizer: IDR 450,000/hectare (urea), plus other fertilizers.
  - Pesticides/Herbicides: around IDR 20,000.
  - Labor: If using labor, IDR 100,000/day/person. If 2 people for 2 weeks for 0.25 ha, the cost is IDR 2,800,000. This is very high and is likely only done by larger farmers or during peak harvests. Most farmers do the work themselves.
  - Seeds: Generally free (local), but premium seeds IDR 4,000/polybag.

Farmers' profit margins are small, and can even be negative if they do not take into account the value of independent labor. Profit sharing with PERHUTANI is very burdensome. The sale of wet seeds cuts potential income. Lack of Grading also makes farmers not get a premium price. Coffee results are considered secondary income, showing inadequate margins as primary income.

2.2.2 Local Collectors

- Income:
  - Selling price green beans to wholesalers: IDR 56,000/kg (lowest IDR 40,000/kg).
  - Turnover per month: 25 tons (25,000 kg).
  - Total Turnover = 25,000 kg x IDR 56,000/kg = IDR 1,400,000,000.
  - Price difference profit: IDR 2,500/kg.
- Main Costs:
  - Coffee purchase price from farmers: IDR 11,000/kg (wet), IDR 54,000/kg (dry).
  - Drying cost: IDR 750,000/ton (IDR 750/kg).
  - Transportation costs to the drying location: IDR 100,000/ton (IDR 100/kg).
  - Working capital: IDR 200,000,000.
  - Bank loan interest (if any).

Gross margin of around 20% and a price difference profit of IDR 2,500/kg. Based on previous calculations (if the collector buy wet beans, process, and sell dry beans), the margin per kg can reach IDR 11,150/kg. This shows that collectors have a much larger profit margin than farmers. However, they also bear the risk of high price fluctuations.

2.2.3 Regional Wholesaler/Offtaker (Temanggung)

- Main Costs:
  - Purchase price from collectors: IDR 56,000/kg (from collector).
  - Storage costs, logistics, quality control .

Wholesalers, as price determinants to collectors, are likely to have stable and larger margins due to their very large volumes (warehouse capacity up to 45 tons) and strong bargaining position.

2.2.4 Profit Margin Conclusion

- Farmers: Farmer margins are severely eroded by profit sharing with PERHUTANI (in Jolotigo) and prices set by collectors. Wet coffee sales command much lower prices, and drying itself is subject to weather constraints. Farmers who implement GAP and sort can get much higher prices.
- Local Collectors: Local collectors have higher margins than farmers, especially if they do their own drying and can sell in large volumes. However, they also face the risk of price volatility.

2.3 Cost-Benefit Ratio (CBR), Productivity and Financial Analysis

The summary of calculation of CBR for each actor is as follows:

Table 3 Summary of coffee CBR calculation

No	Actor	Total Cost (per kg)	Benefit (Revenue per kg)	CBR
1	Farmer	Rp. 2,000	Rp. 11,000	5.5
2	Collector	Rp. 8,000	Rp. 56,000	7.0
3	Off taker	Rp. 61,000	Rp. 90,000	1.5
4	Roaster	Rp. 100,000	Rp. 180,000	1.8

Note: Since the CBR calculation is greater than 1 (CBR > 1), than the coffee commodity in the business perspective is actually a viable business, for detailed calculation see Annex 1

2.3.1 Calculations

Farmers' Cost (Jolotigo Village & Silurah Village):

- Seeds: Most farmers use local seeds that are not purchased. However, there are farmers in Silurah who buy seeds from nursery for IDR 4,000/polybag.

- Fertilizer: 150 kg fertilizer/year (Jolotigo). 100 kg urea fertilizer/hectare (Silurah) for IDR 450,000.
- Pesticides/Herbicides: IDR 20,000 (Silurah). Herbicide use in Jolotigo.
- Labor: Jolotigo farmers generally work by themselves. Silurah farmers use laborers: 2 people for 2 weeks for 0.25 ha with a salary of IDR 100,000/day. If 2 people x 14 days x IDR 100,000 = IDR 2,800,000 for 0.25 ha, then the labor cost is very high. Assuming a land area of 0.25 ha.
- Land Lease scheme (in Jolotigo):
    - Category A = IDR 600,000,
    - Category B = IDR 400,000,
    - Category C = IDR 200,000.

Farmers' Benefits

- Coffee Sales Income: Varies from 200 kg to 1 ton (Jolotigo).
- Average yield 0.5 kg wet coffee per tree (in Silurah). Farmers with premium seedlings could obtain up to 5 kg per tree.

Local Collector's Cost Component

- Working Capital needed: IDR 200,000,000.
- Drying Cost: IDR 750,000/ton.
- Transportation Cost to Drying Location: IDR 100,000/ton.
- Interest Loan: some collector borrowed money from the bank for working capital.

Collectors' Benefit

- Turnover per Month: Average 25 tons.
- Price Difference Profit: Around IDR 2,500/kg.
- Potential Profits from Farmer Loans: one collector (Mr. BC) provides interest-free loans to farmers to build trust and ensure supply.

2.3.2 Analyses

- Income from coffee sales (wet or dry),
- Potential income from coffee waste.
- For most, coffee is a pretty decent side income as an addition to farmer's main income from other activities.
- Benefits gained are often considered secondary source of income only
- Lack of knowledge about efficient agricultural practices (GAP) also limits potential benefits.
- Input costs (fertilizer, pesticides/herbicides).
- Labor costs (if using laborers).
- Opportunity cost of time and energy spent on coffee (considering other primary work).
- "Cost" of PERHUTANI land profit sharing (40% of results).
- With high land profit sharing and selling prices determined by collectors, and lack of maintenance leading to low productivity, the Benefit Cost Ratio for most farmers is likely low, especially when compared to its potential. Farmers who implement GAP (such as the 2 farmers in Silurah) show a higher B/C ratio due to better productivity and selling prices.

- With large turnover and a decent price difference, the collector's B/C ratio is likely quite attractive, despite facing price risks. Collector's ability to manage working capital and build trust with farmers is the key to success. The ratio is more profitable due to the larger scale of the business and the ability to manage post-harvest processes (drying). However, large working capital costs and the risk of price fluctuations need to be taken into account

2.3.3 Productivity

Table 4 Coffee productivity indicators and value

Indicator	Value
Average trees/ha	1,100 trees (3×3 m planting distance)
Actual results/tree	0.5–1 kg dry
Actual yield/ha	±700–1,100 kg/ha
Optimum Target	2,500–3,000 kg/ha
Average selling price	Rp 54,000–63,000/kg dry
Farmer Income/ha	Rp 59–69 million
Farmer Cost/ha	±Rp 10 million
Farmer Profit/ha	±Rp 50–60 million
BEP Farmer	±185 kg
RC Ratio	±6.0
BC Ratio	±5.5 (6)

Figure 4 Coffee plantations

2.4 SWOT Analysis

Table 5 Coffee SWOT analysis

Strengths	Opportunities
• Suitable agro-climate support Suitable environment: Highland areas (300-1200 masl) • Long tradition of coffee (agri "culture") • Local seeds are free and easily accessible.	• Specialty coffee trend (potential for branding), E-commerce and agro-tourism • Implementation of GAP and use of superior seeds can significantly increase crop yields • Jolotigo coffee's claim to be natural because it does not use chemical

• The existence of strong "trust" between farmers and local collectors • Coffee waste can be used as cattle feed, showing potential by product income	fertilizers could be a selling point if it is certified organic • Utilization of coffee waste for cattle feed shows potential for diversification and increased income.
Weaknesses	Threats
• GAP/GHP not implemented • Low Coffee Quality: Lack of grading • Dependence on Perhutani Land, with a 40:60 profit-sharing scheme that is perceived as detrimental to farmers • No cooperatives - Limited institutional setup and financial literacy • Yield per tree is below optimal (0.5-3 kg wet/tree vs 3-5 kg green bean/ideal tree).	• Climate change, root rot fungus (Armillaria and Rigidoporus Fungi), stem borer insect (Zeuzera Coffeae) • Volatile and non-transparent prices • Unpredictable weather, high humidity, and sporadic rainfall threaten the quality of the harvest (mushrooms) and prolong the drying process. • There is also a risk of landslides.

2.4.1 Strengths

- Suitable environment: Highland areas (300-1200 mdpl) with high rainfall throughout the year, support the cultivation of Robusta coffee.
- Coffee has been cultivated for many years (25 years) and the knowledge has been passed down from generation to generation.
- Local seeds are free and easily accessible.
- The existence of strong "trust" between farmers and local collectors facilitates transactions and loans.
- Several farmers who innovated by purchasing superior seeds and implementing GAP showed much better harvest results (5 kg/tree vs 0.5-2-3 kg/tree) and higher selling prices (IDR 90,000/kg).
- Coffee waste can be used as cattle feed, showing potential circular economy.
- There is a desire for further processing (coffee powder) at the farmer level.
- Jolotigo coffee is considered natural because it does not use chemical fertilizers.

2.4.2 Weaknesses

- Dependence on Perhutani Land: The majority of land in the Perhutani forest area, with a 40:60 profit-sharing scheme that is detrimental to farmers in Jolotigo. This results in limited landownership and control.
- Lack of Knowledge & Training: Farmers have not implemented Good Agricultural Practices (GAP) and Good Handling Practices (GHP). Knowledge is only autodidactic/hereditary.
- Lack of understanding of quality seeds, good cutting techniques, post-harvest sorting, and agribusiness aspects.
- Low Productivity: Yield per tree is below optimal (0.5-3 kg wet per tree vs 3-5 kg green bean per ideal tree).
- Poor Post-Harvest Handling: Drying in the open is prone to contamination and is highly dependent on the weather. There is no grading.

- Collector Dependence: Selling prices are set by collectors. Farmers often borrow from collectors or middlemen, locking them into certain sales channels.
- Working Capital & Consumptive Loans: Farmers borrow a lot for consumptive needs, not agricultural capital. Financial literacy is minimal.
- Pests & Diseases: Susceptible to root fungus (which causes plant death) and stem borer insects. Lack of care exacerbates these problems.
- Weak Institutions: There are no solid coffee farmer groups in Jolotigo, hampering advocacy and collaboration.
- Lack of Innovation: Most farmers have not attempted significant product diversification or further processing.
- Information Limitations: It is difficult to obtain accurate data on land area and estimated harvest yields from farmers.
- Jolotigo coffee currently has a mediocre reputation among consumers.

2.4.3 Opportunities

- Increased Productivity: Implementation of GAP and use of superior seeds can significantly increase crop yields.
- Post-Harvest Processing: The demand for modern drying facilities (drying machines, greenhouses) and sorting machines is an opportunity to improve quality and selling value.
- Increasing Added Value: The desire of farmers to process coffee into finished products (coffee powder) is an opportunity to increase profit margins at the farmer level.
- Institutional Support: The formation of solid farmer groups will strengthen farmers' bargaining position, facilitate training, and access to government programs.
- Income Diversification: Utilization of coffee waste for cattle feed shows potential for diversification and increased income.
- Access to Finance: Potential for financial institutions to create products that suit farmers' cash flow due to low credit risk (for middlemen).
- Improving Financial Literacy: Having a basic understanding of financial products can be the basis for more in-depth financial literacy training.
- Specialty Coffee Market: If coffee quality can be improved through GAP and GHP, there is an opportunity to enter the specialty coffee market at a premium price.
- Organic Coffee: Jolotigo coffee's claim to be natural because it does not use chemical fertilizers could be a selling point if it is certified organic.
- Land Policy Improvement: The proposed change from profit-sharing to land lease scheme is an opportunity to increase farmers' income and business certainty.

2.4.4 Threats

- Climate Change: Unpredictable weather, high humidity, and sporadic rainfall threaten the quality of the harvest (mushrooms) and prolong the drying process. There is also a risk of landslides.
- Pests & Diseases: Deadly root fungus diseases (rigidoporus and armillaria) and stemborer insects are serious threats for which there is no effective solution. Monkey attacks are also a pest.
- Market Price Dependence: Farmers and collectors are "price takers", vulnerable to global and regional coffee price volatility.
- Unsustainable Farming Practices: Excessive use of herbicides can damage soil fertility.
- Knowledge Gap: Lack of knowledge transfer from extension workers to farmers.

- Low Coffee Quality: Lack of grading and poor post-harvest handling leads to contaminated coffee beans, resulting in mediocre quality and low prices.
- Dependence on Consumptive Loans: The cycle of consumptive loans can trap farmers in debt and limit their ability to invest in agriculture.
- Lack of Communal Forum: The absence of farmer groups in Jolotigo hampers advocacy and the delivery of aspirations.

2.5 Benchmarking Analysis

Table 6 Coffee benchmark analysis

Location	Average Yield	Practice
Farmers in Jolotigo & Silurah	±700–1,000 kg/ha (actual conditions)	No GAP, local seeds
Farmers with GAP in Silurah (2 farmers, local champion in coffee)	±3,000–5,000 kg/ha	Use high quality seeds, regular plant treatment, clean post-harvest (Good GHP
Industry Benchmark (Global)	±2,500–3,500 kg/ha	GAP, regular fertilization, closed dryer

Benchmark shows three-fold potential yield, if GAP practices and GHP as well as post-harvest practice are implemented, 2 (two) farmers could perform excellently beyond global average yield, as they are well trained and full well knowledgeable in coffee plantation (former regional champion in coffee competition)

2.5.1 Farmers' Productivity

- Jolotigo: 2-3 kg wet beans per tree, or 200kg - 1 ton harvest per season.
- Silurah: Average 0.5 kg wet seeds per tree.
- Benchmarking (optimal): it was stated that 1 coffee tree should produce 3 kg of green beans. Meanwhile, there are also farmers in Silurah who buy quality seeds from nursery, and they can produce 5 kg/tree.

Farmer productivity in Jolotigo and Silurah is far below optimal potential. Farmers who invested in superior seeds and training (GAP) showed drastic improvements. This indicates that current farming practices (local seeds, lack of maintenance, no GAP) are the main limiting factors.

2.5.2 Farmers' Selling Price

- Jolotigo: IDR 11,000 (wet), IDR 54,000 (dry).
- Silurah: IDR 10,000 (wet), IDR 51,000 (dry 13% MC). And if they could process to the level of Grad A, then the price would reach amounting ti IDR 90,000.
- The highest green bean price is IDR 56,000/kg. Generally, the price of green beans is four times higher than wet beans.
- Currently: Roadside/yard drying, prone to contamination, long time during rain.
- Analysis: Farmers' post-harvest processes are far from good standards, affecting final quality and price. The need for better drying facilities is urgent.

The selling price of ordinary farmers is lower than the highest price of green beans obtained by collectors. Farmers who are able to produce Grade A can fetch a much higher price, indicating the potential for increased value through grading and quality control.

2.6 Institutional Analysis

Table 7 Coffee institutional analysis

Institution	Status	Function	Weakness
Farmers Group	Not active	GAP facilitation, marketing channel/information	Not running
Forestry (PERHUTANI)	Landowner	Providing land access	Profit sharing is not flexible
Local Collector	Active	Informal credit provider & coffee aggregation	One-way scheme, monopolistic
Department of Agriculture (Dinas)	One-time interaction	SLPHT training in the beginning	Not sustainable

- Coffee Farmers:
  - Status: Individual or family farmer. In Silurah, most are members of LMDH (*Lembaga Masyarakat Desa Hutan*) "Ganesha Mulia" under the Social Forestry scheme issued by PERHUTANI.
  - Role: Major producer of coffee commodities.
  - Limitations: Lack of strong formal organizations (coffee farmer groups), resulting in a lack of communal advocacy, training, and collective access to information. Knowledge is autodidactic/hereditary.
- PERHUTANI:
  - Status: a State Owned Company (BUMN) as owner of the forest land.
  - Role: Granting permits for land use for coffee farming through profit sharing schemes (Jolotigo) or Social Forestry (Silurah).
  - Limitations: The 40:60 profit-sharing scheme in Jolotigo is considered unfair by farmers, creating a disincentive for optimal land maintenance. Farmers hope that the village government will facilitate a scheme that is more beneficial to both parties.
- Local Collectors (eg, Mr. BC):
  - Status: Individual trader.
  - Role: Connecting farmers with larger markets, providing working capital and informal loans.
  - Limitations: Vulnerable to price volatility. Relies on wholesalers as price setters. Not yet grading.
- Wholesaler (Temanggung):
  - Status: Major player at regional level.

    - Role: Accommodate large volumes of coffee from collectors, distribute to downstream processors, and determine purchase prices from collectors.
    - Limitations: There is no specific information from the document yet.
- Village Government:
    - Role: Expected to facilitate communication between farmers and PERHUTANI for better land schemes.
    - Limitations: No active role in developing the capacity of coffee farmers or institutions has been seen.
- Department of Agriculture/Field Agricultural Extension Workers (PPL):
    - Role: Organized SLPHT training (Integrated Field School for Pest Control) and suggested the formation of farmer groups.
    - Limitations: Training is rare, there is no adequate follow-up for pest problems. Not all farmers apply the knowledge from the training.
- Financial Institutions (BRI KUR / People Enterprise Credit):
    - Role: Providing formal loans (KUR) with collateral requirement.
    - Limitations: Limited access (not all farmers can access), requires collateral, and repeated loan cycles indicate farmers' ongoing financial needs. Farmers' financial literacy is still minimal.
- Currently: There is no solid coffee farmer group in Jolotigo. In Silurah there is LMDH, but it is not yet optimal as a forum for cooperation.
- PPL Recommendation: Strengthening farmer institutions through farmer groups.
- Weak farmer institutions hinder access to information, training, capital, and bargaining position in the value chain.

2.7 Stakeholder Analysis

Table 8 Coffee stakeholder analysis

Stakeholder	Primary Interest	Impact on Value Chain	Interaction
Coffee Farmer	Increased income, land security, cultivation knowledge, access to capital, quality of life.	Primary production, determining the initial quantity and quality of coffee. Low bargaining power due to fragmentation and dependence on collectors.	Selling to collectors, borrowing from middlemen/banks, interacting with PERHUTANI, hoping for village support.
PERHUTANI	Utilization of forest land, profit sharing/land rent, forest sustainability.	Majority land owners determine land use schemes that have a direct impact on farmers' income.	Formal relationship (profit sharing/rent) with farmers, there is no satisfactory facilitation for improving the scheme.

Stakeholder	Primary Interest	Impact on Value Chain	Interaction
Local Collector	Benefits from trade margins, certainty of supply, business sustainability.	Determining purchase prices from farmers, providing working capital, managing early post-harvest, distributing coffee to wholesalers.	Buy from farmers, sell to wholesalers, provide loans to farmers.
Wholesaler (Temanggung)	Advantages of volume, supply stability, product quality, downstream market access.	Determining the selling price to collectors, accommodating large volumes, setting quality standards (water content).	Buy from collectors, sell to downstream roasters/processors.
Village Government	Community welfare, local economic development, conflict mediation.	Potential as a facilitator between farmers and PERHUTANI, as well as a driver of development programs. Currently the influence is not optimal.	It is expected to be a mediator and support farmer institutions.
Department of Agriculture/PPL	Increasing agricultural productivity, implementing sustainable practices.	Provides training (rare), extension, and recommendations on agricultural practices.	Providing training, but follow-up and dissemination of information is not yet even.
Financial Institutions (Banks)	Benefits of loans, KUR distribution, increasing financial literacy.	Providing access to formal capital.	Providing loans with collateral, still lacking suitable products
NGO/Other Private Parties	(Potential) Community development, environmental sustainability, CSR, investment.	Potential as a provider of training, technology, market access, or innovative financing support. (Not much is visible from the document)	(Not many interactions have been recorded yet, but there is a chance)
End Consumer	Availability of quality coffee products,	Driving demand and preference for certain types and qualities of coffee.	Buy processed coffee products.

2.8 Policy and Regulatory Analysis

2.8.1 Social Forestry Policy (PERHUTANI)

Figure 5 Perhutani coffee plantation

Allowing farmers to work on forest land, but the 40:60 profit-sharing scheme in Jolotigo is very disadvantageous to farmers. This may reduce farmers' incentives to invest in long-term maintenance and increase productivity. The land lease scheme proposed by farmers could be a better alternative to encourage business sustainability. Social Forestry Policy opening legal access to land. However, it has not been followed up with functional institutions, and effective organization of farmers group

Recommendation

There is a need to revise the profit-sharing scheme or transition to a more transparent and fairer rental model or facilitate village governments in negotiations with PERHUTANI. This policy must support improving farmer welfare and environmental sustainability.

2.8.2 Coffee Agriculture/Trade Regulations

There is no specific information regarding regulations directly affecting coffee prices or quality. However, the lack of grading and standardization at the farmer level indicate a lack of implementation or enforcement of quality standards that could benefit farmers. The volatility of coffee prices mentioned by collectors indicates a market that is not well regulated or protected for upstream actors.

Still there are no incentives for organic coffee even though many actually farmers do not use chemical fertilizers, as the land forest is actually providing natural based fertilizers

Recommendation

The government needs to consider policies that encourage grading at the farmer level, for example through price incentives, as well as interventions to stabilize prices or protect farmers from extreme fluctuations.

2.8.3 Financial Access (BRI – KUR Credit)

BRI – KUR Credit rovides access to formal financing for farmers who qualify (have collateral). However, loans are often for consumption, not productivity.

Access to KUR is available and possible, however not yet based on coffee farming harvest cycle, and there has been no specific product tailored with the seasonal harvesting and associated cashflow of the farmers

Recommendation

There needs to be a policy that encourages more flexible financial products, adjusted to farmers' cash flow, and without land certificate guarantees. The KUR program needs to be accompanied by financial literacy to ensure funds are used productively.

2.8.4 Training and Coacing

Training from the Department of Agriculture/PPL is rare and ineffective in encouraging widespread adoption of better agricultural practices.

Recommendation

Policies that support sustainable, practical training programs followed by direct field assistance (such as the SLPHT that Mr. CD attended, but with better follow-up). Involve PPL more actively.

2.9 Gender Analysis

Jolotigo Village: Almost all coffee farming activities are carried out by men in Jolotigo Village. Meanwhile, in Silurah Village women are involved in post-harvest activities and sorting of coffee beans.

2.9.1 Jolotigo

Significant gender imbalance. Women’s minimal involvement means they miss out on potential income and access to knowledge and resources in the coffee sector. It can also limit the potential for innovation and sustainability of family businesses. Jolotigo: This can mean that women's access to resources, training, and economic benefits from coffee is limited. Women's involvement can be an untapped potential to increase efficiency and family income.

2.9.2 Silurah

The role of women in post-harvest and sorting is an asset. It shows that women already have critical skills in improving coffee quality. However, it is important to explore whether this role translates into equal control over income and decision-making. Women's involvement in post-harvest and sorting shows the existence of gender-specific roles. These roles are crucial for improving the quality of coffee (especially grading) which can result in higher selling prices. However, it is necessary to ensure whether this role also provides adequate economic control for women

2.9.3 Recommendation

- Inclusion in Jolotigo, Gender-Based Training and Resource Access: Providing specialized training for women in Jolotigo on coffee cultivation, post-harvest processing, and business management. In Silurah, focusing on advanced training for women in specialty coffee grading , roasting , and marketing.: Conducting training and programs that encourage women's involvement in coffee cultivation, plantation management, or even post-harvest processing. Identifying barriers for women to participate.
- Empowerment in Silurah: Providing specific training to women on quality control , grading , and further post-harvest processing. Ensuring women have equal access to information and benefits from improving coffee quality. Promoting women's leadership in farmer groups or post-harvest business units.
- Encouraging Women's Participation in Decision Making: Ensuring that women are involved in farmer groups or cooperatives, and have a voice in decisions regarding coffee cultivation and sales.
- Measuring Economic Impact on Women: Conduct separate evaluations to understand women's economic contributions and how income from coffee affects their family's well-being.

2.10 Sustainability and Social Impact Analysis

Table 9 Coffee sustainability and social impact analysis

Aspect	Findings	Risk
Environment	Herbicides are used, fertilizers are not applied regularly	Soil fertility decreases
Social	No cooperatives, dependence on middlemen for marketing and financial needs (mostly the collector), However since coffee has big potential some youth (students) showed interest in having job in coffee commodity.	Vulnerable to price exploitation, and debt trap
Climate	Unpredictable rain, root fungus disease	Production declines, quality of coffee is poor (lowest standard)

2.10.1 Environmental Impact

- Chemical Use: The use of pesticides for root fungi and insects, and herbicides for weeds, has the potential to damage long-term soil fertility and pollute the environment.

The use of pesticides (for root and stem borer fungi) and herbicides (for weeds) can cause soil degradation, water pollution, loss of biodiversity (non-target insects), and health risks for farmers. Although Jolotigo is said to not use chemical fertilizers, the use of pesticides/herbicides remains a concern.

- Deforestation/Perhutani Land: Coffee is planted among pine trees in forest land. Although social forestry schemes can help maintain forest cover, it is important to ensure that there is no illegal expansion of coffee plantations or practices that damage the forest.
- Climate Change: Unpredictable weather, high rainfall and humidity increase the risk of mold on plants and crops, and extend drying times. The risk of landslides was also exist.
- Waste Utilization: Coffee waste is used for cattle feed, this is a positive practice that reduces waste and shows potential.circular economy .
- Organic Coffee: Jolotigo coffee is not chemically fertilized and is still fertile, showing the potential to be developed as organic coffee.

2.10.2 Social Impact

- Farmer Welfare ➔Coffee as a side income shows a suboptimal contribution to welfare. PERHUTANI's profit-sharing scheme significantly reduces farmers' income.
- Access to Education ➔A large proportion of the population has a junior high school education, which can impact technology adoption and access to information.
- Low Financial Literacy ➔Lack of knowledge about financial products makes farmers vulnerable to consumer loans.
- Health ➔Coffee plant pests and diseases, as well as pesticide use, can impact farmers' health if good safety practices are not in place.

2.10.3 Recommendations for Environmentally Friendly Practices Aspects

Chemical Reduction

- Socialization and training on the manufacture and use of organic fertilizer.
- Introduction of more environmentally friendly Integrated Pest Management (IPM) practices, including the use of biocontrol agents or natural methods for root fungus and insect control.
- Promote manual weeding practices or use of organic mulch to reduce herbicides.
- IPM (Integrated Pest Management): Implementing a more comprehensive IPM strategy, such as the use of pest-resistant varieties, natural enemies, crop rotation, intercrop planting (e.g., the toxic cassava that one famer i.e. Mr. CD has tried), and regular pest/disease monitoring.
- Organic Fertilizer: Train farmers to make and use compost from agricultural waste (including coffee waste), manure, or green manure. This improves natural soil fertility and reduces the need for chemical fertilizers.
- Soil and Water Conservation: Implementing soil conservation practices such as contour planting, terracing, and planting shade trees to prevent erosion, especially in landslide-prone areas. Efficient water management.
- Crop Diversification: Planting shade trees other than pine that are more supportive of the coffee ecosystem (e.g. fruit trees or legumes) to increase biodiversity and soil health.

2.11 Climate Change Analysis

2.11.1 Impact of Climate Change and Weather (Pekalongan and Batang)

- Unpredictable Rainfall Pattern: "The weather is very unpredictable, and very often humid and sporadic rain" in Jolotigo. In Silurah, it rains an average of 121-133 days/year, high rainfall, 97% humidity.
- Increased Pests/Diseases: Damp weather and prolonged rain increase the risk of fungal attacks on coffee plants and beans. Root fungus has become a serious problem.
- Drying Problems: Drying coffee beans takes longer (up to 2 weeks) if the weather is rainy, which can reduce the quality of the coffee and increase the risk of mold growth on the beans.
- Landslide Risk: The mountainous terrain and high rainfall throughout the year make the area prone to landslides.

2.11.2 Climate Change Adaptation Recommendations

- Controlled Drying Facilities: Construction of solar dryers or greenhouses for drying coffee beans that are climate adaptive. Development of drying facilities that are not dependent on weather (e.g.solar dryer or greenhouse dryer).
- Climate-Resistant Varieties: Planting coffee varieties that are more resistant to humid conditions and fungus. Encourage the planting of Robusta coffee varieties that are more tolerant of high humidity and resistant to fungal diseases.
- Early Warning System: Provides accurate weather information and early warnings to farmers regarding the risks of extreme weather (heavy rain, high humidity) so they can mitigate.
- Agroforestry: Developing stronger agroforestry systems by planting diverse shade trees to regulate humidity, temperature, and protect coffee plants from strong winds, as well as prevent erosion.
- Educate farmers about water management and soil conservation practices to reduce landslide risk.
- Organic/Sustainable Certification: Consider organic certification or other sustainability standards for “natural” Jolotigo coffee, to gain premium pricing and wider market access.
- Waste Management: Further developing the potential for processing coffee waste for animal feed or compost.

2.12 Land Status and Risk Analysis

2.12.1 Current Land Status

- The majority of coffee farming land in Jolotigo and Silurah is in forest areas owned by PERHUTANI.
- In Jolotigo, there is a profit-sharing agreement with a proportion of 40:60 (40% of the harvest is handed over to PERHUTANI).

- In Silurah, there is a Social Forestry contract valid until 2030 for 350 families with a contract land area of 169.90 ha.
- Coffee is planted randomly among pine trees, resulting in a fairly high level of shade.
- Some farmers in Jolotigo have private land for other commodities. Some in Silurah also have private coffee land.

2.12.2 Possible Risks Arising from Land Status

- Tenure Insecurity: Farmers do not have title deeds to the land they farm, creating long-term uncertainty and reducing incentives for major investments in land improvements or infrastructure.
- Investment Disincentives: Jolotigo's 40:60 profit-sharing scheme is very disadvantageous to farmers, reducing their incentive to perform optimal maintenance, fertilization, or rehabilitation of crops. Why invest if most of the proceeds must be given away?
- Limited Access to Finance: The absence of land title certificates as collateral limits farmers' access to formal loans from banks (except for KUR which may have different policies with other collateral). This encourages dependence on collectors/middlemen.
- Poor Forest Management: Random planting of coffee among pines without proper management can disrupt the forest ecosystem or the productivity of the coffee itself (excessive shading).
- Land Conflict: Potential conflict between farmers and PERHUTANI if there are changes in policy or enforcement of regulations.
- Weak Legal Protection: Farmers' position becomes weak when facing disputes or changes in land policy.

2.12.3 Recommendations for Land Status

- Revised Revenue Sharing/Rent Scheme: Encourage dialogue between farmers, Village Government, and PERHUTANI to revise the revenue sharing scheme into a fairer and more transparent land lease. The lease scheme can be based on land with fixed payments, providing income certainty for farmers.
- Extension of Social Forestry Contracts: Ensure that Social Forestry contracts have an adequate duration (more than 10 years) to provide long-term business certainty for farmers.
- Providing Access to Loans Without Land Collateral: Financial institutions need to develop loan products that do not require land certificates as collateral but instead use harvest patterns or farmer track records as the basis for credit assessment, as collectors have done with trust .
- Better Land Management: More systematically managing the spacing of coffee plants and shading trees to optimize coffee productivity and maintain forest health.

2.13 Financial Literacy

2.13.1 Present condition

- Most farmers understand the existence of financial products from financial institutions and have even borrowed (banks/leasing for motor vehicles).

- However, their knowledge of financial products and financial literacy is still very minimal.
- Loans obtained by farmers tend to be consumptive, not for agricultural capital. This shows a lack of understanding of business financial management.
- Farmers have loans from middlemen, paid at harvest time with deductions outstanding loans. This relationship is based on trust. Low, even though they have accessed KUR and leasing, no knowledge of various financial products
- There is no recording of costs and cash flow management/activities

2.13.2 Analysis

- The low level of financial literacy among farmers is a major obstacle. Although there is access to formal loans (*Kredit Usaha Rakyat* -KUR), their use is not optimal for business development. Dependence on consumer loans and middlemen shows the urgent need for financial education.
- Collectors who also borrow from banks for working capital may have better financial literacy, but there are still risks in managing price volatility.

2.13.3 Recommendation

- Financial Education Program: Financial literacy training tailored for farmers, including household and business budget planning, separation of personal and business finances, management of productive vs. consumptive debt, understanding savings products, agricultural insurance, and working capital loans.
- Appropriate Financial Products: Encourage financial institutions (banks, cooperatives) to develop more flexible financing products, in line with the coffee harvest cycle, and with lighter requirements (for example without land certificate collateral or using crop pledges).
- Building Village Microfinance Institutions: Establishing or strengthening BUMDes (*Badan Usaha Milik Desa)* or savings and loan cooperatives at the village level to facilitate farmers' access to capital with easier terms and financial guidance.

2.14 Market System Development (MSD) Framework

Table 10 MSD analysis

	Actor	Constraint	Potential Solutions
Core Function	Farmers, collectors	Low GAP and GHP, dependency relationship (farmers-collector)	Training, cooperatives
Supporting Function	BRI, extension services, inputs shop,	Incorrect scheme, not proper inputs (seeds	Tailored microcredit products, cooperation

	Actor	Constraint	Potential Solutions
	Nurseries, Inputs Companies	do not suit with season, improper use of fertilizer and pesticide/herbicide	between inputs providers and farmers, demonstration plots
Enabling Environment	Forestry Company, Village Government, Regency Government	Rigid profit sharing, no advocacy, no regular capacity building for farmers	Negotiation of lease scheme, legalization of group, training, farmer field school

2.14.1 Obstacles Faced in Market System Development:

1. Knowledge & Skills Gap: Lack of adoption of GAP/GHP, knowledge of superior seeds, pest/disease management, and agribusiness aspects at the farmer level.
2. Capital Access & Financial Literacy: Consumer loans dominate, financial products do not match farmers' cash flow , and financial literacy is minimal. Collectors are also constrained by working capital.
3. Weak Institutions: The absence of strong coffee farmer groups hampers collectivity, advocacy, and program access.
4. Land Status & Profit Sharing: PERHUTANI's profit sharing scheme is not profitable for farmers.
5. Post-Harvest Infrastructure: Limited drying facilities and basic processing machinery at the farmer level.
6. Price Volatility: Unpredictable price risks impact profitability across the value chain.
7. Impact of Climate Change: Increased pests/diseases and drying difficulties due to extreme weather.

2.14.2 Market System Development Recommendations

Key Factors and Potential Success of Each Actor:

- Farmer:
  - Key Factors: Willingness to learn and adopt new technologies, access to practical training, access to superior seeds, and improvement of land schemes.
  - Potential for Success: Dramatic productivity increases, improved coffee quality, and potential entry into the specialty coffee market.
- Local Collector:
  - Key Factors: Adequate working capital, strong market links to wholesalers, price risk mitigation capabilities (e.g. contracts with wholesalers), and fair business practices (interest-free loans) to maintain farmer confidence.
  - Potential for Success: Larger business scale, becoming an efficient primary collection and processing center, and potential investment in post-harvest facilities.
- Wholesaler:

- Key Factors: Extensive market network, efficient logistics and storage capacity, and the ability to predict and manage market price risks.
- Potential for Success: Control the supply chain and become a dominant player at the regional level.

2.15 Closed Loop System Strategy

2.15.1 Identification of Value Chain Actors and Institutions

Value Chain Actors Involved

1. Coffee Farmers: Primary producers.
2. Local Collectors: Linking farmers to larger markets, informal capital providers.
3. Regional Wholesaler/Offtaker: Buyer of coffee from collectors, price setter at regional level.
4. Coffee Roaster/Processor: Processing green beans into ready-to-consume products (not explicitly mentioned in Pekalongan, but concluded as a link after wholesalers).
5. End Consumer: Buyer of finished coffee products.

Value Chain Institutions Involved (Supporting Functions & Enabling Environment)

1. PERHUTANI: Owner of the forest land where most of the coffee is grown.
2. Village Government: Has the potential to act as a facilitator between farmers and PERHUTANI.
3. Department of Agriculture/Field Agricultural Extension Workers (PPL): Have provided training, but rarely.
4. Financial Institutions (Banks, for example BRI): Formal loan providers (KUR).
5. Middlemen (Informal): Apart from Mr. BC collectors, there are also other middlemen who provide loans.
6. Ganesha Mulia Forest Village Community Institution (LMDH) (Silurah): Farmer group under the Social Forestry scheme.

Potential Involvement of Other Actors in the Value Chain for Closed-Loop Systems

1. Agricultural Training/Education Center: To provide GAP, GHP, and agribusiness training on an ongoing basis.
2. Research Institute/University: For research on pest/disease resistant coffee varieties, development of organic fertilizers, and post-harvest technology.
3. Agricultural Technology Manufacturers: Providers of affordable dryers, pulpers , graders , or simple processing equipment.
4. Certification Providers (Organic/Fair Trade): To help farmers gain added value from sustainable/organic coffee.
5. Roastery/Specialty Coffee Company: Direct partnership with farmers/farmer groups to source high quality green beans at premium prices, cutting the chain.
6. E-commerce/Logistics Platform: To help farmers/farmer groups market processed coffee products directly to consumers.
7. Civil Society Organizations (NGOs) Environment/Development Focus: To support sustainable agricultural practices and strengthening farmer institutions.

8. Microfinance Service Providers (non-bank): To provide more flexible loan products that suit farmers' cash flow without burdensome collateral.

2.15.2 Closed Loop System Model for Jolotigo Coffee

The closed-loop system focuses on creating a self-sustaining and transparent value chain, minimizing risks and maximizing shared value for all actors.

1. Legal and Inclusive Coffee Farmer Cooperatives:
    - Function: Farmers organize into legally recognized cooperatives that act as central hubs for input procurement, knowledge sharing (GAP/GHP), collective processing (drying, initial grading), and collective marketing. These cooperatives provide a unified voice for farmers.
    - Role in Closed Loop: Reduces farmer vulnerability to individual middlemen, strengthens bargaining power, and provides a formal entity for external partnerships and financial access.
2. Long-Term Purchase Contracts with Permanent Off-takers and Roasters/Exporters:
    - Function: Cooperatives enter into direct, long-term contracts with regional offtakers, roasters, or even direct exporters. These contracts specify quality standards, delivery schedules, and price mechanisms (e.g., fixed-price plus fixed-margin to minimize speculative risk for collectors).
    - Role in Closed Loop: Ensures stable demand and price certainty for farmers and collectors, allowing for better planning and investment. Provides consistent supply for buyers.
3. Productive Credit Flows through Cooperatives Based on Harvest Results (Result-Based Lending):
    - Function: Financial institutions (like BRI) provide productive loans to the cooperatives, with repayment structured based on the actual coffee harvest yields and sales contracts. These loans can be used by the cooperative to provide advances to farmers for inputs or living expenses.
    - Role in Closed Loop: Addresses the working capital needs of both farmers and collectors without predatory interest rates or delayed payments. The revenue from the harvest, secured by contracts, directly repays the loans, creating a self-reinforcing financial cycle.
4. Digital Recording and Traceability (via Simple Application):
    - Function: Implement a simple digital system (e.g., a mobile application) for recording coffee production data (yields, costs, quality), sales transactions, and loan repayments at the cooperative level. This enables traceability from farm to final buyer.
    - Role in Closed Loop: Increases transparency, improves data for business planning and financial analysis, and supports quality control and certification efforts. Builds trust across the value chain.
5. Certification and Branding of Origin Coffee:
    - Function: Work towards certifications (e.g., organic, fair trade if applicable) and develop a distinct "Jolotigo Coffee" brand identity. This highlights the natural cultivation methods and unique origin.
    - Role in Closed Loop: Unlocks access to premium specialty coffee markets, increasing revenue for farmers and other actors, and provides an incentive for adherence to quality and sustainable practices.
6. Continuous Government and NGO Intervention (Quality, Market, and Institutional Development):

- Function: Government (Department of Agriculture, Village Government) and NGOs play ongoing roles in providing technical training, facilitating policy changes (e.g., land lease with Perhutani), linking farmers to markets, and strengthening cooperative governance.
- Role in Closed Loop: Provides a continuous feedback loop and adaptive management to address emerging challenges (e.g., climate change impacts, new pests) and ensure the long-term sustainability and inclusiveness of the system.

2.15.3 Closed-Loop System Development Strategy Recommendations:

Closed-loop systems in the context of coffee refer to approaches that minimize waste and maximize value from each stage, often with an emphasis on sustainability and circularity.

1. Development of Joint Processing Units (Farmers):
   - **Core Value Chain Function**: Farmers can form cooperatives or joint business groups to own and operate post-harvest facilities (pulper machines , drying machines, hulling machines , grading).
   - **Supporting Function**: NGO/Government involvement to facilitate grants of equipment or easy access to financing. Intensive training on good handling practices (GHP).
   - **Enabling Environment**: Village Government facilitates land or permits for facility construction. Incentive policies for high quality coffee products.
   - **Closed-Loop**: Pulp waste from the pulper process can be processed into organic fertilizer or animal feed. This reduces waste and provides input for agriculture.
2. Value Added Products at Farmer/Farmer Group Level:
   - **Core Value Chain Function**: Farmer groups are trained to roast , grind , and package ground coffee/roasted beans.
   - **Supporting Function:** Digital marketing training (e-commerce, social media) to sell directly to consumers. Partnership with local coffee startups or roasteries .
   - **Enabling Environment**: Local government support for local product promotion, facilitation of PIRT (Home Industry Production) licensing.
   - **Closed-Loop**: Significantly increases farmer margins, reduces dependence on collectors and wholesalers, and builds local brands . Waste from the process (e.g. skins) can be used as fuel or compost.
3. Integrated Pest and Disease Management & Organic Farming:
   - **Core Value Chain Function**: Farmers are trained on pest/disease identification, natural prevention methods, and the manufacture/use of organic fertilizers and biopesticides.
   - **Supporting Function**: Agronomists or researchers from universities/research institutions provide training and assistance.
   - **Enabling Environment**: Subsidy policy for organic inputs, certification of local organic coffee.
   - **Closed-Loop**: Reduces reliance on hazardous chemicals, maintains soil health, improves environmental quality, and potentially earns a premium price for organic coffee. Plant residues that die from disease can be properly treated to prevent infection.
4. Market Information System & Partnership Contract:

- **Core Value Chain Function**: Farmers/farmer groups have access to real-time coffee market price information . Collectors can enter into long-term contracts with farmers at more transparent prices.
- **Supporting Function**: Digital platform for pricing information. Facilitator for contract negotiation.
- **Enabling Environment:** Regulation that encourages price transparency and fair business practices.
- **Closed-Loop:** Reducing price uncertainty for farmers, increasing trust, and creating more stable business relationships.

Figure 6 Coffee beans

2.16 Strategic recommendations

2.16.1 Comprehensive Business Model for Jolotigo Coffee

This business model aims to transform the traditional coffee farming practices in Jolotigo into a sustainable, profitable, and inclusive system by integrating all actors within the Market System Development (MSD) framework.

Core Value Chain Enhancement

- Farmers (Strengthening Productivity & Practices):
  - GAP (Good Agricultural Practices) and GHP (Good Handling Practices) Training: Implement intensive, cluster-based mentoring programs to improve cultivation techniques (e.g., proper fertilization, pruning, pest management for root rot fungus), increase yield (targeting 2,500–3,000 kg/ha), and enhance post-harvest handling (e.g., proper drying methods to avoid contamination).
  - Institutional Assistance & Cooperative Formation: Facilitate the formation of legal and functional coffee farmer cooperatives or farmer groups. These groups will serve as advocacy forums, collective bargaining units, and platforms for knowledge sharing and input procurement.
  - Seed & Grafting Techniques: Promote the use of superior seeds and grafting techniques from nurseries, moving away from local wild varieties.
  - Shared Infrastructure: Develop and facilitate access to shared drying houses (e.g., solar dryers or greenhouse drying domes) and initial processing facilities to improve coffee quality and reduce post-harvest losses.
- Collectors (Risk Mitigation & Fair Trade):
  - Fixed Partnership Scheme: Encourage collectors (like Mr. BC) to adopt fixed partnership schemes with farmer cooperatives and regional offtakers/roasters, moving away from speculative, volatile pricing to a fixed-margin approach.
  - Access to Working Capital: Facilitate collectors' access to formal bank working capital financing (e.g., via productive credit) to ensure cash payments to farmers at harvest, reducing delayed payments and reliance on informal high-interest loans.
- Offtakers & Roasters (Direct Sourcing & Quality Control):
  - Direct Partnership Contracts: Establish direct, long-term purchase contracts between regional offtakers and roasters/MSMEs with farmer cooperatives. This ensures consistent supply for buyers and stable demand/fair prices for farmers.
  - Quality Training: Provide training in grading and cupping for roasters and potentially for cooperative members to understand quality requirements and market standards.
  - Brand Jolotigo Coffee: Invest in consumer education about the origin of Jolotigo coffee to achieve premium pricing for specialty markets.

Supporting Functions (Enabling Growth)

- Financial Institutions (Tailored Financing):
  - Results/Harvest Yield-Based Microcredit: Develop and disburse productive financing schemes (e.g., microcredit from BRI) that are based on harvest results and contractual agreements, rather than solely on collateral or

consumptive needs. This aligns financing with agricultural productivity and cash flow.
    - Financial Literacy for Farmers (especially women): Conduct training on basic financial literacy, cost recording, cash flow management, and responsible loan utilization, ensuring that loans are used for productive farming activities.
- Agricultural Extension Workers (Sustainable Mentoring):
    - Intensive Mentoring Programs: Implement intensive, cluster-based mentoring programs for coffee farming, ensuring that GAP and GHP knowledge is consistently applied and adapted to local conditions (e.g., addressing root rot fungus).
    - Facilitation & Problem-Solving: Empower extension workers to act as facilitators between farmers and other stakeholders, helping to solve technical and market-related problems.
- Input Suppliers:
    - Access to Superior Inputs: Ensure farmers have accessible and affordable access to superior seeds, appropriate organic fertilizers (given the low use of chemicals), and biofungicides/natural pesticides.

Enabling Environment (Creating Conducive Conditions)

- Village Government (Mediation & Advocacy):
    - Land Lease Advocacy: Mediate and advocate for a more flexible and beneficial land lease scheme with PERHUTANI, shifting from a profit-sharing model to a land rental system based on area (e.g., Category A, B, C) to provide more certainty for farmers.
    - Legality of Farmer Groups: Facilitate the legal establishment and recognition of farmer groups and cooperatives, providing them with a formal platform for operations and advocacy.
- PERHUTANI (Land Partner):
    - Flexible Land Use Schemes: Collaborate on developing more flexible and mutually beneficial land use agreements that support sustainable coffee cultivation and farmer livelihoods, moving beyond rigid profit-sharing.
    - Issuance of Non-Timber Product (***Hasil Hutan Bukan Kayu/HHBK)*** Certificate for coffee farmers
- Department of Agriculture (Policy & Support):
    - Policy Support: Develop policies that incentivize organic coffee or agroforestry and provide grants for post-harvest equipment and business credit specific to coffee.
    - Sustainable Training: Ensure that training programs on coffee farming skills and post-harvest handling are sustainable and consistently available.
- NGOs/LSMs (Capacity Building & Research):
    - Training & Research: Partner with NGOs to provide specialized training (e.g., advanced post-harvest skills for women, organic farming techniques) and conduct research on effective solutions for pests and diseases like root rot fungus.

2.16.2 Specific Recommendations for Improvement for Coffee Farmers

Knowledge & Skills Enhancement (Human Capital)

- Comprehensive GAP & GHP Training: Covers the selection of superior seeds (such as those purchased from nurseries that produce 5 kg/tree), cultivation

techniques (optimal planting distance, pruning, correct fertilization, effective cutting techniques), identification and control of pests/diseases organically, and post-harvest handling (picking ripe fruit,grading , correct wet/dry process). Training must be practical, ongoing, and accompanied by PPL regularly.
    - Agribusiness & Financial Literacy: Training to calculate costs and income, working capital management, financial planning, and understanding formal financial products.
2. Strengthening Farmer Institutions:
    - Establishment/Reactivation of Coffee Farmer Groups: Facilitate the establishment of active coffee farmer groups in Jolotigo and strengthen LMDH in Silurah. These groups will be a forum for sharing information, collective advocacy (especially related to PERHUTANI land), collective purchasing of inputs (fertilizers, pesticides, seeds), and sale of harvests.
    - Cooperative/Village-Owned Enterprise Development: Encourage the establishment of cooperatives or Village-Owned Enterprises (BUMDes) that focus on coffee to manage post-harvest facilities and process value-added products.
3. Post-Harvest Facilities & Infrastructure Improvement:
    - Drying Machine Facilitation: Assistance or subsidies for the procurement of solar dryers or faster and more hygienic coffee bean drying machines, especially to overcome humid and rainy weather.
    - Sorting & Milling Machines: Procurement of coffee bean pulper and sorting machines to improve quality and selling price.
4. Product Diversification & Value Added Enhancement:
    - Roasting & Grinding Training: Support for farmers who want to process coffee beans into powder or roasted beans, including training in correct roasting and grinding techniques.
    - Marketing Support: Assisting farmers in developing branding , packaging , and marketing channels (e.g. local e-commerce platforms , partnerships with cafes/shops) for processed coffee products.
5. Land Scheme Improvement with PERHUTANI:
    - Land Lease Scheme Advocacy: Farmer groups, facilitated by the Village Government, must actively advocate for changes in the profit-sharing scheme to a more transparent and profitable land lease scheme for farmers. This will provide business certainty and more incentives for farmers to invest in their land.

3 Value Chain Analysis for Carrot Commodity in Simego Village, Petungkriyono District, Pekalongan Regency

This chapter is an in-depth analysis of the Carrot commodity value chain in Simego Village, Petungkriyono District, Pekalongan Regency. The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various source). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

This analysis examines the carrot commodity value chain in Simego Village, Petungkriyono District, Pekalongan Regency, incorporating information from the FGD session held in Simego Village and secondary sources and other references.

3.1 Value Chain Stream Mapping

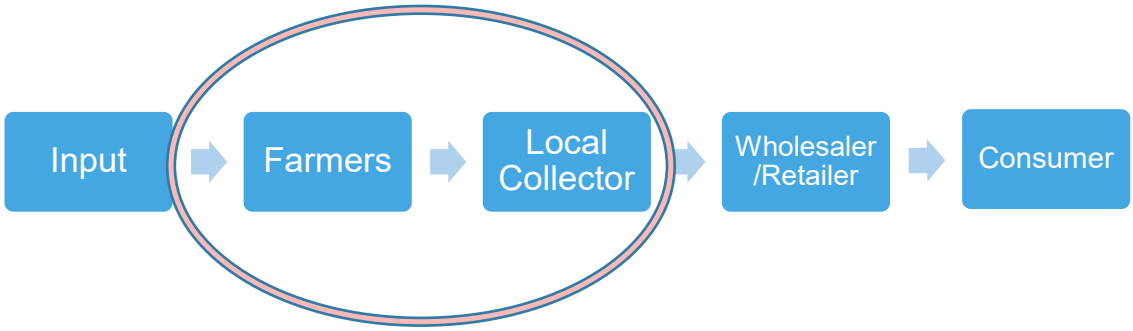


Figure 7 Carrot value chain stream mapping

Note: actors circled are those only present in Simego Village

Actors involved in the carrot supply chain:

- Input Suppliers: Fertilizer, pesticide, seed vendors (private shops, PT PBM, government programs)
- Farmers: Main producers; average landholding: 1.5 ha
- Collectors: 6 known in Simego; purchase carrots directly from farms
- Wholesalers/Retailers: Located in urban centers
- Consumers: Local/regional households, food processors

The carrot value chain in Simego Village primarily involves farmers, collectors, and ultimately, consumers. Supporting actors include input suppliers (agricultural shops), and previously, a private community company (PT Petung Bumi Makmur).

3.1.1 Flow of Commodities

1. Input Acquisition: Farmers obtain seeds (initially free from PT PBM, now self-sourced from previous program distribution), chemical fertilizers (urea, ponska, NPK, KCL) from agricultural shops, manure from local farmer shops, herbicides, additional fertilizers (Gandasil), and insecticides. During the dry season, fuel for water pumps is also acquired.
2. Cultivation (Farmers):
    - Land preparation: Cultivation, field beds making (40 cm x 80 cm), chemical herbicide spraying.
    - Planting: Currently, farmers randomly spread seeds, deviating from/not following GAP.
    - Fertilization: Manure applied (100 sacks/hectare), chemical fertilizers used. Additional fertilizer (Gandasil) is used twice to stimulate fruit growth.
    - Pest and Disease Control: Insecticides sprayed for caterpillars and mole crickets.
    - Watering: During the dry season, water is sprayed using pump machines.
    - Crop Rotation: After harvest, farmers rotate with leeks or potatoes to maintain soil fertility and reduce pest/disease risk.
3. Harvesting: Carrots are harvested approximately 4 months after planting.
4. Sales (Farmers to Collectors): Carrots are sold to collectors using a "slashing/wholesale" system *(sistem Tebasan)*, where harvest costs are transferred to collectors. There are 6 carrot collectors in Simego village.
5. Distribution (Collectors to Consumers): Collectors purchase large quantities (1800 kg to 3000 kg per day) and distribute them to consumers, likely through wholesale markets or direct sales channels outside the village.
6. Waste Utilization: Carrot plant waste is used as animal feed.

The value chain of carrot commodities in Simego Village begins with the farmers who cultivate Berastagi type carrots. These farmers acquire various inputs such as seeds, manure from local shops, and chemical fertilizers (urea, ponska, NPK, KCL) from agricultural shops. They prepare the land, plant (currently by random spreading or broadcasting), fertilize, manage pests, and water the plants. After a 4-month cycle, the harvested carrots are sold to local collectors through a "slashing/wholesale" system *(Sistem Tebasan)*, where collectors would assume harvest costs. These collectors then distribute the carrots to consumers in various markets (implied, not specifically mentioned during FGD). Supporting actors include PT Petung Bumi Makmur (previously initiating the program and providing inputs), and Merci Corps (providing assistance and training); Carrot plant waste is utilized as animal feed. The

primary flow is linear from farmer to collector to consumer, with farmers having limited control over pricing due to the prevailing sales system.

3.2 Profit Margin Analysis

Below is the summary calculation of profit margin for each actor in value chain

Table 11 Carrot profit margin calculation

No	Actor	Avg.Revenue/kg (IDR)	Cost/kg (Est.) (IDR)	Profit/kg (IDR)	Margin (%)
1	Farmer	2,500	1,400	1,100	44%
2	Collector	3,000	2,500	500	16%
3	Wholesaler/Retailer*	4,000	3,000	1,000	25%

Notes:
- **estimate*
- *Revenue/costs vary significantly by quality grade and season.*
- *For detailed calculations, please see Annex 1*

3.2.1 General Observations

- Farmers say that the selling price of carrots is low, suggesting squeezed profit margins at their level. The "slashing/Tebasan" system where harvest costs are handed over to collectors also indicates a power imbalance that may limit farmer profits.
- Collectors seem to capture significant value as they buy in bulk and manage the distribution, covering the harvest costs. The wide price range between lowest quality (IDR 600/kg) and best quality (IDR 2500/kg) suggests that collectors can leverage quality differences for higher margins.

Table 12 Carrot value chain stages

Value Chain Stage	Revenue Source	Cost Components	Potential Margin
Farmers	Sale of carrots to collectors	Seeds, manure, chemical fertilizers, herbicides, additional fertilizers, insecticides, labor (implicit), fuel for water pump (dry season)	Likely Low/Squeezed

Collectors	Sale of carrots to wholesalers/retailers/consumers	Purchase of carrots from farmers33, transportation, handling, potential storage, labor	Potentially Moderate to High

3.2.2 Productivity

Based on information gathered from the Focus Group Discussion, we tried to average the calculation of productivity as follows:

- Current average yield: ~3 tons (3,000 kg) per hectare
- Minimum optimal yield for viability (based on costs)
  - Break-even at the price of IDR ± 1,500/kg
  - or at the quantity of ± 3,014 kg/ha

3.3 Cost-Benefit Ratio Analysis & Productivity (Yield) Analysis

This is the calculation using the best scenario (taking into account all the possible associated cost in carrot farming)

Table 13 Carrot CBR analysis

No	Cost Items	Cost/ha (IDR)
1	Seeds (Berastagi)	350,000
2	Organic Fertilizer (100 sacks @ 2,200)	220,000
3	Chemical Fertilizer + Gandasil	1,000,000
4	Herbicide & Pesticide	500,000
5	Water Pump Fuel (6L/day × 6 days)	450,000
6	Labor (Planting, Spraying, Harvesting)	2,000,000
	Total Cost/ha	**4,520,000**

Avg. Yield/ha	3,000 kg
Revenue with best grading (Grade AB)	Rp. 7,500,000
Net Profit/ha	Rp. 2,980,000
Benefit Cost (BC) Ratio	**1.66**
Return Cost (RC) Ratio	**0.60**

Since the BC calculation is still greater than 1, than the coffee commodity as seen as a business is actually a viable business

3.3.1 Cost Structure

- Seeds: Berastagi type seeds are more expensive than local seeds. While initially free, farmers now use derived seeds from the originally the distributed seed by program by MCI and PT PBM.
- Manure: IDR 2,200 per kilogram, 100 sacks for 1 hectare. (Assuming sack weight, e.g., 50 kg/sack, 5000 kg/hectare x IDR 2200/kg = IDR 11,000,000/hectare)
- Herbicides: IDR 65,000 – IDR 70,000 (brands like Zenicore and Round-up).
- Additional Fertilizer (Gandasil): IDR 40,000, used twice = IDR 80,000
- Chemical Fertilizers (Urea, Ponska, NPK, KCL): Purchased from agricultural shops (no specific price informed by farmers).
- Insecticides: Used for pests (no specific price given).
- Fuel for Water Pump (during Dry Season): 6 liters/day, IDR 12,500/liter (Pertamax) = IDR 75,000/day for 5-6 days watering.
- Labor: Implicit in land preparation, planting, spraying, harvesting.

Benefits (Revenue)

- Revenue from Carrot Sales ➔ Price varies from IDR 600/kg (lowest) to IDR 2500/kg (best).
- Higher Yield in Dry Season ➔ Although with additional fuel costs, dry season yields are generally higher.

Most farmers complain about low selling prices, indicating that the current benefits may not adequately cover or provide sufficient returns for their costs and labor. The initial free inputs from PT PBM addressed limited working capital for starting a new crop, implying that input costs are a significant barrier.

3.4 SWOT Analysis

Table 14 Carrot SWOT analysis

Strengths	Weaknesses
• Highland agro-climate ideal for carrots • Community knowledge on Berastagi type • Prior exposure to GAP	• Poor financial literacy • No farmer group institutions • Poor planting technique & disease control
Opportunities	**Threats**
• Potential expansion to niche markets • Closed-loop seedling/nursery systems • Mechanization & collective marketing	• Market price volatility • Landslides & high rainfall disease risks • Dependency on middlemen

3.4.1 Strengths

- Favorable Climate and Geography: Simego Village is at 1600 meters above sea level with moist weather and 4800 mm rainfall per year, suitable for carrot cultivation.
- Established Carrot Farming: Farmers have experience, some even before the program with PT PBM.
- Existing Support: Merci Corps currently assists farmers. Previous assistance from PT PBM provided free seeds, fertilizers, pesticides, and GAP training.
- Availability of Inputs: Farmers can readily purchase manure, chemical fertilizers, herbicides, and other necessary inputs from local shops.
- Crop Rotation Practice: Farmers rotate crops to maintain soil fertility and reduce pest/disease risk, indicating good agricultural understanding for sustainability.
- Waste Utilization: Carrot plant waste is used as animal feed, promoting resource efficiency.
- Potential for Higher Dry Season Yields: Despite additional costs, dry season cultivation can yield more.

3.4.2 Weaknesses

- Lack of Adherence to GAP: Farmers no longer follow planting instructions, randomly spreading seeds, leading to irregular planting distances.
- Limited Working Capital: An initial obstacle for farmers, which might still be a constraint despite initial free inputs.
- Reliance on Derived Seeds: Farmers still use seeds from the previous program, suggesting limited access to new, quality seeds or seed production knowledge, therefore the quality of seed used is actually degrading along number of times used

- Low Financial Literacy: Farmers in Simego village reportedly have low financial literacy, despite some accessing agricultural credit.
- Limited Water Pump Machines: Farmers express limitations in water pump machines, crucial during the dry season.
- Low Selling Prices: The main complaint from farmers, directly impacting their profitability.
- No Carrot Farmer Groups: Lack of farmer groups hinders collective bargaining, knowledge sharing, and organized support.
- Suboptimal Planting Method: Random seed spreading is energy-efficient but likely reduces yield or quality due to lack of optimal spacing.
- Pest and Disease Susceptibility: Carrots are susceptible to disease in the rainy season due to high humidity, leading to reduced yields and higher expenses.

3.4.3 Opportunities

- Demand for Quality Seeds: Farmers' hope for a carrot nursery or "house" for standard quality seeds indicates a market opportunity for seed suppliers or local seed production.
- Mechanization for Planting: Farmers' need for seed spreading machines presents an opportunity for technology adoption to improve efficiency and consistency.
- Improved Market Access/Direct Sales: Exploring alternatives to the "slashing/wholesale" system could increase farmer bargaining power and profits.
- Value-Added Processing: Potential to process carrots into other products (e.g., juice, chips) to capture more value downstream.
- Strengthening Farmer Groups: Establishing and empowering farmer groups can lead to better negotiation, resource sharing, and collective marketing.
- Targeted Training: Re-training on GAP, financial literacy, and disease management.
- Climate-Resilient Practices: Implementing practices to mitigate risks from high humidity and disease in rainy season.
- Ecotourism/Agritourism: Leveraging the natural beauty and agricultural practices of the area (high altitude, moist weather) for tourism, potentially creating direct sales channels, as Simego is near to Dieng namely a renowned tourism site in Central Java.

3.4.4 Threats

- Price Volatility: The unstable and low selling price of carrots poses a significant threat to farmer livelihoods.
- Pest and Disease Outbreaks: Especially during the rainy season due to high humidity, leading to yield reduction and increased costs.
- Natural Disasters: Landslides are a natural risk in Simego Village.
- Climate Change Impacts: Changes in rainfall patterns or increased extreme weather events could severely impact yields and increase cultivation costs.
- Dependence on Collectors: The current "slashing/wholesale" system creates dependency and limits farmer control over pricing.
- Limited Access to Capital: Despite some *Kredit Usaha Rakyat* (KUR) access, limited working capital remains a potential issue for investment in improved practices or machinery.
- Competition: From other carrot-producing regions or substitutes.
- Environmental Degradation: Intensive use of chemical herbicides and fertilizers could lead to soil degradation and water pollution over time if not managed sustainably.

3.5 Benchmarking Analysis

Table 15 Carrot benchmarking analysis

Indicator (metric)	Simego Farmers	Best Practices (in Java Highlands)
Yield/ha	3 tons	5–7 tons
Spacing Technique	Seed Broadcasting with manual throwing	Line planting with GAP
Grading & Packaging	None (bulk sale)	Grade-based with post-harvest sort
Price/kg (farmgate)	Rp. 600–2,500	Rp. 3,500–4,000 (direct selling)

Below is the analysis of Carrot Farming Practice in Simego benchmarking against the following aspects

Against Good Agricultural Practices (GAP):

- Deviation: Farmers in Simego currently deviate from GAP by randomly spreading seeds, which likely results in suboptimal plant spacing, potentially affecting yield and quality compared to farms adhering to GAP (while actually in the past they have been trained with GAP knowledge)
- Input Use: The use of manure is a positive GAP, but reliance on chemical fertilizers and herbicides needs to be balanced with sustainable practices.
- Crop Rotation: The practice of crop rotation aligns with sustainable agricultural practices for soil health and pest management.

Against Local/Industry Standards (General Observations):

- Yields: While specific yield data for Simego is actually based on assumptions, benchmarking against national or regional average carrot yields could identify areas for improvement. Anecdotal evidence suggests Berastagi type carrots are high-yielding, but the random planting method might be reducing their full potential.
- Input Costs: Comparing input costs (seeds, fertilizers, pesticides) with other regions could reveal inefficiencies or opportunities for bulk purchasing.
- Market Access: The reliance on a few local collectors and the "slashing/wholesale" system might not be the most efficient and less profitable compared to other regions with stronger farmer cooperatives or direct market linkages.

Areas for Improvement:

- Re-adopting GAP for Planting: Implementing proper seed spacing and planting techniques can significantly improve yield and quality.
- Diversifying Market Channels: Exploring direct sales, farmer markets, or online platforms to reduce dependence on local collectors and potentially capture higher prices.
- Collective Bargaining: Formation of farmer groups could enable collective procurement of inputs at lower prices and collective marketing for better selling prices.

3.6 Institutional Analysis

3.6.1 Existing Institutions/Groups

- Merci Corps (NGO): Provides assistance and procure initial GAP training. Their continued involvement is a critical support function.
- PT Petung Bumi Makmur (PBM - Private Community Company): Previously initiated the carrot development program, providing free seeds, inputs, and training. Their withdrawal or reduced involvement may have left a void in the development program for carrot farmers.
- Local Farmer Shops: Key for supplying manure, chemical fertilizers, herbicides, and other agricultural inputs.
- Carrot Collectors: Six active collectors in Simego village, acting as the primary market linkage for farmers.
- BRI (Bank Rakyat Indonesia): Provides agricultural KUR credit to some farmers, indicating access to financial institutions.

3.6.2 Missing/Weak Institutions

- Carrot Farmer Groups: The explicit lack of these is a significant institutional gap. Their formation could facilitate:
    - Knowledge Sharing: Dissemination of GAP and best practices.
    - Collective Procurement: Lowering input costs through bulk purchases.
    - Collective Marketing: Stronger bargaining power with collectors or direct market access.
    - Access to Services: Easier access to credit, training, and government programs.
- Farmer Cooperatives: A more formal structure that could manage input supply, marketing, and even value-added processing.
    - Local Agricultural Extension Services: While Merci Corps provides training, consistent local government extension support could strengthen farmer capacity.
    - Farmer's group/cooperative or other institution for aggregation
    - Nursery for seedling production
- BUMDES: Not really explored the potential in supporting or providing support services to farmers

3.6.3 Role in Market Value Chain

- Farmers as core producers, but lack of organized /effective group, their individual nature limits their influence on the market.
- Merci Corps & PT PBM (past): Crucial supporting functions, particularly in capacity building and input provision.
- Input Suppliers: Essential enabling function, providing necessary resources.
- Collectors: Key market linkage, but their dominant position can lead to unfavorable terms for farmers.
- BRI: Supports enabling environment by providing financial access.
- **Recommendations:**
    - ⇒ ***Forming a carrot farmers' cooperative or at least solid farmer's group/association***

⇒ ***Establish village-level nursery unit (managed by farmer's group or cooperative or BUMDES)***

3.7 Stakeholder Analysis

Table 16 Carrot stakeholder analysis

Stakeholders	Role	Influence
Farmers	Production	High
Collectors	Price setting, aggregation	High
NGOs (Merci Corps)	Capacity building	Medium
PT PBM	Input supply	Medium
BRI	Credit facilitation	Low
Local Govt - Agri Office (Dinas)	Regulation, potential subsidy/incentive	Medium

3.7.1 Key Stakeholders

- Carrot Farmers:
  - Interests: Higher profits, stable prices, access to quality inputs, improved farming techniques, reduced risks, better market access.
  - Objectives: Sustainable livelihoods, increased income from carrot farming.
  - Interaction: Direct engagement in production, interaction with input suppliers and collectors.
- Carrot Collectors:
  - Interests: Consistent supply of carrots, competitive prices, efficient logistics, maximizing profit margins through bulk purchasing and distribution.
  - Objectives: Profitable trading of carrots.
  - Interaction: Direct purchase from farmers, control over pricing and harvest costs.
- Merci Corps (NGO):
  - Interests: Farmer empowerment, sustainable agricultural practices, improving farmer livelihoods.
  - Objectives: Providing training, assistance, and support to farmers.
  - Interaction: Direct engagement with farmers, providing capacity building.
- PT Petung Bumi Makmur (PBM):
  - Interests: Sourcing specific carrot varieties (Berastagi), potentially market expansion,
  - Objectives: Initiating and supporting carrot commodity development.
  - Interaction: Past direct involvement with farmers, providing inputs and training.

- Local Agricultural Shops:
  - Interests: Selling agricultural inputs, maintaining customer base among farmers.
  - Objectives: Profitable retail of farm supplies.
  - Interaction: Transactional relationship with farmers.
- Government Agencies (Local/Provincial Agriculture Department or Dinas):
  - Interests: Agricultural development, food security, rural poverty reduction, promoting sustainable practices.
  - Objectives: Providing extension services, policy support, subsidy program, infrastructure development.
  - Interaction: Indirectly through policies and potential programs, possibly through BRI's KUR.
- Banks (e.g., Bank Rakyat Indonesia / BRI):
  - Interests: Providing financial services, credit repayment, supporting economic activity.
  - Objectives: Profitable lending.
  - Interaction: Providing agricultural credit to farmers.
- Consumers:
  - Interests: Access to affordable, high-quality carrots.
  - Objectives: Meeting dietary needs.
  - Interaction: End-users of the product.

3.7.2 Influence on Market Chain

⇒ Farmers: Limited influence individually due to lack of organization and financial literacy.
⇒ Collectors: High influence due to their control over market access and pricing mechanisms (slashing/wholesale system).
⇒ Merci Corps: Significant positive influence through capacity building and direct support.
⇒ PT PBM (past): Demonstrated strong influence in initiating a new commodity and providing initial support.
⇒ Government: Potential for strong influence through policy, regulations, and direct support programs, but current direct influence on Simego farmers is not heavily explored during FGD

3.8 Policy and Regulatory Analysis

3.8.1 Current Impact

- Price is still an issue, there is still no price stabilization mechanism both at local or at regional level
- There is still lack of support for introduction of mechanization or policies related with subsidies
- Limited extension post-program, or extension services hired by decision makers/ local government office
- KUR credit exists but still low uptake, and also there is need more exploration regarding tailored financial services for farmersAgricultural KUR Credit: The availability of agricultural KUR credit from BRI indicates a financial sector support aimed at supporting farmers' access to finance.

- Input Regulations: some farmers owned the Kartu Tani and with this farmers card they could purchase subsidizrd chemical fertilizers, pesticides, and herbicides implies government support to farmers, however it was not clear if any national regulations regarding agricultural input sales and usage imposed,
- Land Status: Land ownership (0.2 ha to 1.5 hectares), but it was not specified formal land titles or any regulatory aspects related to land use, which could impact investment and tenure security.

3.8.2 Recommendations for Policy and Regulatory Improvements

- Support for Farmer Group Formation: Policies encouraging and facilitating the establishment of formal farmer groups or cooperatives could empower farmers in negotiations and market access.
- Market Price Stabilization Mechanisms: Policies to address low selling prices, such as direct market intervention, could benefit farmers.
- Subsidies for Sustainable Practices: Incentives or subsidies for adopting environmentally friendly practices (e.g., organic farming, reduced chemical use) could promote sustainability, or leading to development/introduction of green financing by financial sector.
- Enhanced Agricultural Extension Services: Government investment in robust local agricultural extension services can provide ongoing training and technical support to farmers, ensuring adherence to GAP and adaptation to new challenges.
- Access to Certified Seeds: Policies promoting local seed nurseries or easier access to certified high-quality seeds (as farmers hope for) could improve productivity.
- Access to Modern Agricultural Equipment: Policies supporting access to or subsidies for relevant machinery like seed spreading machines could improve efficiency.

3.9 Gender Analysis

Generally, in many agricultural communities, women play crucial roles in various stages of the value chain, often involved in:

- Farm Labor: Planting, weeding, harvesting, and post-harvest activities.
- Input Management: Decisions on purchasing inputs, though men often control finances.
- Marketing: Sometimes responsible for selling produce in local markets.
- Household Responsibilities: Balancing farm work with domestic duties.

3.9.1 Exploring Potential Gender-Related Aspects in Simego

The following inquiries should be addressed:

- Labor Division: Are women primarily involved in specific tasks like seed spreading, weeding, or post-harvest sorting?
- Decision-Making: Who makes decisions regarding crop choice, input purchase, and sales? Is it predominantly male-headed households?
- Access to Resources: Do women have equal access to training, credit (like KUR), and land ownership? The issue of limited financial literacy should be examined for potential gender disparities.

- Benefits Distribution: How are the profits distributed within the household? Do women benefit equally from income generated?
- Participation in Training/Groups: Are women adequately represented in the training (previously provided by Merci Corps)? If farmer groups are formed, is there active female participation?

3.9.2 Potential Gender Roles for Simego Village

- Male Farmers: Often involved in physically demanding tasks like land preparation, spraying chemicals, and managing sales to collectors. Likely primary decision-makers for major farm investments and sales.
- Female Farmers: Frequently involved in tasks such as seed spreading (though currently random), weeding, harvesting, and post-harvest handling. May also be responsible for household finances, often balancing farm income with daily household needs.
- Decision Making: It is common for men to hold more power in decision-making regarding agricultural practices, input purchases, and sales, even if women are heavily involved in labor.
- Access to Resources: Women might face barriers in accessing formal credit, training, or land ownership, which are often directed towards male heads of households. The mention of some farmers accessing KUR credit might primarily refer to male farmers.

3.9.3 Implications for the Value Chain

- Untapped Potential: Overlooking women's roles and contributions can lead to missed opportunities for improving productivity and efficiency.
- Ineffective Interventions: Training and support programs that do not specifically target or include women may fail to achieve their full impact.
- Disparities in Benefits: If women have less control over income or decision-making, their contribution to the value chain may not translate into equitable benefits for themselves or their families.

3.9.4 Recommendations for Gender Inclusion

- Disaggregated Data Collection: Future assessments should collect gender-disaggregated data on labor, decision-making, access to resources, and income.
- Gender-Sensitive Training: Ensure training programs (GAP, financial literacy and also climate literacy) are accessible and tailored to both men and women farmers, considering their schedules and specific needs.
- Promote Women's Leadership: Encourage and support women's participation and leadership in farmer groups and cooperatives.

- Targeted Financial Inclusion: Address any barriers women face in accessing credit or financial services. Access to Financial Resources for Women: Facilitate women's access to credit and financial services, potentially through women's savings groups or targeted microfinance initiatives.
- Recognize and Value Women's Labor: Develop awareness within the community about the significant contributions of women to carrot farming, and advocate for fair compensation and recognition.

3.10 Sustainability and Social Impact Analysis

Table 17 Carrot sustainability and social impact analysis

Aspect	Impact	Recommendation
Utilization of Fertilizer/pesticide	Chemical runoff, soil depletion	Promotes organic input alternatives
Seed scattering Practice (hand throwing)	Low yield, seed waste (redundancy)	Promotes precision planting tools, mechanization
Plant Rotation practices	Maintains soil health and pest management	Already good practice
Risks due to Landslide	High in area with high slopes/steep land	Agroforestry & vegetative buffers

3.10.1 Environmental Sustainability

- Positive Practices:
  - Crop Rotation: Farmers rotate crops to maintain soil fertility and reduce pest/disease risk, a key sustainable practice.
  - Manure Use: Use of chicken manure for soil fertility is a positive organic input.
  - Waste Utilization: Carrot waste used as animal feed reduces waste.
- Areas of Concern/Negative Impacts:
  - Pesticide Pollution: The use of insecticides for caterpillars and mole crickets and chemical herbicides poses risks. Heavy reliance on chemical herbicides (*Zenicore, Round-up*) , chemical fertilizers (*urea, ponska, NPK, KCL*) , and insecticides can lead to:
    - Soil Degradation: Reduction in soil biodiversity and long-term fertility.
    - Water Pollution: Runoff into water sources, pollute nearby rivers and ground water, impacting aquatic ecosystems and human health.
    - Pest Resistance: Over-reliance can lead to pests developing resistance, necessitating higher doses or stronger chemicals.
    - Greenhouse Gas Emissions: Nitrogen-based fertilizers can contribute to nitrous oxide emissions, a potent greenhouse gas.
    - Soil Imbalance: Can alter soil pH and nutrient balance over time. Soil Health Degradation: Long-term use can reduce soil biodiversity, degrade soil structure, and harm beneficial microorganisms.
    - Biodiversity Loss: Harm to non-target insects (e.g., pollinators), birds, and other wildlife.

- Random Planting: While energy-efficient, irregular planting can lead to inefficient resource use (water, nutrients) if not optimized, potentially increasing overall input needs.
- Landslides: Identified as a natural risk, potentially exacerbated by land management practices (it's a general concern in mountainous agricultural areas). Intensive cultivation on slopes without proper terracing or vegetative cover can increase erosion risk.
- Water Usage (Dry Season): Pumping water using fossil fuel-powered machines has a carbon footprint and relies on non-renewable energy.

3.10.2 Social Impact

- Livelihoods: Carrot farming is a significant source of income for Simego farmers. However, low selling prices directly impact their livelihoods and financial well-being.
- Health: Exposure to chemical pesticides and herbicides can pose health risks to farmers and their families if proper safety measures are not followed.
- Community Cohesion: The lack of farmer groups might limit social capital and collective problem-solving within the community.
- Knowledge and Skills: Initial GAP training was provided , but lack of continued adherence suggests a gap in knowledge retention or practical application, impacting productivity and sustainability.
- Access to Resources: Limitations in water pump machines and the desire for a nursery indicate unmet needs for crucial resources.

3.10.3 Recommendations for Sustainability and Social Impact

- Integrated Pest Management/ IPM *(Pengendalian Hama Terpadu/PHT)*: Promote and train farmers on IPM strategies to reduce reliance on chemical insecticides, incorporating biological controls, cultural practices, and resistant varieties.
- Terracing and Contour Plowing: Given the mountainous slopes, implement or reinforce terracing and contour plowing to reduce soil erosion and prevent landslides.
- Agroforestry: Integrate trees and shrubs into the farming system to stabilize slopes, improve soil health, and provide additional income.
- Resistant Varieties: Promote the use of carrot varieties naturally resistant to common diseases and pests.
- Train farmers to regularly monitor for pests and diseases, allowing for targeted interventions only when necessary, reducing broad-spectrum spraying.
- Minimal Chemical Use: When chemicals are necessary, encourage the use of less toxic alternatives and precise application techniques.
- Sustainable Nutrient Management: Encourage balanced use of organic and inorganic fertilizers, soil testing, and precision application to minimize chemical runoff and improve soil health.
- Organic Farming Transition: Explore potential for transitioning to organic carrot farming, which could fetch premium prices and significantly reduce environmental impact. Composting and Organic Matter: Maximize the use of composted organic matter (including carrot waste beyond animal feed) to improve soil structure, water retention, and nutrient availability.
- Water-Efficient Irrigation system: Introduce more efficient irrigation techniques beyond simple spraying (e.g., drip irrigation or piping mechanism using gravity) to conserve water and reduce fuel consumption. Invest in and train farmers on water-efficient

irrigation methods like drip irrigation, which delivers water directly to the plant roots, reducing water loss and fuel consumption for pumping.

- Renewable Energy for Pumping: Investigate feasibility of solar-powered water pumps to reduce reliance on fossil fuels.
- Cover Cropping: Introduce cover crops during fallow periods to protect soil from erosion, suppress weeds, and add organic matter.
- *Farmer Field Schools:* Implement practical, hands-on training programs to reinforce GAP, IPM, and climate as well as financial literacy.
- Support Farmer Organization: Facilitate the formation of strong farmer groups to enhance collective action, market power, and social support networks.
- Fair Trade Principles: Explore opportunities to link farmers with buyers who adhere to fair trade principles, ensuring better prices and working conditions (if possible contract farming)
- Health and Safety Training: Provide training on safe handling and application of agricultural chemicals, including provision of personal protective equipment.
- Sustainable Seed Management: Local Seed Saving and Exchange: Encourage practices that allow farmers to save and exchange high-quality, locally adapted seeds, reducing reliance on external and potentially genetically uniform seeds. Community Seed Bank: Establish a community seed bank to preserve local biodiversity and ensure access to resilient seed varieties.

3.11 Climate Change Analysis

Figure 8 Typical weather in project area

Simego Village, located at 1600 meters above sea level with 4800 mm annual rainfall and moist weather, is inherently exposed to specific climate and weather risks.

3.11.1 Identified Risks

- Landslides: Explicitly stated as a natural risk , exacerbated by being on "slope mountains". Heavy rainfall (4800 mm/year) can trigger these risks.

- Disease Due to High Humidity: Carrot plants are often attacked by disease due to high humidity factors, especially in the rainy season, leading to decreased yields and higher costs for medicine/pesticides.

3.11.2 Broader Impacts of Climate and Weather Changes

- Increased Rainfall Intensity and Variability: While Simego has high rainfall, climate change can lead to more intense, short-duration downpours and longer dry spells.
    - ⇒ Impact: Increased erosion on slopes, more frequent landslides, waterlogging and root rot in fields, and increased reliance on costly watering during unpredictable dry spells.
- Temperature Fluctuations: Changes in average temperatures or more extreme heat events.
    - ⇒ Impact: Can affect carrot growth and development, potentially reducing yields or quality. Can also alter pest and disease cycles, leading to new or more virulent outbreaks.
- Changes in Pest and Disease Distribution: Warming temperatures can allow pests and diseases to expand their geographic range or complete more life cycles per year.
    - ⇒ Impact: Increased pressure on carrot crops, necessitating more intensive pest management, potentially more chemical use and higher costs.
- Reduced Water Availability (Long Dry Spells): Despite high overall rainfall, extended dry seasons or changes in rainfall patterns could lead to water scarcity.
    - ⇒ Impact: Increased costs for water pumping (fuel), reduced yields if irrigation is insufficient, and competition for water resources.
- Extreme Weather Events: More frequent and severe storms.
    - ⇒ Impact: Direct damage to crops, infrastructure, and increased risk to farmers' livelihoods and safety.

3.11.3 Recommendations for Climate Resilience

- Climate-Smart Agriculture (CSA): Promote CSA practices that integrate adaptation and mitigation strategies.
    - ⇒ Adaptation:
        - Drought-Resistant Varieties: Research and introduce carrot varieties that are more tolerant to water stress.
        - Water Harvesting and Efficient Irrigation: As mentioned, critical for managing variable rainfall.
        - Improved Drainage Systems: To prevent waterlogging during intense rainfall events.
        - Early Warning Systems: Implement localized weather forecasting and pest/disease early warning systems to enable proactive responses.

    - ⇒ Mitigation:
        - Reduced Chemical Use: Transition to organic fertilizers and IPM to reduce greenhouse gas emissions associated with synthetic inputs.
        - Agroforestry and Reforestation: Planting trees on slopes helps sequester carbon and stabilize soil, reducing erosion and landslide risk.
        - Renewable Energy: Shifting to solar-powered water pumps reduces fossil fuel consumption.

- Diversification: Encourage farmers to diversify their crops beyond carrots to reduce dependence on a single commodity vulnerable to climate shocks.
- Risk Transfer Mechanisms: Explore agricultural insurance schemes that can provide financial safety nets for farmers against climate-related yield losses.
- Knowledge Exchange and Capacity Building: Continuously educate farmers on climate change impacts and adaptive strategies.

3.12 Land Status

3.12.1 Land Status

- Ownership: Farmers own land ranging from 0.2 to 1.5 hectares, with an average of 1.5 hectares. This indicates a degree of land tenure security for the individual farmers.
- Geography: The land is 1600 meters above sea level, "agriculture part big on the slope mountains".

3.12.2 Risks Arising from Land Status

- Landslides: The most prominent natural risk identified is landslides, directly linked to the "slope slope mountains" geography. While not explicitly stated by farmers, intensive agriculture on slopes without proper soil conservation measures can exacerbate this risk, leading to loss of productive land, damage to infrastructure, and potential danger to lives.
- Erosion: Sloping land is highly susceptible to soil erosion, especially with heavy rainfall and potentially exposed soil from cultivation. Erosion reduces soil fertility, decreases productivity, and can pollute water bodies.
- Fragmentation (Potential): While average land is 1.5 ha, the range from 0.2 ha implies some fragmentation. Highly fragmented landholdings can be less efficient for mechanized farming and overall management.
- Tenure Security (Implied but not explicit): While farmers mentioned "own" land, it is not certain if they have formal land titles. Lack of formal titles can limit access to formal credit or long-term investments, though some farmers do access KUR credit.
- Limited Expansion: Given the mountainous terrain, expansion of agricultural land might be limited, putting pressure on existing plots to increase productivity.
- Climate Change Vulnerability: The high altitude and reliance on rainfall make the area vulnerable to changes in precipitation patterns (too much rain leading to landslides, too little leading to drought and increased water pump costs).

3.12.3 Recommendations Related to Land Status

- Landslide Mitigation: Implement comprehensive landslide mitigation strategies, including terracing, contour farming, agroforestry (planting trees on slopes), and proper drainage systems.
- Soil Conservation Practices: Promote practices like minimum tillage, cover cropping, and increased organic matter application to enhance soil structure and reduce erosion.
- Mapping and Risk Assessment: Conduct detailed land use mapping and risk assessments for landslide-prone areas to inform land management decisions and community preparedness.

- Community-Based Land Management: Facilitate collective action among farmers for watershed management and sustainable land use planning, especially on shared or adjacent slopes, the methods typically used is Participatory Land Use Planning (PLUP)
- Secure Land Titles: If formal titles are an issue, facilitate the process for farmers to obtain them, enhancing their ability to access credit and make long-term investments.
- Diversification: Given potential limitations in expansion and climate risks, encourage crop diversification or integration of other livelihood activities to reduce reliance solely on carrots.

3.13 Financial Literacy

The level of financial literacy of farmers in Simego village is still lacking, even though there are farmers who have accessed agricultural KUR credit from BRI".

- Suboptimal Credit Utilization: Farmers with low financial literacy might not effectively manage the KUR credit, potentially misusing funds or struggling with repayment schedules.
- Poor Financial Planning: This could lead to inefficient resource allocation, inability to accurately calculate costs and profits, and difficulty in making informed investment decisions for farm improvements.
- Vulnerability to Shocks: Low financial literacy makes farmers more vulnerable to market price fluctuations and unexpected expenses.
- Limited Savings/Investment: Difficulty in managing income and expenses can hinder the ability to save or invest in long-term farm sustainability.
- Negotiation Weakness: Lack of understanding of market dynamics and costs could weaken their bargaining position with collectors.

3.13.1 Recommendations

- Targeted Financial Education Programs: Design practical, hands-on training tailored to farmers' needs, focusing on:
    - Basic bookkeeping and record-keeping.
    - Cost-benefit analysis of inputs and practices.
    - Budgeting and cash flow management.
    - Understanding credit terms and responsible borrowing.
    - Financial products knowledge, Savings and investment strategies.
- Use of Simple Tools: Introduce easy-to-use financial tools (e.g., simple ledgers, book keeping, mobile apps) that can assist farmers in tracking their income and expenses.
- Partnerships with Financial Institutions: Encourage BRI and other financial institutions to provide financial literacy training alongside their credit offerings.
- Mentorship Programs: Establish peer-to-peer learning where more financially literate farmers can mentor others.
- Integration with Farmer Groups: Financial literacy training can be more effectively delivered and reinforced within farmer groups, fostering collective learning and support.

3.14 Market System Development (MSD) Framework

Table 18 Carrot MDS framework

	Actor	Constraint	Solutions
Core Function	• Farmers, • collectors,	• Access to quality input, low financial literacy, lack GAP • Price volatility	• Skill Training, • cooperatives formation, • farmer's group, • mechanization
Supporting Function	• Nurseries, agri-input shops, machinery rental • Financial services (KUR credit access)	• Incorrect financial scheme, knowledge gap on optimal input use, • improper use of fertilizer and perticide/herbicide	• Train shop staff to offer basic advice on product usage and sustainable practices • Tailored microcredit products, • Demonstration plots
Enabling Environment	• Village Government, Regency Government • Policy & Market Linkage	• Price volatility, • limited infrastructure for direct market access, • lack of specific policies to empower farmer groups	• Policies and funding mechanisms • Market Information Systems • Landslide Mitigation Programs

Table 19 Detailed Key Factors and Potential Success of Each Actor and Obstacles Faced

Actor/Institution	Potential Success	Obstacles Faced
Farmers	High-altitude land suitable for carrots , willingness to adopt new varieties (Berastagi).	Low financial literacy , limited working capital , lack of adherence to GAP , reliance on derived seeds , low selling prices , limited water pump machines , lack of farmer groups , pest/disease susceptibility in rainy season.
Carrot Collectors	Established market access to consumers, absorb harvest costs , handle large volumes.	Potentially thin profit margins depending on market dynamics, reliance on farmer supply, may face competition, logistical challenges in remote areas.
Agricultural Shops	Essential suppliers, direct access to farmers.	May lack diverse stock of sustainable inputs, potentially limited knowledge sharing on optimal input use.

Actor/Institution	Potential Success	Obstacles Faced
Merci Corps	Existing presence and experience in providing training and assistance.	Sustainability of programs after project ends, potential for limited reach, ensuring long-term adoption of practices.
PT PBM (Past)	Significant initial investment and program initiation.	Lack of sustained presence, potential for creating dependency if farmers aren't empowered for self-reliance post-program.
BRI	Provides access to formal credit (KUR).	Farmers' limited financial literacy may hinder effective credit utilization and repayment, limited reach to all farmers.
Farmer Cooperatives	Collective bargaining power, shared resources, improved market access, knowledge exchange.	Requires strong leadership, trust among members, initial capital, training in organizational management. The current lack of farmer groups is a major hurdle.
Local Seed Nursery	Addresses farmer demand for standard quality seeds, ensures local adaptation.	Requires technical expertise, initial investment, land for nursery, market acceptance, competition from established seed companies.
Food Processors	Creates new markets for lower-grade carrots, adds value.	Requires investment in processing facilities, market research for processed products, quality control, consistent supply of raw materials.
Government Agencies	Policy support, infrastructure development, extension services.	Bureaucracy, limited funding, lack of coordination, difficulty in reaching remote communities, political will for long-term programs.

3.15 Closed Loop System Strategy

Identification of actors and value chain institutions involved and the potential involvement of other actors in the value chain that can help create a closed loop system.

3.15.1 Existing Actors and Institutions

A. Core Value Chain Function:
   - Farmers: Cultivation and initial supply.
   - Carrot Collectors: Aggregation and distribution.

B. Supporting Functions:
   - Agricultural Shops: Input supply (fertilizers, pesticides, manure, herbicides, etc.).
   - PT Petung Bumi Makmur (PBM - Private Company): Previous initiator, providing initial inputs and training.
   - BRI (Bank Rakyat Indonesia): Financial services (agricultural KUR credit).

C. Enabling Environment:
   - Village Owner Enteprise (*Badan Usaha Milik Desa*/BUMDES).
   - Government (implied): Policies allowing agricultural credit (KUR) and general agricultural support.

3.15.2 Potential Involvement of Other Actors for a Closed-Loop System

A closed-loop system aims to minimize waste and maximize resource utilization, often by reintroducing outputs back into the production cycle.

A. Farmer Groups:
   - Role: Farmers explicitly lack groups. These could aggregate produce, collectively purchase inputs, share knowledge, manage post-harvest processing, and potentially even run a community-based nursery or input supply. This directly addresses the need for standard quality seeds and seed spreading machines.
   - Closed-loop contribution: Facilitate organic waste composting, collective management of water resources, and internal knowledge sharing on sustainable practices.

B. Composting/Organic Fertilizer Producers:
   - Role: While farmers use chicken manure and carrot waste as animal feed, there's potential to establish more systematic composting of other farm waste or even communal composting sites.
   - Closed-loop contribution: Convert all organic farm waste into high-quality compost, reducing reliance on external chemical fertilizers and improving soil health.

C. Local Seed Bank/Nursery:
   - Role: Farmers express a need for a carrot nursery for standard quality seeds. This entity could research, produce, and distribute high-quality, locally adapted seeds, reducing reliance on external suppliers and "derived" seeds.
   - Closed-loop contribution: Promote seed saving and local seed adaptation, strengthening genetic diversity and resilience.

D. Agricultural Technology Providers (for mechanization):
   - Role: Provide access to or training on seed spreading machines and more efficient water pump technologies.
   - Closed-loop contribution: Optimize resource use (seeds, water, fuel) through precision agriculture.

E. Research Institutions/Universities:

- Role: Conduct research on local carrot varieties, pest-resistant strains, sustainable farming techniques, and climate-resilient practices relevant to Pekalongan's specific conditions.
- Closed-loop contribution: Provide scientific backing for sustainable agriculture and resource management.

F. Food Processing Companies:
- Role: Utilize lower-grade carrots or surplus for processing into value-added products (e.g., carrot juice, dried carrots, purees).
- Closed-loop contribution: Reduce post-harvest losses and create new markets for carrots that might not meet fresh market standards.

G. Financial Institution/Microfinance Institutions/Impact Investors:
- Role: Provide tailored financial products beyond KUR, specifically for sustainable agriculture investments (e.g., organic inputs, water-efficient technology, seed nurseries, green financing).
- Closed-loop contribution: Enable farmers to invest in sustainable practices and infrastructure.

3.15.3 Identification of value chain channels

⇒ **Primary Channel (Current):**

Farmers → Carrot Collectors → (Wholesalers/Retailers/Consumers)

This is the dominant channel, characterized by the "slashing/wholesale" system where farmers sell their entire harvest to collectors.

⇒ **Potential Alternative Channels (for improvement and closed-loop):**

Farmers (via Groups/cooperatives) → Direct to Retail/Consumers

Farmers' groups could bypass collectors and sell directly to urban markets, supermarkets, restaurants, or even through online platforms. This increases farmer control over pricing.

Farmers (via Cooperatives/Groups) → Food Processors → Retail/Consumers

For lower-grade or surplus carrots, processing into juice, dried carrots, or other products opens up new markets and adds value.

Farmers → Local Markets/Agritourism

Farmers could sell directly at local farmers' markets or develop agritourism initiatives, allowing visitors to purchase directly from the farm.

Farmers → (Community-Based) Seed Nursery → Farmers:

A closed loop for seed supply, where farmers produce or are supplied with quality seeds from a local, farmer-managed nursery.

3.15.4 Points of consideration for an effective closed loop system

- Seedling Nursery: village-based, farmer-managed collective system
- Form and establish Carrot farmers based organizations or farmers association at the minimal for collective input procurement and collective sale
- Contract Farming: with wholesalers or retailers to secure prices
- Mechanization Support: subsidized seed spreaders
- Market Information System: SMS/WA/Social Media Apps updates on prices & quality specs
- Training & Re-certification on Good Agriculture Practice
- Seek potential collaboration with village owned enterprise (BUMDES), for post-harvest handling, provision of equipment and space rental, transport services, provision of revolving loan (for BUMDES that provides microcredit)
- financial product from formal financial institutions based on harvest results

3.16 Strategic recommendations

3.17 Overall Recommendations (Market System Development Concept)

3.17.1 Actors in the Core Value Chain Function

- **Farmers:**
  - Key Factors for Success: Access to quality inputs, knowledge of GAP, financial literacy, climate literacy, collective action, and fair market prices.
  - Obstacles: Low financial literacy , limited working capital , non-adherence to GAP , low selling prices , lack of farmer groups.
  - **Recommendations:**
    - Form Farmer Groups/Cooperatives: This is critical. Facilitate their formation, provide training on organizational management, collective bargaining, and marketing.
    - Re-emphasize and Enforce GAP Training: Provide hands-on, practical training on correct seed spacing, planting techniques, and integrated pest/nutrient management.
    - Improve Financial Literacy: Implement tailored training programs on budgeting, cost analysis, credit management, and savings.
    - Facilitate Access to Quality Seeds: Support the establishment of a local carrot nursery or create direct links to certified seed suppliers.
    - Promote Mechanization: Facilitate access to seed spreading machines and efficient water pumps through group purchases or subsidies.
- Collectors:

- Key Factors for Success: Efficient logistics, strong market linkages, fair pricing mechanisms.
- Obstacles: Potentially squeezed margins depending on the market, reliance on farmers' supply.
- **Recommendations:**
  - Fairer Pricing Models: Encourage collectors to adopt transparent and fair pricing mechanisms that reflect quality (grading AB vs. TO) and market demand, potentially moving away from the "slashing/wholesale" system or making it more transparent.
  - Partnerships with Farmer Groups: Collectors could establish formal agreements with farmer groups for consistent supply and quality control, ensuring better returns for farmers and stable supply for collectors.
  - Invest in Post-Harvest Infrastructure: Encourage investment in better sorting, grading, and temporary storage facilities to maintain quality and reduce post-harvest losses.

3.17.2 Actors in Supporting Functions

Financial Institution (BRI):

- Key Factors for Success: Accessible and flexible financial products, good outreach.
- Obstacles: Farmers' low financial literacy.
- **Recommendations:**
  - Tailored Financial Products: Develop credit products specifically designed for investments in sustainable practices (e.g., efficient irrigation, organic fertilizers).
  - Integrate Financial Literacy: Collaborate with Merci Corps or farmer groups to embed financial literacy training as a mandatory component for credit recipients.

3.17.3 Enabling Environment

- Key Factors for Success: Supportive policies, stable market conditions, access to infrastructure, effective governance.
- Obstacles: Price volatility, limited infrastructure for direct market access, lack of specific policies to empower farmer groups.
- **Recommendations:**
  - Government Support for Farmer Organizations: Policies and funding mechanisms to support the establishment and strengthening of farmer groups and cooperatives.
  - Market Information Systems: Develop and disseminate real-time market price information to farmers, improving their bargaining power.
  - Investment in Rural Infrastructure: Improve roads and transportation networks to reduce logistical costs and facilitate direct market access for farmers.
  - Landslide Mitigation Programs: Government-led initiatives for land-use planning, terracing, and reforestation in vulnerable areas.
- **Merci Corps:**
  - Key Factors for Success: Continuous presence, adaptive training programs, strong farmer relationships.

- Obstacles: Ensuring long-term behavior change and impact beyond project duration.
- **Recommendations:**
  - Long-term Engagement: Develop long-term strategies that foster self-reliance rather than dependence.
  - Training of Trainers (TOT): Train local farmers to become peer-to-peer trainers for GAP and financial literacy, creating a sustainable knowledge transfer mechanism.
  - Facilitate Linkages: Actively connect farmers to other market actors, financial institutions, and government services.

3.17.4 Recommendations for Enabling Closed Loop System Development Strategies

1. Community-Based Organic Waste Management & Composting:
   - **Strategy ➔ Establish a communal composting facility managed by farmer groups. All crop residues (beyond animal feed), animal manure, and even suitable household organic waste can be collected and composted.**
   - Actors Involved ➔Farmer groups (management, labor), local government (initial investment, land allocation), Merci Corps (training on composting techniques), input suppliers (selling compost turning tools, bio-activators).
   - Closed Loop Impact ➔ Reduces reliance on chemical fertilizers, improves soil health, reduces waste, lowers input costs for farmers.
2. Local Carrot Seed Production and Nursery:
   - **Strategy ➔ Establish a farmer-managed or cooperative-owned carrot nursery and seed bank as farmers hope for. This would focus on propagating and distributing high-quality Berastagi seeds and potentially local resilient varieties.**
   - Actors Involved ➔ Farmer groups (ownership, management), Merci Corps (technical training on seed saving, breeding, nursery management), research institutions (technical expertise, quality control), local government (initial funding, land).
   - Closed Loop Impact ➔ Ensures consistent supply of quality seeds, reduces dependence on external suppliers, promotes local adaptation and genetic diversity, potentially lowers seed costs for farmers.
3. Water Resource Management and Rainwater Harvesting:
   - **Strategy ➔ Develop community-level rainwater harvesting systems, especially given high rainfall, and implement more efficient irrigation methods (e.g., drip irrigation). Explore solar-powered pumps.**
   - Actors Involved ➔ Farmer groups (management), local government (infrastructure investment, policy support), NGOs (technical training on irrigation and pump maintenance), BRI (financing for efficient irrigation tech).
   - Closed Loop Impact ➔ Sustainable water use, reduced reliance on traditional pumping, lower fuel costs, improved resilience to dry seasons.
4. Value-Added Processing & By-product Utilization:
   - **Strategy ➔ Explore opportunities for processing lower-grade or surplus carrots into products like juice, dried carrots, or purees. Ensure effective utilization of all carrot plant waste.**
   - Actors Involved ➔Farmer groups (potential processing unit ownership), food processing companies (partnerships for larger scale), technical training providers (food processing, quality control), local markets/retailers.

- Closed Loop Impact ➔ Reduces post-harvest losses, creates new income streams, adds value to the commodity.

4 Value Chain Analysis for Corn Commodity in Jolotigo Village, Talun District, Pekalongan Regency

This document is an in-depth analysis of the Corn commodity value chain in Jolotigo Village, Pekalongan Regency. The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various source). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

4.1 Value Chain Stream Mapping

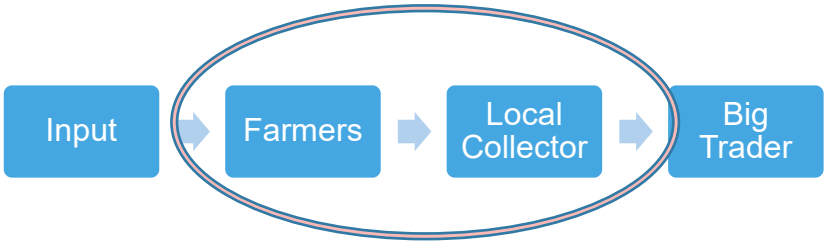


Figure 9 Corn value chain stream mapping

Notes : The Supply Chain is very short, farmers sell directly to local collector → thus lack further processing and value addition.

4.1.1 Key Players and Processes Involved/ Flow of Commodity:

- Corn Farmers (Producers):
  - Land Preparation: Plowing and hoeing, spraying herbicide (Brand: Roundup).
  - Planting: Planting hybrid corn seeds (Brand: Bisi 2, Pertiwi, NK Sumo, NK Perkasa). Planting pattern 20 cm x 60 cm, 1 seed per hole, but often random.
  - Fertilization: Manure (15 days after planting), urea fertilizer (25 days after planting).
  - Pest Control: Spraying pesticides (Brand: Danke 40).
  - Harvest: Done twice a year. Requires the help of farm laborers and corn sheller rental.
  - Post-Harvest: Drying (often suboptimal, causing mold.
- Farmer's Shop (Input Provider): Sells hybrid corn seeds, herbicides, and pesticides.

- Local Collectors: Buy corn from farmers (dry or wet). There is only one collector in Jolotigo Village, and 2 in neighboring villages.
- Microfinance Institutions (Supporting Function): PT PNM Mekaar, Komida Cooperative, Bank Rakyat Indonesia / BRI (providing Kredit Usaha Rakyat/KUR loans).
- Farm Laborer: Helps with land preparation and harvest.
- Transportation (Pick Up Car): Transporting the harvest.
- Consumers: The end of the value chain.

4.2 Productivity and Financial Analysis

Table 20 Corn harvest productivity (yield) per Ha

Average land area	0.3 ha
Harvest results per cycle	±1,000 kg
Crop Cycle per year	2 times
Yield / ha per cycle	3,333 kg
Yield / ha per year	±6,666 kg/ha per year (cumulative 2 cycles)

Calculation of Productivity or Yield of Harvest Results for Each Hectare (kilograms per ha)

- Average Farmers:
  - Average land area: 0.2 - 0.3 hectares (take an average of 0.25 ha for general farmer representatives)
  - Harvest yield per 2 kg of seeds: 400 kg (minimum) - 800 kg (maximum); therefore take an average of 600 kg
  - Assuming 2 kg of seeds for 0.25 ha.
  - Productivity: 0.25 ha 600 kg=2400 kg/ha = 2.4 tons/ha
- One Leading Farmer (Mr. A):
  - Land area: 0.3 hectares
  - Harvest yield: 1 ton (1000 kg)
  - Productivity: 0.3 ha1000 kg ≈ 3333.33 kg/ha ≈ 3.33 tons/ha

Farmers	Land Area (ha)	Harvest Yield (kg/cycle)	Productivity (kg/ha/cycle)	Productivity (ton/ha/cycle)
Average	0.25	600	2400	2.4
Mr. A	0.3	1000	3333.33	3.33

Analysis: The productivity of corn farmers in Jolotigo is still far below the potential of hybrid corn which can reach 8-12 tons/ha per cycle. This shows great potential for increasing productivity through improved cultivation practices. Corn Productivity in Jolotigo (6.6 tons/ha per year) is also still below the optimal national target (12–16 tons/ha per year).

Table 21 Minimum optimal productivity of corn

Component	Value
Average land	0.3 ha
productivity target	5-7 tons/ha/ year
Target results farmer /0.3 ha	2,100 kg/ year (2 cycles)
Potential income (Rp /kg)	Rp4,800
Optimal total revenue	Rp10,080,000 per harvest season

Note: For detailed Calculation and Analysis please see Annex 1

If we refer to the potential of hybrid corn in Indonesia which can reach 8-12 tons/ha per cycle, then the minimum optimum productivity that should be achieved is 8 tons/ha .

For the average farmer's land ownership (0.25 ha), the harvest yield per cycle should be at least:

8 tons/ha × 0.25 ha = 2 tons = 2000 kg

This is an ambitious but realistic target if farmers implement Good Agricultural Practices (GAP) consistently.

4.2.1 Cost, Revenue, and Profit per Actor Analysis

Table 22 Corn farmers' cost, revenue and profit

Component	Value (Rp)
Seeds (2 kg x Rp. 75,000)	150,000
Manure/Pupuk kandang (35 x 10,000)	350,000
Fertilizer (Urea, KCL, NPK)	250,000–400,000
Pesticides + Herbicides	250,000
Labor, harvest labor, harvest porter (10 days)	±1,350,000
Rent machine (shelling corn)	50,000
Transportation	100,000
Total cost	±2,500,000
Income (1000 kg x 4800)	Rp4,800,000
Profit per cycle	±Rp2,400,000

Table 23 Corn collectors' cost, revenue and profit

Component	Value (Rp)
Price buy from farmer	Rp4,800/kg
Price sell to warehouse / factory	Rp5,200–5,500/kg
Margin gross per kg	Rp400–700/kg
Transport volume per cycle	±5 tons
Profit per cycle	±Rp2,000,000–3,500,000

4.2.2 Profit Margin

Based on the available data from FGD, we can calculate the estimated profit margin for farmers. While data for collectors and other downstream actors, we did not manage to obtain so no analysis could be made.

Estimated Profit for Corn Farmers (per planting cycle):

Assumptions:

- Average land area: 0.2 - 0.3 hectares (we will use 0.3 ha for example calculations)
- Yield per 2 kg of seeds: 400 kg (minimum) - 800 kg (maximum) (we will use an average of 600 kg for 0.3 ha if 2 kg of seeds per 0.3 ha)
- Selling price of dry corn: IDR 4800/kg

Case Study: Farmer A (0.3 ha, yield 1 ton = 1000 kg):

Farmer A's Production Costs (per planting cycle, 0.3 ha):

- Hybrid seeds (2 kg): There is no specific price, but it is stated that "quality corn seeds are also considered expensive by farmers". Assuming the price of hybrid seeds is IDR 60,000/kg, then 2 kg = IDR 120,000.
- Herbicide (Round up): 2 bottles x IDR 75,000 = IDR 150,000
- Manure: 35 bags x IDR 10,000 = IDR 350,000
- Chemical Fertilizers (Urea, KCL, NPK): IDR 250,000 (subsidized price)
- Pesticides (Dante): There is no number of bottles, but other farmers (generally) use 2 bottles of Danke 40 x IDR 50,000 = IDR 100,000.
- Machine rental: IDR 50,000/day
- Earthworks labor wages: IDR 100,000/day x 10 days = IDR 1,000,000
- Harvest laborer wages: IDR 200,000
- Porter wages: IDR 50,000
- Harvest transportation (pick-up car): IDR 100,000 (if harvest is 1 ton, 1 car is needed)

Farmer A's Total Estimated Costs:

- IDR 120,000 (seedlings) + IDR 150,000 (herbicide) + IDR 350,000 (manure) + IDR 250,000 (chemical fertilizer) + IDR 100,000 (pesticide) + IDR 50,000 (peeling machine rental) + IDR 1,000,000 (land preparation fee) + IDR 200,000 (harvesting fee) + IDR 50,000 (porting fee) + IDR 100,000 (transportation) = **IDR 2,370,000**

Farmer A's Income: Harvest: 1000 kg

- Selling price: IDR 4800/kg
- Total Income: 1000 kg x IDR 4800/kg = IDR 4,800,000
- Farmer A's Profit: IDR 4,800,000 (Income) - IDR 2,370,000 (Cost) = IDR 2,430,000 per planting cycle
- **Farmer A's Profit Margin: = 50.6%**

Comparison with general average farmers data (if 2 kg of seeds produce 600 kg)

- Seedling cost: IDR 120,000
- Herbicide (Round up, 1 liter): IDR 80,000
- Manure (30 sacks): IDR 10,000 x 30 = IDR 300,000
- Urea fertilizer (100 kg): 4 x IDR 250,000 = IDR 1,000,000 (if using a farmer card) or 4 x IDR 400,000 = IDR 1,600,000 (if not) (will use a subsidy for the calculation)
- Pesticide (2 bottles): 2 x IDR 50,000 = IDR 100,000
- Rent a corn cob machine: IDR 50,000
- Labor wages: Assuming 1 laborer, 1-2 days. If 2 days @ IDR 100,000 = IDR 200,000 (this is lower than Farmer A, so maybe only for harvesting or tillage).. Average labor for preparation and harvesting IDR 350,000 (wages for tillage (1-2 days) + harvesting).
- Transportation: IDR 100,000 (if the yield is 600 kg, maybe less than 1 full car, but the minimum cost is still assumed to be IDR 100,000)

Total Estimated General Farmer Costs (per planting cycle, 0.2-0.3 ha):

- IDR 120,000 (seedlings) + IDR 80,000 (herbicide) + IDR 300,000 (manure) + IDR 1,000,000 (urea fertilizer) + IDR 100,000 (pesticide) + IDR 50,000 (peeling machine rental) + IDR 350,000 (labor) + IDR 100,000 (transportation) = **IDR 2,100,000**

General Farmer Income: Harvest: 600 kg

- Selling price: IDR 4800/kg
- Total Income: 600 kg x IDR 4800/kg = IDR 2,880,000
- General Farmer Profit: IDR 2,880,000 (Income) - IDR 2,100,000 (Cost) = IDR 780,000 per planting cycle
- **General Average Farmer Profit Margin: 27.08%**

Analysis:

- Farmer profit margins vary depending on productivity and cost management. Farmer A has a higher profit margin because his productivity is much higher (1 ton vs 600 kg for the same land area). This shows the importance of increasing productivity.
- "The average corn farmer in Jolotigo village actually admits that there is not much profit or profit obtained from 1 cycle of corn farming." This statement is supported by the general farmer's profit margin which is only around 27%.
- The biggest costs are fertilizer (especially urea if there is no subsidy) and also cost of labor wages.

4.3 Ratio Analysis

Table 24 Cost benefit ratio and return cost ratio for corn

Actor	Total Cost	Revenue	Profit	RC Ratio	BC Ratio
Farmer	2.5 million	4.8 million	2,3 million	1,92	0,48
Collector	24 million	27,5 million	3,5 million	1,15	0,13

The following is comparison of RC Ratio and BC Ratio for farmer and collector in Corn value chain in the Jolotigo Village.

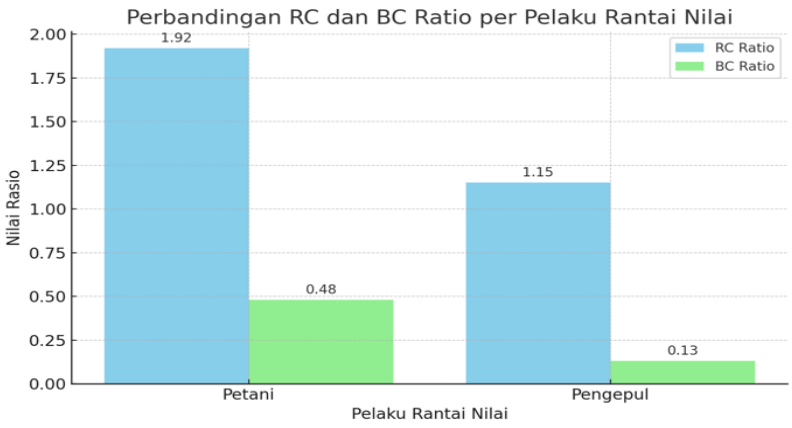


Figure 10 RC and BC comparison for corn value chain actors

This Graphics show that farmers have higher cost return ratio (RC), but still low benefit cost (BC) indicates that the profit margins are thin (the total benefit received by farmers are very minimal), and this can be categorized as subsistence farming.

4.3.1 Cost Benefit Ratio Analysis

Cost Benefit Ratio (BCR) = Total Benefits / Total Costs

- Farmer A: BCR = IDR 4,800,000 / IDR 2,370,000 = 2.02
- General Farmers: BCR = IDR 2,880,000 / IDR 2,100,000 = 1.37

Analysis:

- BCR > 1 indicates that the benefits obtained are greater than the costs incurred, so the activity is technically financially feasible.
- Farmer A has a significantly higher BCR, indicating better efficiency and profitability from his investment in corn farming. This underscores the importance of optimal farming practices to increase financial benefits.
- **The relatively low BCR of general farmers (1.37) explains why they feel their profits are not much.**

4.4 SWOT Analysis

Table 25 Corn SWOT analysis

Strengths	Opportunities
• Land ownership • Potential harvest 2 times per year • Availability of access to seed	• Potential for waste processing (cattle feed) • No barrier for access to market (market price relatively competitive) • KUR is available and also loan from PNM Mekaar
Weaknesses	**Threats**
• Low Productivity • No Farmers group → minimal coordination • Minimal technical skill and farming management • Post-harvest not optima	• Weather is unpredictable extreme , long rainy season • Pests / fungi that regularly infested • Dependence on pricey chemical inputs

4.4.1 Strengths

- Almost all farmers have their own land status, reducing rental costs.
- Seed availability: Hybrid corn seeds are not difficult to obtain from the nearest farmer's shop.
- Access to loans: Farmers have access to microfinance institutions such as BRI (KUR), PNM Mekaar, Komida Cooperative (in the past)
- Farmers have experience in farming corn, although they are self-taught/ hereditary.
- The presence of local collectors: Makes it easier for farmers to sell their crops.
- Women involved in harvesting and drying: Demonstrating positive gender contribution in the production process.

4.4.2 Weaknesses

- Low productivity: The productivity of corn fields is not yet high/relatively low.
- Lack of seed knowledge: Farmers do not really know the types, specifications and characteristics of the seeds they buy.
- Suboptimal planting patterns: Planting techniques and patterns are still random and do not follow the corn GAP.

- Post-harvest techniques are not optimal: Drying and storage problems cause corn to easily become moldy.
- Fertilizer difficulties: Farmers find it difficult to obtain fertilizers (manure and chemical) and consider them expensive.
- Quality seeds are expensive: The price of quality seeds is perceived by farmer expensive.
- Lack of farmer organizations: There are no farmer groups that can serve as a forum for aspirations and cooperation.
- Dependence on local collectors: There is only 1 local collector, which can limit farmers' bargaining power.
- Financial literacy: Not explicitly mentioned during FGD, but with the presence of loan sharks and a lack of understanding of seed specifications, perhaps financial and technical literacy still needs to be improved.
- Unattractive job prospects for farmers: Farmers do not expect their children to continue working as farmers.

4.4.3 Opportunities

- The existence of a fertilizer subsidy program: Through the "farmer card" *(Kartu Tani)*.
- Availability of financial institutions: Providing access to capital for farmers.
- Potential utilization of corn waste: Corn cobs can be utilized for animal feed.
- Increasing demand for corn: Corn is a strategic commodity for animal feed and the food industry. (Demand for corn in Indonesia tends to be stable and increases along with population growth and the animal feed industry.)

4.4.4 Threats

- Unpredictable weather: Prolonged rain causes many corn plant diseases, prone to landslides, the weather tends to be humid.
- Pest and disease attacks: Dry leaves, fungus, caterpillars, crickets, grasshoppers, mice, ants, and corn downy mildew.
- Corn prices fluctuate: Although currently IDR 4800/kg, agricultural commodity prices are susceptible to market fluctuations.
- Competition with neighboring villages: The presence of collectors in neighboring villages can be a competition or an alternative for farmers, depending on the strategy.
- Loan sharks: The existence of loan sharks can be a threat if farmers have difficulty accessing formal loans.
- Dependence on chemical inputs: Continuous use of herbicides and pesticides can have negative impacts on the environment and health.

4.5 Benchmarking Analysis/Comparative Analysis

- Productivity: The productivity of Jolotigo farmers (generally farmers productivity ranging 0.6 tons/0.3 ha = 2 tons/ha upto 3 tons/ha) is relatively low compared to the potential yield of hybrid corn which can reach 8-12 tons/ha (maximum) on optimal land. This shows that there is a large room for improvement, subject to improvement substantially on GAP
- Planting patterns: Random planting patterns and not following the corn GAP are substandard indicators.
- Post-harvest: Drying and storage issues cause mushrooms to exhibit substandard post-harvest standards.

- Institutions: The absence of farmer groups is a weakness compared to best practices in other agricultural areas that have strong farmer groups.
- Average National yield: 6–8tons/ha (Advanced farmers: use superior/high quality seed and employ GAP)

4.6 Institutional Analysis

4.6.1 Institutions Playing Roles

- Farmer's Shop: The main source of information on seeds, although lacking in detail.
- Microfinance Institutions (BRI, PNM Mekaar, Komida Cooperative): Providing access to capital.
- Government: Through the fertilizer subsidy program ("Kartu Tani/farmer card").
- Local Collectors: The main link between farmers and markets.
- Loan sharks: They exist but are not widely used.

4.6.2 Gaps/Weaknesses in Institutional Support

- Lack of agricultural extension: "There has been no regular corn training program provided to corn farming communities in Jolotigo." This correlates with the lack of farmer knowledge about seeds and planting patterns.
- Absence of farmer groups: This hinders cooperation, information exchange, and farmers' bargaining power.
- Lack of information: Farmers rely on farmer shops for seed information which is often incomplete.
- BUMDES capacity relatively unknown
- Access to financial institution not yet optimally utilized, particularly specific credit for agriculture

4.7 Stakeholder Analysis

Table 26 Corn stakeholder analysis

Stakeholders	Role	Influence
Dept. of Agriculture (Dinas)	Coaching, GAP, distribution of fertilizer (subsidy or non-subsidy)	High
Village Government	Mediation & advocacy, BUMDES support	Medium, conflict resolution, service support from BUMDES
Financial institutions	Financing (micro credit)	High, if the scheme & product is right and tailored for corn cycle
Farmer Shop	Input provider, input knowledge	Medium, could serve as agent

Stakeholders	Role	Influence
Collector	Access to market	High, price informer
Husbandry / Poultry	End Buyer	High, local buyer

4.7.1 Key Stakeholders and Their Influence

- Farmer's Shop:
  - Interests: Selling products, retaining customers.
  - Influence: Has a major influence in providing inputs and initial information to farmers.
- Local Collectors:
  - Interest: Buy corn at competitive prices, sell to larger markets.
  - Impact: Determines purchase price at the farmer level, controls farmer access to markets. Limited number of collectors can limit farmer choices.
- Financial Institutions (BRI, PNM Mekaar, Komida Cooperative):
  - Interests: Distributing loans, gaining profit from interest, supporting local economic development.
  - Impact: Provides crucial access to capital for farmers for investment and operations.
- Government (Agricultural Service):
  - Interests: Improving food security, farmer welfare, controlling commodity prices.
  - Influence: Through subsidy policies (fertilizer), extension, regulation.
- NGOs/Academics:
  - Interests: Conducting mentoring, research, community development, advocacy.
  - Impact: Potential to provide training, technology transfer, and facilitate the formation of farmer groups.

4.8 Policy and Regulatory Analysis

4.8.1 Impact of Policies and Regulations

- Fertilizer Subsidy Program ("Kartu Tani/Farmer Card"):
  - Positive Impact: Helps reduce fertilizer costs for farmers with cards, increases access to essential inputs.
  - Negative Impact: If farmers do not have a farmer card, they must buy fertilizer at a much higher market price, creating inequality. The availability of subsidized fertilizer is also an obstacle. Not all farmer have the Kartu Tani (Farmer Card) for accessing subsidized fertilizer
- Regulations regarding the use of pesticides/herbicides (“Glyphosate/Round Up”):
  - Impacts: Glyphosate herbicide use is very common.
  - Although effective, there are global concerns about environmental and health impacts.
  - Tighter regulations or promotion of more environmentally friendly alternatives may be needed.
- General Agricultural Policy:

    - There is no regular maize training program indicating a lack of adequate policy intervention in improving farmer capacity.
- Corn is still perceived inferior by policy makers compared to other staple crops such as rice
- There are not yet available support services such as machines for drying and proper storage (warehouse)

4.8.2 Policy Recommendations

- The government needs to ensure equal access to subsidized fertilizer and consider expanding the scope of the "Kartu Tani/farmer card" program.
- Promote regular corn agricultural extension and training programs, especially regarding Good Agricultural Practices (GAP) and post-harvest management.
- Develop policies that encourage sustainable agricultural practices and reduce reliance on hazardous chemicals.

4.9 Gender Analysis

4.9.1 Gender Role in Value Chain

- Men (Male Farmers): The majority are involved in land preparation, planting, fertilizing, and pest control. Corn farmers who attended the FGD were on average 40-55 years old and are assumed to be dominated by men.
- Women (Farmer's Wives): Involved during harvest and post-harvest drying process. For example, a farmer's wife is involved in corn and coffee farming.

4.9.2 Gender Analysis

- Women have an important role in the post-harvest stage, especially drying, which is a critical stage due to mold problems. Optimizing the role of women in this process can improve the quality of the harvest.
- Training and support should take gender roles into account. Post-harvest training (better drying, storage) will be particularly relevant for women.
- Women's access to information, capital and technology also needs to be addressed to ensure full participation and equal benefits in the value chain.
- There has never been gender sensitive approach in any intervention previously**.**
- Still unclear role and position in the decision-making process
- Potential empowerment in forming cooperative for farmers,
- Potential to be involved in training post-harvest processing of corn (small scale home industry)

In essence, women are very involved in harvesting and post-harvest (drying), which is an important stage to maintain product quality. Capacity building in this area can empower women and increase added value.

4.10 Sustainability and Social Impact Analysis

4.10.1 Environmental Sustainability

- Herbicide Use (Glyphosate/Roundup): Routine use can cause weed resistance, damage soil biodiversity, and potentially contaminate water and soil.
- Pesticide Use: As with herbicides, excessive use can damage ecosystems and threaten the health of farmers and consumers.
- The application of unsustainable farming inputs such as pesticide, and other chemical substance is excessive → potential for land quality deterioration and water contamination
- Tillage Practices: Excessive plowing and hoeing can cause soil erosion, especially in mountainous areas prone to landslides such as Jolotigo.
- Corn Waste: Corn cobs have not been optimally utilized, even though they can be processed into animal feed.
- Impacts of Climate Change: Unpredictable weather, prolonged rains, and high humidity increase the risk of pest and disease attacks, as well as crop failure. The risk of landslides is also increasing.
- There is no plant rotation system
- The concept of climate smart agriculture is not yet practiced
- Landownership is clear; however, the risk is associated with high potential of landslide, and the humid and rainy season makes corn farming prone to disease

4.10.2 Social Impact

- Farmer Welfare: Low profits and the view that farmers' prospects are not attractive indicate problems with the welfare and sustainability of the farming profession.
- Farmer Health: Use of agrochemicals without adequate knowledge can have negative impacts on farmer health.
- Access to Capital: The availability of KUR loans and other microfinance institutions has a positive impact on access to capital, but the existence of loan sharks shows that there is still a gap in financial access.
- Education: A large proportion of the population has a secondary education, which may influence the adoption of modern agricultural technologies and practices.
- Most of corn farmers expressed skepticism with the prospect of corn farming as a good source of income as they signaled that they are not expecting their children to inherit the job as corn farmers (decreased future numbers of corn farmers).

4.10.3 Recommendations for Environmentally Friendly Practices Aspects:

- Reducing the Use of Chemical Herbicides/Pesticides: Encourage Integrated Pest Management (IPM) practices that emphasize both biological and mechanical approaches. If chemicals are used, ensure their use is judicious and safe.
- Utilization of Agricultural Waste: Encourage the processing of corn cobs into animal feed, compost, or biomass energy to reduce waste and add value.
- Soil Conservation: Implementing soil conservation practices such as no-till (TOT) planting or conservation tillage to reduce erosion.
- Agroforestry: Integrating corn planting with trees or ground cover crops to reduce erosion and increase biodiversity.
- Utilization of organic fertilizer: Encourage more massive use of manure and production of organic fertilizer to reduce dependence on chemical fertilizers.

- In short, the main environmental impact comes from the use of glyphosate herbicides and pesticides, which have the potential to damage soil, water, and health. Recommendations include IPM, waste utilization, soil conservation, agroforestry, and the use of organic fertilizers.

4.11 Land Status

4.11.1 Land Status

- Almost all land status used for corn farming is own property (not rented or occupying land owned by Perhutani).
- Investment Security: Land ownership provides long-term security for farmers to invest in land improvements or infrastructure without fear of eviction.
- Access to Credit/Collateral: Land ownership certificates can be used as collateral to obtain loans from formal financial institutions such as BRI KUR, which offer lower interest rates than loan sharks. A Farmer (Mr. A's land is guaranteed with a certificate when borrowing KUR BRI.

- Motivation to Increase Productivity: Farmers are more motivated to increase productivity and maintain land sustainability because the land is their own asset.

4.11.2 Possible Risks

- Scale Limitations: Small average land area (0.2-0.3 hectares) limits the potential for economies of scale and income.
- Landslide Risk: Mountainous areas and high rainfall make the land prone to landslides. Even though it is privately owned, the risk of land damage due to natural disasters remains.
- Land Fragmentation: If land ownership becomes increasingly fragmented across generations, this can reduce agricultural efficiency.
- Lack of Technical Support for Small Farms: Sometimes government programs or modern agricultural technologies focus more on large scale, so farmers with small farms get less attention.

4.12 Climate Change & Risk Mitigation

Table 27 Climate change and risk mitigation affecting corn farming

Risk	Impact	Mitigation
High Rainfall	Diseases & Fungi	Use high tolerant variety of seed
Unpredictable climate and weather	Time management of planting / harvesting season	flexible planting Calendar & support of info from BMKG

Risk	Impact	Mitigation
		info, installation of weather predictor equipment
Rising in temperature or rain and humidity rises	Increasing in disease and pest	Planting rotation, pest control

4.12.1 Assessment of Risks and Impacts of Climate Change and Weather in the Pekalongan Region

Figure 11 Typical weather condition in project area

Jolotigo Village is located in a mountainous area (300-1200 meters) with humid weather, prone to landslides, and quite high rainfall throughout the year. Farmers also complain about unpredictable weather. Prolonged rain increases corn plant diseases.

4.12.2 Risk

- Increased Pest and Disease Infestation: High humidity and prolonged rains are ideal for the growth of fungi (including corn downy mildew), caterpillars, and other insects. This increases crop losses.
- Crop Failure: Unexpected extreme rain or drought can cause total crop failure or drastic reductions.
- Land/Infrastructure Damage: High rainfall and mountainous conditions increase the risk of landslides and flooding, damaging agricultural land and road access.
- Decrease in Harvest Quality: Corn that is too wet at harvest has a lower selling price and is more susceptible to mold if drying is not optimal.
- Shifting Planting Seasons: Uncertainty about the rainy/dry seasons makes it difficult for farmers to determine the right planting time, disrupting the planting cycle.

4.12.3 Impact

- Decrease in Farmer Income: Due to decreased productivity, low quality, and risk of crop failure.
- Increased Production Costs: Increased use of pesticides/fungicides to control pests/diseases, or land improvement costs.
- Threats to Local Food Security: If corn production decreases significantly.
- Migration: Unattractive agricultural prospects due to climate risks may push young people to seek employment in other sectors.
- Further Environmental Impacts: Increased use of chemicals to control pests/diseases caused by climate change.

4.12.4 Climate Change Adaptation Recommendations

- Development of Extreme Climate-Resistant Corn Varieties: Encourage the use of corn seeds that are resistant to high humidity conditions, disease, or drought.
- Weather Early Warning System: Building a simple weather information system that is easily accessible to farmers, enabling them to make better planting decisions.
- Land Drainage Management: Improve the drainage system in corn fields to reduce waterlogging during rain.
- Efficient Irrigation Techniques: If possible, introduce simple irrigation systems to anticipate short dry periods.
- Crop Diversification: Encourage farmers to not only rely on corn, but also to plant other commodities that are more resistant to climate variation.
- Agricultural Insurance: Encourage farmer participation in agricultural insurance programs to mitigate the risk of crop failure due to extreme weather.

4.13 Financial Literacy

4.13.1 Financial Literacy Level

- Indications of Low Financial Literacy:
    - Reliance on Farmers' shop for Seed Information: "farmers are not very knowledgeable about the types, specifications and characteristics of the corn seeds they buy. Explanations about seeds mostly come from the farmers' store where they buy the seeds". This shows a lack of ability to analyze product information and its potential impact on yields and profits.
    - Random Planting Pattern: "random planting pattern and planting distance" and "Techniques and planting patterns that are still unsystematic and do not follow the corn GAP". This indicates a lack of planning and technical understanding which can also impact cost efficiency and productivity.
    - Loans from Loan Sharks: While “not many people borrow money from loan sharks,” the presence and use of loan sharks suggests that some farmers may have difficulty accessing formal loans or may be less aware of the risks and costs of informal loans.
    - Feeling of “Not Much Profit”: Even though the calculations show sufficient profits, this perception may stem from a lack of systematic financial record keeping or understanding of profit margins.
- Indications of Moderate Financial Literacy:

- BRI KUR Access: The existence of farmers who have accessed KUR from BRI amounting to IDR 25,000,000 shows that some farmers are familiar with formal banking products and are able to meet loan requirements.
- Use of Farmer Cards: The fertilizer subsidy program through "farmer cards" shows an understanding and adaptation to government programs that require administrative literacy.

The financial literacy level of corn farmers in Jolotigo varies, tending to be at the elementary to intermediate level. There is a need to improve financial literacy, especially in business planning, financial recording, and investment evaluation (e.g., understanding the impact of seed selection on profits).

4.14 Market System Development (MSD) Framework

4.14.1 Core Value Chain

- Productivity Improvement: GAP training for corn (potential to explore collaboration with seed company), utilization of high-quality seed
- Post-harvest: dryer machine or equipment, watertight storage
- Collective sale (marketing): establishment of farmers group → scaling up volume productivity → price negotiation
-

Supporting Function

- Cooperative for Farmers: shared access to input, tools and equipment, farming management
- Training in basic financial literacy, and digital marketing
- CSR support from Big Inputs Provider company
-

Enabling Environment

- Ownership of Kartu Tani (Card Farmer) for all corn farmers to access subsidized fertilizer
- Endorse the creation of credit micro based on planting cycle
- Regular Training and coaching program from local government (Dinas)

4.14.2 Identification of Value Chain Channels

Main Channels (Current):

Corn Farmers → Local Collectors → Advanced Market/Industry (not clearly identified) → Consumers

Input Channel:

Seed/Fertilizer/Pesticide Producer → Farmer Shop → Corn Farmer

Support Channels:

Financial Institutions → Fertilizer Subsidies, Labor/Equipment Service Providers → Corn Farmers

4.14.3 Recommendations Regarding Market System Development Aspects

Actors in the Core Value Chain Function:

- **Corn Farmer:**
  - Key Success Factors: Increased productivity (yield), adoption of corn GAP, improved post-harvest quality, better access to capital.
  - Constraints: Low productivity, lack of technical knowledge, poor post-harvest, access to expensive quality fertilizers/seeds, no farmer groups.
  - **Recommendation:**
    - Comprehensive Technical Training: Providing regular training on selecting superior seeds (types, specifications, characteristics), correct planting patterns (according to GAP), balanced fertilization, environmentally friendly integrated pest control (IPM).
    - Facilitating the Formation of Farmer Groups: Supporting the formation and strengthening of farmer groups as a forum for learning, sharing experiences, and increasing collective bargaining power.
    - Post-Harvest Development: Training and providing access to improved drying and storage technologies (e.g. simple silage or corn dryers).
    - Capital Access: Strengthening cooperation with financial institutions to facilitate access to KUR or other loans with schemes that suit the harvest cycle.
- **Farmer's Shop:**
  - Key Success Factors: In-depth product knowledge, informative service, availability of quality products.
  - Constraints: Lack of in-depth knowledge provided to farmers.
  - **Recommendation:**
    - Product Education: Encourage farmer shops to receive training from seed/fertilizer/pesticide producers to provide more accurate and complete information to farmers.
    - Diversification of Environmentally Friendly Products: Providing more environmentally friendly product alternatives (e.g. biofertilizers, botanical pesticides).
- **Local Collectors:**
  - Key Success Factors: Stable purchasing scale, competitive pricing, logistics efficiency.
  - Constraints: Only one local collector in the village, potential low bargaining power of farmers.
  - **Recommendation:**
    - Collector Network: Encourage collectors to build wider networks, or facilitate farmers to reach more collectors outside the village.
    - Partnerships: Encourage contractual partnerships between farmers (through farmer groups) and collectors/processing industries to guarantee prices and absorption of output.

Actors in Supporting Function:

- **Financial Institutions (BRI, PNM Mekaar, Komida Cooperative):**
  - Key Success Factors: Flexible loan scheme, easy process, farmers' financial literacy level.
  - Constraints: Collateral requirements (land certificates), lack of understanding of financial literacy among farmers.
  - **Recommendation:**
    - Development of Special Agricultural Financial Products: Creating more flexible loan products, tailored to the corn planting cycle and farmer risks.
    - Improving Financial Literacy: Conducting financial literacy training programs for farmers, including financial management, business planning, and understanding financial products.
- **Government (Agriculture Department):**
  - Key Success Factors: Effective policy implementation, provision of extension services, adequate budget allocation.
  - Constraints: Lack of regular training programs, uneven availability of subsidized fertilizer.
  - **Recommendation:**
    - Active Agricultural Extension: Reactivating the role of field agricultural extension workers (PPL) and conducting regular training on GAP, agricultural innovation, and post-harvest.
    - Strengthening the Subsidy Program: Ensuring the availability and distribution of subsidized fertilizers that are on target and timely.
    - Accurate Agricultural Data: Improving agricultural data collection for better planning and interventions.

Enabling Environment:

- **Policies and Regulations:**
  - Key Success Factors: Pro-farmer policies, regulations that support sustainable practices, easy access to information and services.
  - Constraints: Policies that do not fully support increasing farmer capacity and environmental sustainability.
  - **Recommendation:**
    - Preparation of Local Corn Development Roadmap: Developing a comprehensive strategy to increase productivity, quality, and added value of corn at the local level.
    - Regulation of Chemical Use: Encourage the use of safer chemicals or organic alternatives, accompanied by massive socialization.
- **Availability of Technology and Innovation:**
  - Key Success Factors: Access to superior seeds, modern agricultural tools, post-harvest technology.
  - Constraints: Lack of access to drying equipment, shellers, and corn cob grinders.
  - **Recommendation:**
    - Technology Pilot Project: Conducting a pilot project to introduce affordable and farmer-scale corn cob drying, shelling and grinding technologies.

        - Collaboration with Research Institutions: Facilitating farmer collaboration (through farmer groups) with research institutions for innovation adoption.
- **Market Information:**
    - Key Success Factors: Farmers' access to information on prices, demand and market trends.
    - Constraints: Dependence on local collectors for price information.
    - **Recommendation:**
        - Market Price Information System: Develop a simple platform (e.g. via SMS or group application) to deliver current corn price information.

4.15 Closed Loop System Strategy

Table 28 Closed loop system for corn

Component	Recommendation
Production	GAP, high quality input , bio-fertilizer (introduction of organic inputs)
Input	cooperative + seed distributor
Credit	KUR scheme based on harvest cycle, other micro credit scheme
Post-harvest & logistics	Corn Shelling Tool, dryer tool, local storage
Market	Trading Contract with feed factory or animal husbandry/poultry
Processing	Corn milling , animal feed fermentation

4.15.1 Identification of Value Chain Actors and Institutions Involved and the Potential Involvement of Other Actors in the Value Chain that Can Help Create a Closed Loop System.

Actors and Institutions Involved (currently):

- Core Actors: Corn Farmers, Farmer Shop, Local Collectors.
- Supporting Actors/Institutions: Farm Laborers, Transportation Providers, Pestilence Machine Owners, Microfinance Institutions (BRI, PNM Mekaar, Komida Cooperative), Government (Fertilizer Subsidies), Loan Sharks.

Potential Involvement of Other Actors for Closed Loop System:

- Animal Feed Processing Industry: As a buyer of ground corn cobs or other by-products.

- Local Farmers: As direct consumers of feed from corn cobs or crop residues.
- Compost/Organic Fertilizer Company: If the production of corn waste and manure can be managed centrally on a larger scale.
- Research Institutions/Universities: For the development of corn varieties, post-harvest technologies, and sustainable agricultural practices appropriate to local conditions.
- Environmental/Agricultural NGOs: For technical assistance, facilitation of group formation, and promotion of organic farming.
- Corn-Based Food/Beverage Processing Industry: If there is potential to process corn into final products (e.g. corn flour, chips, corn oil) at the local level.
- Appropriate Technology Providers: Local companies or workshops that can provide or modify affordable corn cob dryers, shellers, and grinders.
- Flow of Commodities:
- Seeds & Fertilizers → Farmers → Corn (harvest) → Local Collectors → Market/Industry → Consumers

4.15.2 Closed Loop System Development Strategy Recommendations

Closed loop system in the context of corn farming in Jolotigo means utilizing all the output and waste from corn production to create added value and reduce dependence on external inputs.

1. Utilization of Corn Cob Waste for Animal Feed:
    - Implementation: Providing corn cob grinding tools at the farmer group level. Training farmers in processing corn cobs into animal feed.
    - Benefits: Reduces waste, creates local animal feed sources (reduces feed costs for farmers), has the potential to increase farmer income through feed sales.
    - Actor Involvement: Farmers (collectors and processors), Farmer Groups (tool managers), Animal Husbandry/Agriculture Service (training).
2. Production of Organic Fertilizer from Corn and Manure Waste:
    - Implementation: Teaching farmers how to make compost from corn crop residue and manure.
    - Benefits: Reduces dependence on expensive chemical fertilizers, improves soil health, reduces waste.
    - Actor Involvement: Farmers, Farmer Groups, Agricultural Extension Workers.
3. Agriculture-Livestock Integration (Agro-silvopastoral):
    - Implementation: Integrating corn planting with small livestock (e.g. goats or chickens) on farmers' land. Corn waste becomes feed, and livestock manure becomes manure.
    - Benefits: Income diversification, increased natural soil fertility, reduced input costs.
    - Actor Involvement: Farmers, Department of Agriculture/Livestock.
4. Development of Processed Corn Products on a Household/Group Scale:
    - Implementation: Train mothers (involved in post-harvest) to process corn into value-added products such as corn flour, corn chips, or fish/bird feed.
    - Benefits: Increased income, product diversification, absorption of harvest results, empowering women.
    - Actor Involvement: Farmers/Farmers' Wives, Farmer Groups/Women Farmer Groups, Industry/Trade Service (marketing).
5. Local Seed Bank:

- Implementation: Farmer groups establish local seed banks to store and distribute maize seeds that are adaptive to local conditions and disease resistant.
- Benefits: Reduces dependence on farmer shops, ensures availability of seeds, maintains local varieties.
- Actor Involvement: Farmers, Farmer Groups.

4.16 Strategic Recommendations

4.16.1 Recommendations for Improvement for Corn Farmers:

1. Technical Capacity Building and GAP Adoption:
   - Continuous Extension: Provide comprehensive regular (not just one-off) corn training programs on selecting superior seeds according to location specifications and objectives, correct cultivation techniques (optimal planting distance, simultaneous planting, balanced fertilization), and Integrated Pest Management (IPM).
   - Demonstration Plots (Demplot): Create a demonstration plot in the village that demonstrates the correct implementation of GAP and its results, so farmers can see first-hand best practices.
2. Post-Harvest Quality Improvement:
   - Procurement of Drying Equipment: Facilitate farmers' access to effective and affordable corn drying equipment to reduce water content and prevent mold. This can be done through farmer groups or rental schemes.
   - Drying and Storage Techniques Training: Teach better drying and storage methods, including the use of corn silage for feed or proper storage in sacks.
3. Strengthening Farmer Institutions:
   - Establishment and Strengthening of Farmer Groups: Immediately facilitate the establishment of corn farmer groups. These groups will be a forum for sharing knowledge, accessing market information, negotiating with collectors (increasing bargaining power), and gaining collective access to tools or loans.
   - Development of Agricultural Cooperatives: If the farmer group is strong, develop it into a cooperative for procurement of inputs (seeds, fertilizer), marketing of harvest results, or management of post-harvest equipment.
4. Integrated Capital Access:
   - Wider Socialization of KUR: More intensive socialization of BRI KUR and other loan schemes, including more simplified requirements and procedures.
   - Financial Literacy Assistance: Through farmer groups, provide basic financial literacy training (record keeping, planning, risk management, understanding financial products).
5. Waste Utilization and Product Diversification:
   - Corn Cob Processing Training: Provide training and equipment support to process corn cobs into animal feed. This not only reduces waste but also creates a new source of income.
   - Corn Processed Product Development: Encourage female farmers to process corn into value-added products (e.g., corn flour, snacks) to diversify income.
6. Climate Change Adaptation:
   - Weather Information Provision: Provide accurate and easily accessible weather information to assist farmers in crop planning.
   - Introduction of Climate-Resistant Varieties: Encourage the use of corn seeds that are more resistant to diseases and extreme weather conditions.

- Soil and Water Conservation: Train farmers in soil conservation practices to reduce erosion and landslide risk, as well as efficient water management.

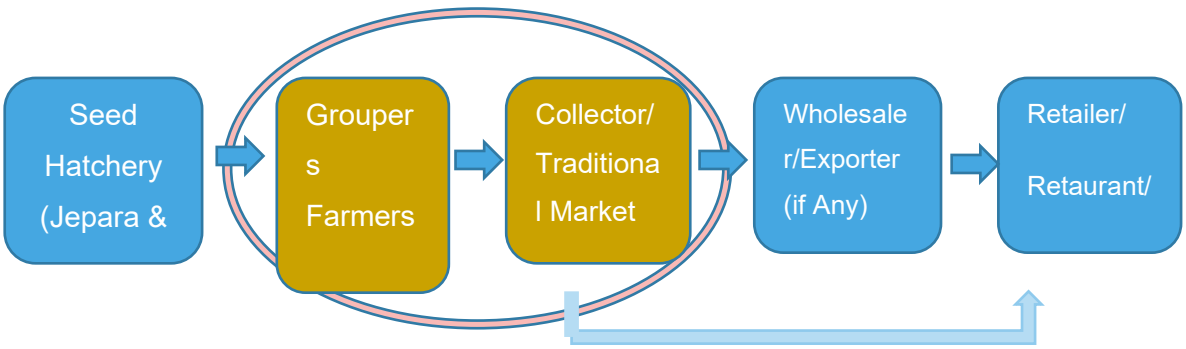
7. Increasing Environmental and Health Awareness:
    - Integrated Pest Management and Chemical Reduction: Educate farmers about the negative impacts of excessive use of chemical pesticides/herbicides and promote Integrated Pest Management (IPM) practices and the use of more environmentally friendly alternatives.
    - Occupational Safety: Socialization of the use of Personal Protective Equipment (PPE) when spraying chemicals.

5 Value Chain Analysis for Groupers Commodity in Pekalongan and Batang Regency

This chapter is an in-depth analysis of the Grouper Fish commodity value chain in Pekalongan as well as Batang Regency. The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various sources). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

The information provided in this assessment report primarily focuses on the challenges and experiences of **former grouper fish farmers** in Pekalongan & Batang (practiced in 2018, and now ceased). While it offers valuable insights into the production stage, a complete value chain analysis from upstream to downstream, including detailed financial calculations for all actors and comprehensive information on all the components analyzed, requires more extensive data and information, especially regarding downstream activities and broader market dynamics. Therefore, this analysis will try to leverage the information gathered during field visits and integrate with general knowledge from secondary sources, and we are also acknowledging the limitations of the assessment.

5.1 Value Chain Stream Mapping



Note: actors circled are those only known present in the assessed areas

5.1.1 Key Actors

- Seed Suppliers: Jepara & Situbondo hatcheries
- Farmers: Former groupers farmers in coastal areas of Pekalongan & Batang
- Feed Suppliers: Local fish markets (natural fish for feed)
- Buyers: Collectors, traders, traditional markets
- Support: Fisheries Dept (Dinas Perikanan)., village government, NGOs

5.1.2 Flow of Commodities:

1. **Seed Production (Upstream**): Grouper fish seeds are purchased from nurseries (hatchery), primarily in Jepara and Situbondo, known for quality seeds and accessibility.
2. **Fish Farming/Cultivation (Upstream - Production)**: Former grouper fish farmers in Pekalongan City cultivated grouper, initially starting in 2018. They utilized fixed cage ponds with nets *(Jaring Tancap)*, often located near milkfish ponds. Farmers manually minced natural fish meat for feed that require extra efforts.
3. **Harvest:** After an 8-10 month cycle, grouper fish are harvested, reaching approximately maximum 1 kilogram per fish.
4. **Distribution (Midstream**): Harvested grouper are sold to collectors or directly to fish traders/retailers in traditional markets. There's also potential for out-of-region sales if packaged well and fresh.
5. **Consumption (Downstream)**: The final consumers purchase groupers from traditional markets or potentially from out-of-region buyers.

5.1.3 Narrative Description of the Grouper Commodities Value Chain

The value chain for grouper commodities primarily focuses on the upstream segment (production) with limited information on downstream activities.

Upstream (Production):

- **Seed Nurseries:** The value chain begins with grouper fish seeds purchased from nurseries in Jepara Regency, Central Java, and Situbondo, East Java. These locations are recognized for producing quality seeds, which are easily accessible and transportable to farmers. The seed price is IDR 1,000 per head for 5 cm seedlings.
- **Grouper (Former) Fish Farmers**: They are the central actors in the upstream segment. They undertook grouper cultivation in 2018, initially with technical guidance from PPL officers of the Pekalongan City Fisheries Service (Dinas Perikanan).
    - Pond Setup: Farmers used fixed cage ponds *(jaring tancap*) constructed with fine mesh nets tied to bamboo stakes, similar to milkfish farming practices. These ponds are located in coastal seas or river estuaries, relying on direct seawater circulation. A typical pond measures 3 meters long, 2 meters wide, and 2.5 meters deep, divided into two parts. Each pond is filled with 150 grouper seeds, separated by size as they grow.

- Feeding: Groupers are fed manually minced natural fish meat. Feed costs around IDR 2,000-2,500 per kilogram. Initially, feed intake is 3 ounces per day for 1.5 months, increasing to 1 kilogram per day as the fish grow.
- Maintenance: Ponds require cleaning every 3-4 months, which involves hired laborers. Nets need frequent replacement (up to 5 times) due to damage from crabs or pufferfish, with each replacement costing around IDR 250,000.
- Labor: Grouper cultivation requires 2-3 daily wage laborers (IDR 100,000/day) for cleaning nets, feeding, and harvesting.
- Challenges: Farmers faced significant challenges, including:
  - Chemical Contamination: Milkfish farmers near grouper ponds often use chemicals to eradicate pests, contaminating surrounding seawater and causing mass grouper mortality (up to 50%).
  - Water Quality: Cold water during rainy seasons or excessive river inflow reduces salinity and temperature, making groupers susceptible to illness and death, as they require high salinity.
  - Pond Infrastructure: Nets frequently suffer leakage. The rising sea level has deepened ponds (from 2 meters to 4 meters), risking fish escaping. The fixed cage system is less durable than floating nets *(Jaring Apung)*.
  - Feed Preparation: Manual mincing of natural fish feed is time-consuming (typically up to 5 hours daily) and labor-intensive.
  - Theft: Grouper fish in ponds are frequently stolen due to their higher market value.
  - Market Price Instability: The selling price in 2018 was IDR 80,000-90,000 per kilogram, but currently, it's IDR 50,000-60,000 per kilogram, this is a disincentive.
- Harvest: The cultivation cycle is 8-10 months. At harvest, 1 kilogram typically contains 2 grouper fish on the average. Initial seed weight of 6 ounces can reach up to 1 kilogram at harvest.

- **Local Collectors/Traders:** At harvest, farmers sold their produce to collectors and directly to fish traders/retailers in traditional markets. There isn't yet a special collector or buyer for grouper fish, but demand exists, and well-packaged fresh fish can be sold outside the region for a higher price.

Downstream (Distribution and Consumption):

The limited assessment duration and further actors outreach provides limited detail beyond initial sales to collectors and traditional market traders. It implies that these actors then facilitate further distribution to consumers, though the specific channels (e.g., wholesalers, retailers, restaurants, direct consumers) are not then elaborated upon. The mention of potential sales outside the region suggests a broader market reach if further supply chains are optimized.

The grouper commodity value chain in Pekalongan, as observed from the FGD, is a nascent and fragile system that has faced significant challenges leading to a halt in local production. It begins with seed nurseries in Jepara and Situbondo, recognized for providing quality grouper seeds. These seeds are then acquired by grouper fish farmers in Pekalongan, who historically cultivated them in fixed cage ponds, often adjacent to milkfish farms. The cultivation cycle spans 8-10 months, during which farmers manually mince natural fish meat for feed, a labor-intensive daily task.

Upon harvest, the groupers, typically weighing around 0.5 - 1 kilogram, are sold to collectors or directly to fish traders in traditional markets. While no specific grouper collectors exist, there is a consistent demand, with potential for sales beyond the local region if properly packaged.

However, the chain is burdened with vulnerabilities. Farmers face severe financial losses due to high mortality rates, primarily from chemical contamination originating from neighboring milkfish ponds. Environmental factors like cold water and low salinity during the rainy season also contribute to fish sickness and death. The fixed cage system is prone to damage from crabs and puffer fish, as well as damaged by strong wind, requiring frequent and costly net replacements. Furthermore, fluctuating market prices and the risk of theft act as significant disincentives.

The enabling environment condition is currently lacks robust regulations on chemical use and land management, contributing to the sector's decline. The observed cessation of farming activities underscores the pressing need for systemic interventions to establish a more resilient and profitable value chain.

5.2 Profit Margin Analysis

Below is the table of profit margin for cultivation and initial sales actor in value chain (2018 data):

Table 29 Profit margin calculations for groupers

No	Actor	Avg.Revenue/kg (IDR)	Avg.Cost/kg (Est.) (IDR)	Avg. Profit/kg (IDR)	Margin (%)
1	Farmers	60,000	40,000–45,000	15,000–20,000*	25% - 33%
2	Collector	70,000	60,000	10,000	14%

Note:

- **This is an estimate based on normal situation*
- *However, actual Farmers' margins are squeezed by feed, seed cost, labor, mortality risk, and infrastructure damage (net replacement). For detailed breakdown, calculations and exemplary cases of Profit Margin, see Annex 1*

Profit Margin Squeeze comes from the following factors:

- High Seed Cost: IDR 6,000 per seed is a significant initial outlay.

- High Mortality Rates: 50% mortality (at the minimal and 100% loss at the maximal) due to chemicals and potential mortality from cold water severely reduces the harvestable yield.
- Fluctuating Market Prices: The current market price of IDR 50,000–IDR 60,000 per kilogram is a disincentive compared to the 2018 price of IDR 80,000–IDR 90,000, directly squeezing farmer profit margins.
- Feed Costs: While natural fish meat is "inexpensive" per kg, the volume needed makes it a substantial cost and such feed is actually rots quickly and can cause disease to the fish
- Net Durability: Frequent net replacement adds recurring costs.

5.2.1 General Observations on Profit Margins

- Seed Nurseries (based on assumptions): Likely have a healthy profit margin given their specialization and recognized reputation. However, no financial data is provided.
- Grouper Farmers: Experience highly squeezed margins, often leading to losses, primarily due to:
  - High initial investment (seeds, netting setup).
  - Significant ongoing operational costs (mostly feed, labor, & net replacement).
  - High mortality rates from chemical contamination and unfavorable water conditions (salinity and temperature).
  - Unstable and declining current market prices.
- Collectors/Traders (based on estimates): They likely factor in transportation, handling, and market demand, aiming for a profitable markup (margins). Their still existence suggests they find enough margin to operate.

5.2.2 Conclusion on Profit Margin Analysis

The current structure and existing unfavorable conditions, especially for farmers, appears to be operating at very low or negative profit margins (due to losses), making it unsustainable, which is why farmers have ceased cultivation. The lack of a stable market price and significant uncontrollable risks (chemical contamination, environmental changes) are major contributors to this issue, even though grouper is high value commodity factually.

5.3 Cost-Benefit Ratio Analysis, Productivity (Yield) & BEP Analysis

This is the calculation using the average scenario; since from farmers experience, there are cases of high mortality losses (more than 50% fish die) and there are cases with moderate mortality rate (around 50%) and rare case with low mortality rate (less than 50 %, on average 30% is generally considered normal).

Table 30 Cost-benefit ratio calculations for groupers

No	Items	Amount (IDR)
1	Total Cost (2000 seed, feed, netting, labor,etc)	45,385,000
2	Revenue (case: harvest 850 kg): current price approx.IDR 55,000/kg (IDR 50,000 – 60,000 per kg)	46,750,000
3	Net Profit	1,365,000
4	BC Ratio	1.03

Since the BC calculation is still greater than 1, thus the Groupers commodity is still considered a feasible business (however this is relatively tight, given that the cycle is 8-10 month, and it explained why farmers abandoned this business).

The following analysis aims to quantify the financial viability. Given the data limitations, we will focus on the farmer's perspective, using the "Farmer B" example for a more optimistic scenario (since Farmer A suffer loss).

Farmer B (2000 seeds, 850kg harvest):

Total Benefits (Revenue): IDR 46,750,000

Total Costs: IDR 45,385,000

Benefit-Cost Ratio (BCR):

BCR = Total Benefits / Total Costs = IDR 46,750,000 / IDR 45,385,000 = 1.03

A BCR of 1.03 means that for every IDR 1.00 spent, the farmer generates approximately IDR 1.03 in revenue. While greater than 1, indicating a positive return, it's a very narrow margin, leaving little room for unforeseen circumstances or economic shocks (especially fishery is a sector prone to climate risks). This low BCR confirms the squeezed profit margins and explains why farmers abandoned grouper cultivation. The high risks (mortality, price fluctuations) make such ***a slim margin.***

Given the limited and sometimes contradictory financial data informed by the farmers, a precise C/B ratio is hard to achieve in accuracy. However, we can highlight key cost drivers and benefits.

5.3.1 Costs

- Initial Capital: Seeds (significant) and increase as the number of seeds to cultivate, pond equipment/netting (the number and coverage area also adjusted with the volume of fish to cultivate)
- Operational Costs:
  - Feed (manual mincing, large quantity).
  - Labor (daily wages for cleaning, feeding, harvest).
  - Net replacement (frequent).
  - Pond cleaning (every 3-4 months, requires labor).
- Hidden/Externalized Costs:
  - Losses due to chemical contamination.
  - Losses due to cold water/low salinity.
  - Losses due to theft.
  - Time spent on manual feed preparation, extra efforts (5 hours/day).

5.3.2 Benefits

High Value Commodity: Grouper has a high selling price compared to other fish.

Potential for High Revenue: Farmers who had good harvests (e.g., 2000 seeds yielding 800-900 kg, or 5000 seeds yielding 2 tons) suggest significant revenue potential.

The recurring issues of high mortality rates from external factors (chemicals, weather), exacerbated with fluctuating market prices and significant operational costs (feed, labor, net replacement), suggest that the current cost-benefit ratio for many farmers is “unfavorable”, leading to them ceasing cultivation.

Pond infrastructure is one area of priority to get attention:

The initial high investment for floating nets/”Karamba Jaring Apung” (IDR 20-30 million) is a barrier, even though it offers better durability and avoids sinking risks, and in the long run would decrease operational and maintenance cost thus resulting in higher profits.

5.3.3 Productivity

This is the calculation of scenario for making this Grouper could be attracted again by farmers and willing to go back doing this business

Table 31 Productivity calculations for groupers

Metric	Value
Productivity (per 5000 seeds)	~2,000 kg (~ 400 kg/1,000 seeds)
Yield per m² (pond 8x8~64m²)	~31.25 kg/m²

Metric	Value
Minimum Optimum Productivity	400–500 kg from 1000–1500 seeds
Cost per 1000 seeds	IDR 6,000,000
Feed cost per cycle	IDR 5,000,000–6,000,000
Revenue per 1000 seeds (if survived)	IDR 24,000,000–30,000,000
Profit per 1000 seeds	IDR 8,000,000–12,000,000

Based on these theoretical calculations (assuming the risks and cost associated is normal and controlled) then the grouper cultivation venture is actually viable in business sense.

5.3.4 Break-Even Point (per cycle)

Break-even point (BEP) is the point where total costs equal total revenue (zero profit)

Farmer's Break-Even Point (using Farmer B's cost structure as an example):

Total Fixed Costs (initial investment, some equipment): IDR 6,000,000 (seeds) + IDR 4,000,000 (netting) = IDR 10,000,000.

Total Costs (for 2000 seeds): = IDR 45,385,000

selling price is IDR 55,000/kg.

BEP in kg: Total Costs/ Price per kg = IDR 45,385,000/ IDR55,000 = **825 kg.**

This means for a farmer with a similar result to Farmer B (2000 seeds and associated costs), they need to harvest approximately 825 kg of grouper fish to break even. Farmer B harvested 850 kg, which is just above the break-even point, confirming the very thin profit margin.

5.4 SWOT Analysis

Table 32 Summary SWOT Analysis Table

Strengths	Opportunities
• High market value commodity	• Export potential,

• Existing experience & basic infrastructure • Quality seeds accessible (Jepara/Situbondo)	• Potential for demo plots with ideal controlled ecological ecosystem • Potential Closed-loop system with village facilitation
Weaknesses	**Threats**
• Vulnerability of ponds • Susceptible to disease, • salinity changes • Low adoption of floating cages • high feed efforts and other variable costs • Theft and chemical contamination from neighbors • Reliance on external water circulation, prone to natural disasters and pollution • Low Literacy	• Climate change, • Chemical contamination • sea level rise • price instability • No exclusive collectors • low cooperation

5.4.1 Strengths

- **Technical Guidance Availability**: Initial technical support from Pekalongan City Fisheries Service PPL officers (Dinas Perikanan, Kab. Pekalongan).
- **Quality Seed Source**: Access to quality grouper seeds from renowned nurseries in Jepara (Central Java) and Situbondo (East Java Province) is available and easy
- **High Survival Rate (Initial**): Historically, a 70% survival rate from seeds to harvest was achievable (this information confirmed by the PPL officer)
- **High Value Commodity:** Grouper fish is a high-value commodity, fetching higher prices than other fish if successful.
- **Established Local Market**: Direct sales to collectors and traditional market traders exist.
- **Farmer Experience**: Farmers have prior experience in grouper cultivation (albeit former and not currently practicing).

5.4.2 Weaknesses

- **Vulnerability of Fixed Cages**: Nets are prone to leakage from crabs/pufferfish and require frequent replacement, adding to costs and labor for maintenance.
- **Manual Feed Preparation**: Time-consuming and labor-intensive, need extra efforts (up to 5 hours daily).
- **Spoilage of Natural Feed**: Natural fish meat spoils quickly and can carry disease
- **High Operating Costs**: Significant costs associated with seeds, feed, labor cost, and net replacement.
- **Limited Technical Knowledge/Practices:** Farmers do not use chemicals for pest/predator control due to grouper sensitivity, but lack alternative effective methods when faced with external chemical contamination (from neighboring ponds).

- **Lack of Dedicated Post-Harvest Infrastructure**: No specialized collectors or buyers for grouper, potentially limiting market reach and pricing power for farmers.
- **Inadequate Pond Design**: Fixed cages are susceptible to rising sea levels, leading to sinking nets and fish escape risks.
- **Lack of Capital for Better Pond Infrastructure**: Farmers are reluctant to invest in more durable but expensive floating net systems (*Jaring Apung)*
- **Financial Literacy:** Implied low financial literacy given the challenges in managing costs and understanding risk.

5.4.3 Opportunities

- **High Market Demand**: Even with current instability, requests for grouper exist, and fresh, well-packaged grouper can be sold outside the region at higher prices (global export market is huge)
- **Improved Market Access**: Potential for specialized collectors/buyers for groupers
- **Potential for Improved Technology**: Adoption of Floating Net Systems (FNS) / *Karamba Jaring Apung (KJA*) offers durability and mitigates sinking risks, though with higher initial costs.
- **Government/Village Facilitation**: Potential for agreements and regulations among farmers, supported by local government, to control chemical use and enhance security.
- **Demonstration Plots**: A successful pilot project could convince farmers of the profitability of grouper farming (**one area of priority needs to apply in implementation phase)**
- **Increased Awareness**: Growing awareness of environmental aspects among farmers could lead to more sustainable practices.
- **Value-Added Processing**: Potential for processing or better packaging could open up new markets and higher prices.
- **Technological Advancement (Chopping Machines**): Basic need for chopping machines to reduce labor and time in feed preparation.

5.4.4 Threats

- **Chemical Contamination**: Uncontrolled use of chemicals by neighboring milkfish farmers leads to mass grouper mortality.
- **Climate Change/Environmental Factors**: Decreased water salinity and drop in temperature during rainy seasons, as well as rising sea levels, negatively impact grouper health and pond infrastructure.
- **Market Price Instability and Decline**: Current market prices are significantly lower than in 2018, discouraging farmers.
- **Theft:** High value of grouper makes them targets for theft. (security and community patrol need to be considered)
- **Lack of Collective Action:** Absence of strong agreements among farmers regarding chemical use and security exacerbates risks as well as land management
- **Competition:** Other fish commodities or grouper producers from other regions.
- **Lack of Regulations/Enforcement**: ***Absence of clear regulations on chemical use and pond land management contributes to contamination issues (one area of priority in term of policy formulation and advocacy that potential to be supported in future project)***

5.5 Benchmarking (Comparative) Analysis

Table 33 Benchmark Summary

Factor	Groupers Fish	Milkfish
Market Price	IDR 50,000–90,000/kg	IDR 20,000–30,000/kg
Cycle Time	8–10 months	5 months
Risk	High (salinity, theft, mortality)	Medium
Feed Cost	Low (manual mincing, extra effort)	Low (pellet food)
Technology Use	Low (fixed nets)	Low (fixed nets)

Note: Grouper is more profitable, but also riskier, and need more efforts.

The following is the analysis of benchmark, yet lacks direct external benchmarks, however we could compare inter-commodities benchmark and inter-infrastructure comparison as benchmark

- **Fixed Cage vs. Floating Net System (FNS):**
  - **Fixed Cage (Current Practice*)/"Karamba Jaring Tancap***": Lower initial cost (implied by farmers not using FNS, though not explicitly stated for fixed cages), but high maintenance (frequent net replacement), vulnerable to leakage, and susceptible to rising sea levels leading to sinking and escape of fish risks.
  - **Floating Net System / FNS (Proposed)*/"Karamba Jaring Apung'***: Higher initial cost (IDR 20,000,000-30,000,000), but more durable (5-10 years) and immune to sinking due to following sea levels. This comparison suggests that while the upfront cost is a barrier, FNS offers significantly better long-term durability and operational stability, reducing maintenance costs and risk of loss.
- **Grouper vs. Milkfish Farming**:
  - Grouper ponds are often located near milkfish ponds. However, milkfish farmers use chemicals that are detrimental to groupers, highlighting a critical conflict in farming practices and environmental management and also potential for social conflict.
  - Water Reliance: Both rely on water circulation from direct seawater.
  - Pond Structure: Grouper farmers used fixed nets tied to bamboo stakes, similar to milkfish farming practices.
  - Chemical Use: Milkfish farmers use chemicals to eradicate "pest" fish, which is a major threat to grouper cultivation. Grouper farmers do not use chemicals due to sensitivity.
  - Floating Net System: Neither traditionally use floating net systems due to high initial cost, despite benefits.
- **Against Best Practices (General Aquaculture):**
  - Feed Management: Manual mincing and use of perishable natural fish meat is less efficient and carries disease risk compared to formulated, balanced feeds used in modern aquaculture.
  - Biosecurity: Lack of control over external chemical contamination indicates poor biosecurity practices.
  - Disease Prevention: Dependence on natural conditions (salinity, temperature) rather than controlled environments, leading to disease susceptibility.

- Market Integration: Lack of specialized collectors and reliance on traditional market channels suggests less developed market linkages compared to more integrated value chains.

- **Profitability**: The low or negative profitability of grouper farming, as experienced by former farmers, can be benchmarked against other aquaculture commodities in the region. The fact that farmers stopped cultivating groupers suggests that other commodities (e.g., milkfish, if profitable for them) offer better returns or ***lower risks.***

5.5.1 Recommendations for Improvement

- **Adopt Floating Net Systems:** Despite higher initial costs, the long-term benefits of durability and reduced risk outweigh the fixed cage system's problems. Financial assistance or cooperative models could help farmers overcome the initial investment barrier.
- **Establish Collective Agreements**: Implement community-wide agreements, facilitated by local government (regency government for inter-village agreement) and Village government (inter-people in the village), to prohibit chemical use in shared waters, drawing inspiration from success stories like Desa Jeruk Sari.
- **Mechanize Feed Preparation**: Invest in a machine for chopping fish feed to reduce labor efforts and time, improving efficiency and potentially reducing costs.
- **Shift to formulated feeds**, this would incur higher input cost, however more robust yield
- **Implement stricter biosecurity** measures and advocate for chemical-free zones (through policy formulation support, could be at village level, regional level, and even national level).
- **Support the Development of stronger farmer associations** for collective action and market negotiation.

Figure 12 Karamba Jaring Apung/KJA (Floating Net System/FNS)

5.6 Institutional Analysis

5.6.1 Existing Institutions/Groups

- **Grouper Fish Farmers (Community Group):** While they form a group that participated in the FGD, their current operational cohesiveness and ability to

collectively address challenges are neither operational nor effective, as they have ceased grouper cultivation.

- **Pekalongan City Fisheries Service (PPL Officers)**: Provided initial technical guidance. Their role seems to have been primarily at the beginning of cultivation, however not continued.
- **Local Collectors and Traditional Market Traders:** Act as intermediaries in the market chain.
- **Nurseries in Jepara and Situbondo**: Supply a critical input to the value chain.

5.6.2 Institutional Gaps and Weaknesses

- **Lack of Strong Farmer Cooperatives/Associations**: The absence of a robust farmer group or association dedicated to grouper farming prevents collective action on issues like chemical contamination, theft, shared security/community patrol, market/price negotiation, and shared investment among farmers (e.g., Floating Net System co-operations).
- **Limited Government Intervention** (No further ongoing intervention): While initial guidance was provided, there's a need for sustained technical assistance, regulatory enforcement (policy on chemical use and environmental protection), and facilitation of collective agreements.
- **Local Government**: Identified as key facilitators for creating a conducive enabling environment, including joint agreements and security. This government institutions encompassing the provincial government, the regency (regional government) and the Village government. (area of priority to develop collaboration for empowering the enabler in the future implementation of the project).
- **Fragmented Market Linkages**: No specialized buyers for grouper indicate a less developed institutional framework for market access and potentially unfair pricing for farmers/asymmetric information.

5.7 Stakeholder Analysis

Table 34 Stakeholders Summary

Stakeholders	Role / Interest	Influence
Farmers	Production, labor	High
Collectors/Buyers	Market linkage	Medium
Fisheries Dept (Local Govt)	Technical support	Medium
Village Govt.	Policy enforcement, Community Agreement Facilitation	Medium
Hatcheries	Seed suppliers	Low
NGOs/University	Facilitation, Capacity building	Medium

Stakeholders	Role / Interest	Influence
Financial Institutions	Provide access to financial product	Medium
Milkfish Farmers (Adjacent)	Use chemical substance as pest control	High

5.7.1 Key Stakeholders and Their Influence

- **Grouper Fish Farmers:**
  - Interests: Production, Profitability, sustainable livelihood, reduced risks (mortality, theft), market access, fair prices.
  - Objectives: To resume and sustain/get benefit from profitable grouper cultivation.
  - Influence: Directly control production; their collective action (or lack thereof) significantly impacts the sector's viability. Their current cessation of activity highlights their profound influence.
- **Seed Nurseries (Jepara, Situbondo**):
  - Interests: Consistent demand for quality seeds, fair prices for their product.
  - Objectives: To maintain and expand their market for grouper seeds.
  - Influence: Critical upstream suppliers; the quality and availability of their seeds directly affect farmer success.
- **Pekalongan City Fisheries Service/Dinas Perikanan (PPL Officers):**
  - Interests: Promoting sustainable aquaculture, improving farmer livelihoods, food security policy.
  - Objectives: To provide technical guidance and support to farmers.
  - Influence: Provision of technical expertise and initial support. Their sustained engagement is crucial for long-term success.
- **Adjacent Milkfish Farmers (Neighboring**):
  - Interests: Efficient and profitable milkfish farming, pest control.
  - Objectives: To maximize their milkfish yield, generally includes using chemicals to control non-milkfish species.
  - Influence: Their farming practices (chemical use) have a devastating negative impact on grouper farmers, highlighting a significant inter-stakeholder conflict.
- **Local Collectors/Traditional Market Traders**:
  - Interests: Sourcing fish at competitive prices, efficient distribution, meeting market demand.
  - Objectives: To maximize their trading profits.
  - Influence: Act as primary market access points for farmers. Their pricing and demand directly affect farmer revenue.
- **Local/Village Government**:
  - Interests: Community welfare, economic development, environmental protection, facilitating people.
  - Objectives: To facilitate agreements, enforce regulations, provide security, and support local industries.
  - Influence: Can create an enabling environment through regulations, patrols, and community mobilization.
  - determine the viability of the entire chain.

- **Financial Institutions (BRI, PT PNM MEKAR, Local Microfinance Institution**):
  - Interests: Profitable lending, risk management.
  - Objectives: To provide capital for investment.
  - Influence: Crucial for enabling adoption of fairly costly infrastructure like Floating Nets.
- **Academic/Research Institutions/NGOs**:
  - Interests: Knowledge generation, technological advancement, community development.
  - Objectives: To develop and disseminate improved farming practices, introduction of new technologies.
  - Influence: Can provide scientific support and innovation for sustainable aquaculture.
- **Consumers**:
  - Interests: Access to fresh, affordable, and safe grouper fish.
  - Objectives: To purchase grouper fish for consumption.
  - Influence: Drive market demand; their preferences and purchasing power ultimately

Figure 13 Fixed cage adjacent with Floating Net System

5.7.2 Interactions and Gaps:

The most critical interaction gap is the conflict between grouper farmers and milkfish farmers over chemical use. There is also a lack of strong, formal collaboration among grouper farmers themselves and insufficient ongoing support/regulation from local government to address this and other systemic issues (theft, market and price instability). This will be elaborated further in next section of this document

5.8 Policy and Regulatory Analysis

5.8.1 Existing Policies/Regulations

- **Technical Guidance from Fisheries Extension Service (PPL Officer)**: Suggests some level of government involvement in promoting aquaculture.

5.8.2 Policy Gaps/Weaknesses (Either Implied or Direct)

- **Implicitly Lack of Regulation on Chemical Use**: A major gap is the absence of regulations or joint agreements preventing the use of harmful chemicals in surrounding ponds, directly leading to mass mortality. The widespread use of chemicals by milkfish farmers and its devastating impact on grouper farmers implicitly indicates a significant

regulatory gap or insufficient enforcement regarding water quality and ban of chemical discharge in shared aquaculture areas.

- **Enforcement:** Even if regulations exist, their enforcement appears weak given the continued chemical contamination.
- **Land Management Regulations**: a need for "regulations on pond land management", implying the non-existing (or existing but perhaps insufficient) frameworks of land use and land management or the need for new clear regulations.
- **Theft Prevention:** No clear policies or enforcement mechanisms to deter fish theft

5.8.3 Impact on the Value Chain

- **Negative Impact of Chemical Contamination**: The lack of effective regulations or enforcement against harmful chemical use by neighboring farmers is a primary cause of farmer losses and the cessation of grouper cultivation. This policy gap directly undermines the profitability and sustainability of the entire grouper value chain at the production level.
- **Weak Enforcement against Theft:** The frequently happening theft of high-value grouper fish suggests inadequate security enforcement or policies, discouraging new investment and participation in the value chain.
- **Insufficient Support for Sustainable Technologies**: While floating nets *(jaring apung*) are known to be superior, there appears to be no policy, programs or financial incentive to help farmers adopt this more expensive but sustainable technology.
- **Lack of Integrated Coastal Zone Management**: The issues of rising sea levels and shared water resources pointing out to a need for more comprehensive coastal zone management policies that taking into account the interdependencies of various aquaculture activities and environmental changes.

5.8.4 Recommendations for Policy and Regulatory Improvements

- **Implementation of Strict Regulations on Chemical Use**: Implement and rigorously enforce regulations prohibiting the use of harmful chemicals in shared aquaculture waters. This requires clear demarcation of zones and regular monitoring accompanying Community agreements, facilitated by the government, as suggested, should be formalized into local regulations. This could be in the form of ***Village Regulation (Peraturan Desa/PerDes).***
- **Enhanced Security Measures**: Implement joint patrol and security agreements, potentially involving community and local government, to deter theft. This could be supported by local ordinances.
- **Incentives for Sustainable Practices**: Develop policies that provide financial incentives (e.g., subsidies, low-interest loans) for farmers to adopt more sustainable and resilient technologies like Floating Net Systems.
- **Integrated Aquaculture Zoning:** Establish clear zoning regulations for different aquaculture activities (e.g. grouper zone vs. milkfish zone) to prevent negative externalities and promote harmonious co-existence between farmers (avoiding potential social conflict)
- **Disaster Preparedness and Climate Adaptation Policies**: Develop policies to help farmers adapt to climate change impacts like rising sea levels and temperature fluctuations, potentially including insurance schemes from Insurance Company or infrastructure support.
- **Market Price Stabilization Mechanisms**: Explore policies that could help stabilize market prices for high-value commodities like grouper, perhaps through market information systems or support for collective marketing.

5.9 Gender Analysis

The FGD has very limited direct information for comprehensive gender analysis. The roles and involvement of women in grouper farming are not explicitly mentioned in the discussion. However, some shared conditions inferred based on general aquaculture practices in Indonesia:

- **Labor Division**: In many traditional aquaculture settings, men are primarily involved in physically demanding tasks like pond construction, net setting, feeding, and harvesting. Women often play crucial roles in post-harvest activities such as cleaning, sorting, processing, and marketing fish. They may also be involved in managing finances and household decisions related to farming.
- **Decision-Making**: During discussion, specifying gender roles in decision-making regarding cultivation practices, investment, or sales is not clearly mentioned. It is common for men to be the primary decision-makers regarding farm operations, while women often have significant influence over household finances and consumption.
- **Access to Resources**: We have no specific information on whether women farmers have equal access to technical guidance, financial resources, or land/pond tenure.
- **Impact of Challenges:** The challenges faced (chemical contamination, theft, price instability, manual labor) would likely impact all members of a farming household. However, if women are involved in certain tasks (e.g., manual feed chopping, which is time-consuming), they might bear a heavier burden. The time required for manual feed preparation could also limit women's participation in other income-generating activities or household responsibilities.

5.9.1 Potential Areas for Gender-Sensitive Interventions

- **Data Collection**: Future FGDs or surveys or even in the implementation phase of the project, should explicitly gather gender-disaggregated data on roles, responsibilities, decision-making power, access to resources, and income within grouper farming households.
- **Targeted Training**: Ensure that technical assistance and training programs are accessible to and tailored for both men and women farmers, considering their specific roles and literacy levels. Mostly women are suitable with training related with simple accounting, book keeping and recording.
- **Financial Inclusion**: Ensure women have equal access to financial literacy training and credit facilities for investment in improved technologies
- **Promote Women's Participation in Decision-Making**: Encourage women's involvement in farmer groups and community-level agreements regarding chemical use, security, and market strategies.

5.10 Sustainability and Social Impact Analysis

5.10.1 Environmental Sustainability

- **Positive Aspect (Farmer's Intent)**: Farmers do not use chemicals as anti-pest and anti-predator drugs because they are sensitive to grouper health. This indicates an inherent awareness of the negative impact of chemicals on their cultivation.
- **Major Threat (External Chemical Contamination)**: The most significant environmental threat is the contamination of surrounding seawater by chemicals used by neighboring milkfish farmers. This leads to mass grouper mortality and directly

compromises the sustainability of grouper aquaculture in these shared water areas. This also indicates a broader ecosystem impact beyond just the grouper ponds.

- **Pond Infrastructure Impact**: The use of fixed nets *(Jaring Tancap)* susceptible to damage from crabs/pufferfish indicates a need for more robust, potentially less environmentally impactful materials or designs. The frequent replacement of nets also has implications for waste generation apart from affecting farmers household economic.
- **Rising Sea Levels:** This is a direct environmental impact of climate change affecting pond viability, risking fish escape into the open sea and requiring adaptation in pond design. The impact of Rising Sea Levels makes ponds becoming deeper and the risk of fish escaping suggest a vulnerability to climate change, potentially impacting the marine ecosystem if farmed fish escape.
- **Water Quality**: Cold water (during rainy season) and decreased salinity due to excessive river inflow (especially ponds situated in the estuary), often exacerbated by climate patterns, directly impact grouper health, highlighting the sensitivity of this species to environmental fluctuations. The use of fixed cages and reliance on direct seawater circulation without controlled systems could lead to localized water quality (water quality degradation) issues if not managed properly.
- **Waste from Natural Feed Source**: Reliance on natural fish meat as feed raises questions about the sustainability of the source and its impact on wild fish populations. Large amount of fish meat as feed requires proper storage and handling, since it susceptible to rot and inviting pest and insects.: While natural, minced fish feed can contribute to organic loading if not fully consumed, affecting water quality. It also spoils quickly and can carry disease.
- **Waste Management:** No specific mention of waste management from pond operations or processing, which can impact local water quality. However it was implied that netting waste as need frequent replacement could lead to plastic waste in the marine environment.

5.10.2 Social Impact

- **Loss of Livelihood:** The cessation of grouper cultivation by farmers due to unprofitability and high risks has a direct negative social impact, leading to loss of income and livelihoods for the farmers and associated laborers (ponds management employs labor from local people)
- **Economic Instability:** The instability of market prices and high financial risks create economic precarity for farming households. Economic. Price instability and high risks deter farmers from engaging in grouper cultivation, hindering local economic development.
- **Community Conflict:** The conflict arising from chemical use by neighboring milkfish farmers creates social tension and undermines community cohesion.
- **Food Security/Availability:** The decline in local grouper production is actually a loss and could affect local food supply.
- **Labor Conditions:** Manual, time-consuming tasks like feed preparation represent a burden on farmers/laborers.
- **Security Issues**: Theft of fish can lead to distrust and insecurity within the community, as well as social unrest since grouper is a high value commodity.
- **Potential for Empowerment**: If successful, a revived and sustainable grouper industry could empower farmers, create employment, and improve rural livelihoods.

5.10.3 Recommendations for Sustainability and Social Impact

- **Implement Integrated Coastal Management:** Develop and enforce comprehensive management plans for coastal areas to regulate land use, chemical substance discharge, and aquaculture zoning, ensuring the sustainability of shared aquatic resources.
- **Promote Environmentally Friendly Aquaculture Practices, Enforce Chemical-Free Zones**:
    - Strongly enforce prohibitions on harmful chemicals in aquaculture zones.
    - Crucial to implement and enforce joint agreements or regulations to prevent chemical use in surrounding areas. Village and local governments should facilitate this.
    - Research, investigate and promote sustainable feed alternatives to natural fish meat.
    - Encourage the adoption of **Floating Net Systems** *(**KARAMBA JARING APUNG**)* to reduce infrastructure failure and material waste. *Explore subsidies or collective purchasing models or tailored financing from financial institutions.*

Figure 14 Karamba Jaring Apung

- **Climate Change Adaptation**:
    - Research and adopt grouper variety more tolerant to temperature and salinity fluctuations.
    - Develop pond designs that are resilient to rising sea levels.
    - Implement early warning systems for adverse weather conditions (use of weather technology).
    - Coastal areas like Pekalongan and Batang are vulnerable to increased storm intensity and frequency with climate change. This could damage fixed cage structures and lead to further escape or loss of fish.
- **Strengthen Community Governance:** Facilitate community agreements and local regulations to address shared resource management (chemical use, security) and foster collective responsibility.
- **Support Diversification and Value Addition**: Encourage farmers to explore other aquaculture species or value-added processing of grouper to reduce reliance on a single commodity and increase resilience.
- **Improve Working Conditions:** Introduce appropriate technology (e.g., feed choppers) to reduce manual labor burdens.
- **Socialization and Awareness:** Conduct extensive campaigns to raise environmental awareness among all fish farmers regarding the interconnectedness of their practices and the need for collective awareness and stewardship.

- **Site Selection:** Future pond development should consider areas less prone to severe salinity and temperature fluctuations, or invest in technologies to maintain optimal water parameters. **Pilot Project with site selection** for demonstration plot is good test case for ideal environment for grouper cultivation

5.11 Market System Development (MSD) Framework

To make the market system development functioning there are the needs of expected roles or activities to be taken up for the Grouper Farmers as the central Actor in the value chain

Table 35 Roles and activities in MSD framework for groupers

	Expected Roles /Activities
Core Value Chain Actors	• Empower farmers through cooperatives or farmers association • Establish direct partnerships with downstream buyers (restaurants/exporters)
Supporting Functions	• Feed chopper machine sharing • Floating cage financing (KUR/Kredit Usaha Rakyat financing, subsidy, CSR, village fund/*Dana Desa*)
Enabling Environment	• Village-level regulations prohibiting/banning use of chemicals substances • Community security patrols (for theft issue and rampant use of non-ecological substance • Demo plot replication to showcase success to encourage the willingness to back to business (groupers fishery)

Potential Involvement of other Actors in the framework of Market System Development & Establishment of A Closed-Loop System:

- **Core Value Chain Functions**:
  - **Processing Units:** For value-added products (fillets, frozen, smoked) to increase shelf-life and market reach.
  - **Retailers (Modern):** Supermarkets, specialized fish shops for broader consumer access.
  - **Restaurants/Hotels**: Direct sourcing of fresh grouper.
  - **Exporters:** To access international markets for higher prices, especially if quality standards are met.
- **Supporting Functions**:
  - **Financial Institutions: Banks (Bank Rakyat Indonesia**, at provincial or regency branch), Financing Institutions (**PT PNM Mekar, Pekalongan Branch**), Microfinance Institution (**BPR, Cooperatives, BMTs** and other existing MFIs operating in Pekalongan & Batang) for micro credit and loans.

  - **Aquaculture Technology Providers**: For Floating Net Systems (nearest producer and industry), automated feeders, water quality monitoring.
  - **Veterinary Services/Fish Health Specialists (Public or Private)**: For disease prevention and treatment.
  - **Feed Manufacturers**: To produce more consistent, disease-free, and potentially cheaper formulated feed.
  - **Logistics & Cold Chain Providers**: For efficient and fresh delivery to distant markets.
  - **Insurance Companies (Zurich, Allianz etc)**: To provide crop insurance against mortality and other risks.
- **Enabling Environment**:
  - **Farmer Cooperatives/Associations**: To enable collective action, bulk purchasing, shared resources, and market negotiation.
  - **Research & Development Institutions (UNDIP or other local Universities)**: For continuous improvement in genetics, feed, disease management, and climate adaptation.
  - **NGOs & Development Agencies (Mercy Corps)**: For capacity building, market linkages, and funding support.
  - **Certification Bodies**: For sustainable aquaculture certifications (e.g., ASC) to access premium markets.
  - **Law Enforcement Agencies**: To address theft more effectively.

5.12 Closed Loop System Strategy

A closed-loop system aims to minimize waste and by products, optimize all actors, and maximize resource efficiency, endorsing the principles of a circular economy (See Annex 2, for the comprehensive business model).

5.12.1 Potential Role of Institutions in a Closed-Loop System

- **Farmer Cooperatives**: Can facilitate bulk purchasing of seeds and feed, shared investment in machinery (e.g., feed choppers, Floating Nets), collective marketing to secure better prices, and enforcement of internal regulations (e.g., sustainable practices). They can also pool resources for security patrols.
- **Local Government (Village/Regional):** Crucial for establishing and enforcing regulations on chemical use, mediating agreements between different farming communities (grouper and milkfish), providing continuous technical assistance, and facilitating access to finance or subsidies for adopting better technologies.
- **Financial Institutions: Banks or microfinance institutions** can provide loans for initial investment in FNS or feed choppers, especially if supported by government guarantees or cooperative structures.
- **Research Institutions/Academia:** Can offer advanced technical guidance, research into disease-resistant strains, sustainable feed alternatives, and climate-resilient farming practices.
- **NGOs/Development Organizations**: Can provide capacity building, facilitate community organizing, and link farmers to funding opportunities or market access initiatives.
- **Private Companies / Buyers (ASC Standard)**: Can provide information related with practice and complience to eco labelling and certified products that would yield higher revenue for farmers

5.12.2 Recommendations: For Closed Loop System that is Sustainable and Viable

1. Conventional Recirculation Aquaculture Systems & Water Quality Management
    - Explore the feasibility of semi-closed or fully closed Recirculation Aquaculture Systems on land, as alternative, especially for critical stages like hatchery and nursery, or even for grow-out if space and capital allow for the initiative. This would provide complete control over water quality (salinity, temperature, pest & pathogens) and eliminates external chemical contamination risk.
    - High initial investment, but offers high biosecurity and consistent production. Could be a long-term goal or a pilot project.
    - Directly addresses the chemical contamination and water quality issues.
2. Integrated Multi-Trophic Aquaculture:
    - Combine grouper cultivation with other species that can utilize waste products from the grouper system. For example, cultivate seaweeds (absorb excess nutrients), shellfish (filter water), or detritivores organism (consume uneaten feed and feces) alongside groupers.
    - Benefits: Reduces environmental pollution, creates additional revenue streams, and mimics natural ecosystems.
    - Addresses environmental concerns, specifically nutrient discharge, and can improve overall water quality within the farming area.
3. Sustainable Feed Production and Waste Valorization:
    - Shift from natural fish meat to sustainably sourced, high-quality formulated feeds. Additionally, explore technologies to convert aquaculture waste (sludge, uneaten feed) into valuable products like bio-fertilizers (*pupuk kompos*)
    - Reduces the needs on wild fish stocks, improves feed conversion ratio, minimizes pond pollution, and creates circular resource flow.
    - Directly addresses feed cost and potential disease issues and aligns with environmental sustainability.
4. Community-Based Resource Management & Certification:
    - Establish a robust community-based management system, potentially with local government support and backing, to manage shared water resources, especially in coastal and estuary area. This includes collective decision-making on farming practices, enforcement of environmental regulations (e.g., chemical ban), and joint security and patrolling.
    - Explore obtaining sustainable aquaculture certifications (e.g., ASC, Global GAP) for the community's grouper product.
    - Ensures environmental protection, fosters social cohesion, deters theft, and opens doors to premium, ethically conscious markets.
    - Directly supports recommendations for policy and regulation aspect.
5. Market Linkages & Traceability:
    - Develop strong, direct market linkages between farmers (or their associations/cooperatives) and high-value buyers (restaurants, modern retailers, exporters).
    - Implement a robust traceability system, providing information on the origin, farming practices, and quality of the grouper.
    - Bypasses multiple intermediaries, ensures better prices for farmers, builds consumer trust, and enables a responsive supply chain.
    - Addresses the lack of specialized buyers and the potential for higher prices for fresh, well-packaged fish
    - Ensure the self-ecological preservation activities and spirit, through market mechanism incentives.

5.12.3 Financial Literacy Level

In relation to the assessment of financial literacy, several points suggest a need for improvement:

- **Lack of detailed financial records**: The provided data as informed by farmers is anecdotal and aggregated, suggesting farmers may not keep precise records of all costs (e.g., feed consumption, labor hours for specific tasks, net lifespan vs. replacement frequency).
- **Inability to manage financial risks**: The high impact of chemical contamination and price instability on farmers' profitability, leading them to cease operations, indicates a lack of strategies or financial tools (e.g., insurance, hedging) to mitigate these risks.
- **Reluctance to invest in higher initial cost but more durable technology:** The avoidance of Floating Net Systems due to initial cost, despite their long-term benefits in durability and reduced risk, suggests a short-term financial perspective and potential lack of understanding of long-term **ROI (Return on Investment)** at the simplest mindset.
- **Manual processes despite high time/labor costs**: The manual chopping of feed for 5 hours daily, while acknowledging it "drains energy and efforts", without proactive investment in machinery, points to a potential financial barrier or a lack of cost-benefit analysis for such improvements.

5.12.4 Recommendation

- Maintain accurate financial records.
- Understand cost structures and profitability.
- Conduct proper cost-benefit analyses for investments (e.g., Netting & Ponds Infrastructure, feed choppers).
- Develop risk management strategies, including exploring insurance options or collective saving schemes.
- Negotiate better prices and understand market dynamics.

5.13 Strategic Recommendations

5.13.1 Recommendations for Improvements to Value Chain Actors (Especially at the Grouper Farmers Level) with Market System Development Perspective

The overarching goal is to transform the current high-risk, unprofitable grouper farming into a sustainable and profitable farming venture.

A. Actors in the Core Value Chain Function (Focus on Farmers):

- **Key Factors for Success**: *Access to quality seeds, effective disease and predator control, stable and high market prices, efficient production methods, reduced operational costs, strong market linkages.*
- **Challenges Faced:** High mortality from chemicals, unstable market prices, theft, labor-intensive feed preparation, vulnerability of fixed cages, high operating costs, lack of post-harvest support.

- **Recommendations for Farmers**:
  - **Form Farmer Cooperatives or Associations**: This is critical for collective bargaining (for inputs like seeds, feed, and FNS), bulk purchasing for inputs, knowledge sharing, shared risk management (e.g., insurance pools for insurance products), joint marketing to secure better prices and access new markets, and for collective security patrols against theft, collective advocacy for policy changes etc.
  - **Adopt Floating Net Systems (FNS)**: Prioritize investment in FNS *(Jaring Apung)* for durability and gradually shift from fixed cages *(Jaring Tancap)*, reduced maintenance, and immunity to rising sea levels and fish escape. This requires overcoming the initial high cost barrier through financial assistance. Explore collective investment, microfinance loans, or government subsidies to overcome the high initial cost. Highlighting the long-term benefits of durability, reduced maintenance, and climate resilience.
  - **Mechanize Feed Preparation**: Acquire or collectively invest in a machine for chopping natural fish feed to significantly reduce labor and time, improving efficiency to reduce labor, time (5 hours/day is excessive), and improve consistency of natural feed. Explore the feasibility of gradually incorporating formulated feeds.
  - **Implement Biosecurity Measures**: Beyond avoiding chemicals, adopt other biosecurity protocols to prevent disease outbreaks and manage environmental factors (e.g., monitoring water quality, appropriate stocking densities).
  - **Diversify Revenue Streams**: Explore opportunities for value-added processing of grouper (e.g., filleting, freezing) to increase profit margins and extend shelf-life, reaching wider markets (e.g. restaurants, export market)
  - **Conduct Financial Literacy Capacity Building**: Participate in training to better understand cost structures, manage finances, evaluate investments, and mitigate risks, and **also gender sensitive training**

B. Actors in Supporting Functions:

- **Key Factors for Success**: *Availability of affordable and appropriate technology, reliable supply of inputs, access to credit, effective advisory services*.
- **Challenges Faced:** High cost of Floating Net System (FNS), manual feed preparation, lack of specialized market linkages for grouper.
- **Recommendations for Supporting Actors**:
  - **Pekalongan City Fisheries Service (PPL)/Dinas Perikanan**:
    - Shifting from just initial guidance program to continuous, intensive technical assistance, particularly in sustainable aquaculture practices, seed quality, feed management, disease management, and climate change adaptation, this need to be adopted as regular local government program with specific allocation from local budget and resources.
    - Facilitate Technology Transfer, Introduce and demonstrate new technologies (floating nets, chopping machines) through **pilot projects/demonstration plots.**
    - Market Information Dissemination: Provide farmers with up-to-date market prices and trends to improve their bargaining power
    - Certification Programs: Explore certifications for "chemical-free" or sustainably farmed grouper to access premium markets.

        - Promote Field School for farmers, an activity where farmers could learn and co-shared experience
    - **Financial Institutions:**
        - Develop tailored loan products with favorable terms for grouper farmers, especially for investment in floating net system and feed processing machinery/chopper.
        - Tailored Financial Products: loan products with flexible repayment terms suited to the grouper cultivation cycle (8-10 months)
        - Investment in Sustainable Practices: Offer incentives (lower interest rates) for farmers adopting floating net systems or other environmentally friendly technologies
        - Consider group lending models for farmer cooperatives.
        - Aquaculture Insurance: Develop and promote insurance schemes to mitigate risks from disease, environmental changes, or theft.
    - **Aquaculture Technology Suppliers/Company**: Promote and make available appropriate technologies like FNS and feed choppers at competitive prices, potentially offering after-sales support and training.
    - **Feed Industry**: Encourage local development or import of high-quality, sustainable, and affordable formulated grouper feed to reduce reliance on fresh fish and minimize disease transmission.
    - **Logistics & Cold Chain Providers**: Invest in infrastructure and services to ensure fresh grouper can reach distant, higher-value markets efficiently, crucial for expanding market access.

C. Enabling Environment:

- **Key Factors for Success**: *Clear and enforced regulations, supportive policies, effective governance, secure tenure/resource access, market information, community cohesion.*
- **Challenges Faced**: Chemical contamination from neighbors, theft, unstable market prices, rising sea levels, lack of collective action, inadequate land/pond management regulations.
- **Recommendations for Enabling Environment**:
    - **Local/Village Government**:
        - Facilitate & Enforce Agreements: Actively facilitate and enforce community-wide agreements prohibiting chemical use in shared waters, drawing inspiration from Desa Jeruk.
        - Pond Land/Water Management: Establish clear regulations and zoning for aquaculture, possibly formalizing water use rights to provide security for farmers and reduce conflicts.
        - Joint Patrols and Security: Organize and support joint community-government patrols to deter theft and ensure compliance with environmental regulations.
        - Market Information System: Establish a system to provide farmers with real-time market prices to improve their bargaining power.
    - **Policy Makers (Local/Regional/Village):**
        - Incentivize Sustainable Technology: Implement policies such as subsidies, or matching grants for farmers adopting FNS and other environmentally friendly practices.
        - Climate Change Adaptation Strategy: Develop and fund a comprehensive strategy to help the aquaculture sector adapt to rising sea levels, changing water temperatures, and extreme weather events.

- Strengthen Legal Framework: Revise or create laws that protect aquaculture areas from chemical pollution and strengthen enforcement mechanisms. This requires inter-agency coordination (Fisheries offices, Environment offices, local government & village government).
- Zoning for Aquaculture: Implement effective zoning to separate different aquaculture types or create dedicated chemical-free zones for sensitive species like grouper.
- Security and Law Enforcement: Establish community-based patrols supported by local law enforcement to combat theft, and other environmental restriction violation.
- Facilitate Multi-stakeholder Discusion and mediation: Create platforms for dialogue and conflict resolution between different farming communities (e.g., grouper and milkfish farmers).
- Infrastructure Support: Potentially invest in shared infrastructure if viable (e.g., centralized chopping facility, cold storage etc).

- **Research & Development Institutions**:
  - Conduct local adaptation research on climate-resilient grouper strains/varieties, grouper strains that best suited to the local Pekalongan/Batang environment and resilient to climate impacts (temperature, salinity fluctuations).
  - Sustainable Feed Alternatives: Research on local, sustainable, and cost-effective feed ingredients
  - Develop Cost-effective disease management solutions relevant to the Pekalongan/Batang area; Disease Diagnostic & Control: localized solutions for common grouper diseases.
- **Community and Social Norms:**
  - Environmental Awareness Campaigns: Implement sustained campaigns to educate all community members, especially farmers, on the environmental impacts of chemical use and the benefits of sustainable practices.
  - Promote Collective Responsibility: Foster a sense of shared responsibility for environmental protection and sustainable resource management within the community and people in the village.
  - Success Story Dissemination: Highlight successful **demonstration plots** and profitable grouper farmers to inspire and convince others.
- **NGOs/Development Partners**:
  - Support capacity building and trainings/coaching for farmer groups, facilitate access to funding, and help establish sustainable market linkages.

6 Value Chain Analysis for Fresh Milkfish in Pekalongan and Batang Regency

This chapter is an in-depth analysis of the **Fresh Milkfish** commodity value chain in Pekalongan and Batang Regency. The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various source). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

6.1 Value Chain Stream Mapping

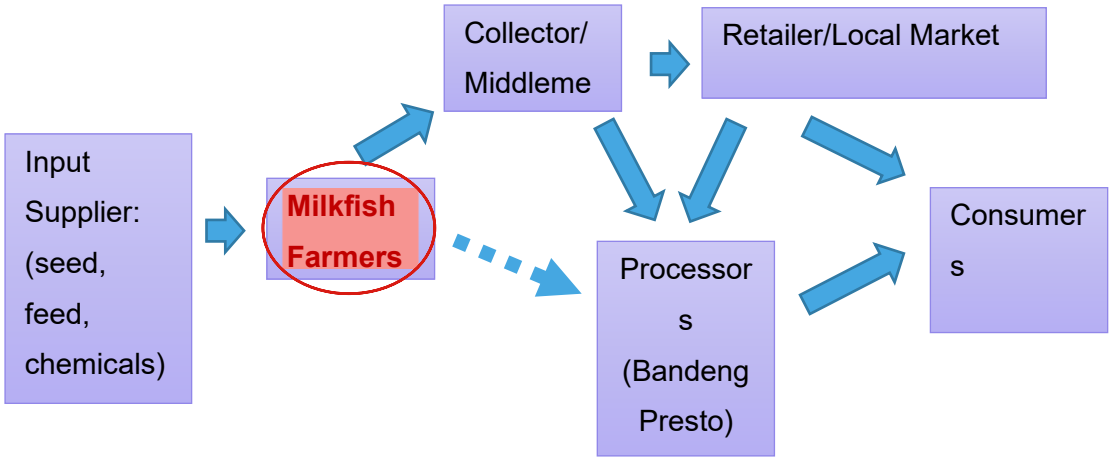


Figure 15 Value chain for milkfish

6.1.1 Description of Key Players and Processes

- Upstream actors:
  - Seed Suppliers: Provide milkfish seeds (*nener*) to farmers.
  - Feed Producers/Local Stores: Supply various brands of fish feed (e.g., Sharks, Alfred, Turbo).
  - Material Suppliers (local material stores): Provide netting, bamboo poles, and other pond equipment.
- Core Value Chain Function (**Farmers**):
  - Milkfish Farmers: The central actors, often former rice farmers whose land is now submerged due to seawater intrusion to the former rice field. They manage pond preparation, stocking, feeding, maintenance, and harvesting.
    - Pond Preparation & Maintenance: Includes cleaning nets periodically.
    - Stocking: Purchase milkfish seeds.

        - Feeding: Administer various types of feed based on fish age.
        - Pest Control: Use chemical pesticides to eliminate pest (unwanted) fish, although this has environmental problems.
        - Harvesting: Manual net harvesting (using net) for smaller ponds, trawl for larger ones. Harvests are often partial, based on need or demand.
- Downstream actors:
    - Village-level Collectors/Middlemen: Purchase milkfish directly from farmers. They often provide working capital to farmers in exchange for harvest (*different type of microfinancing/micro loan scheme, which is informal)*
    - Pressure Cooked (*Presto*) Milkfish Businesses/Processors: Buy milkfish from farmers, sometimes at a higher price than collectors for specific sizes.
    - End Consumers: Purchase milkfish through various channels (e.g., retail, processed products).

6.1.2 Flow of Commodities

1. **Seed Production (Upstream**): Fresh Milk fish seeds are purchased from nurseries (hatchery) with price @ !DR 150 and sized 1.5 cm, which is quality of seeds are much complained by farmers, some cases are good, but many cases are not good, the huge variation in quality affect the yield and survival rate of the fish.
2. **Fish Farming/Cultivation (Upstream - Production)**: Milkfish farmers in Pekalongan City many has been doing the cultivation for years. They mostly use fixed cage ponds with nets *(Jaring Tancap)*.
3. **Harvest:** After about 5 month cycle, Milkfish are harvested, on average 1 kilogram contains 5-6 milkfish.
4. **Distribution (Midstream**): Harvested milkfish are sold to collectors or directly to fish traders/retailers in traditional markets (some cases, processor like pressure cooked milkfish buy directly to farmers). There's also potential for out-of-region sales if packaged well and fresh (in Styrofoam box).
5. **Consumption (Downstream)**: The final consumers purchase milkfish from traditional markets (milkfish is generally marketed locally only).

6.1.3 Narrative Description of the Milkfish Value Chain

The milkfish value chain in the Pekalongan/Batang area is primarily characterized by small-scale farmers transitioning from rice cultivation due to coastal inundation (currently the rice field already submerged under water about 1-2 meters deep). The chain begins with farmers purchasing milkfish seeds (*nener*) from suppliers, often of inconsistent quality, leading to high mortality rates. Farmers then cultivate the milkfish in coastal or estuarine ponds that rely on direct seawater circulation. This involves significant input costs for feed (various brands and types depending on fish age) , netting, and bamboo poles. Pond maintenance, including cleaning and net repair, requires additional labor. Farmers faced challenges such as pest fish (managed with chemical pesticides harmful to other fish) , predatory birds , and climate impacts like tidal floods and high salinity.

Harvesting is done manually with nets for smaller ponds, leading to fish scale damaged and reduced market price (unfavorable appeal). Farmers typically don't harvest all at once but based on demand. The harvested milkfish are then sold to village-level collectors/middlemen, who often provide working capital to farmers, creating a debt-based relationship (typical in primary sector setting). Some farmers also sell directly to pressure cooked (*presto*) milkfish businesses or other processors, who may offer slightly higher prices

for specific sizes. Finally, the milkfish, either fresh or processed, reach the end consumers through various retail channels. The farmers consistently face issues of uncertain selling prices and a lack of suitable financial support from formal financial institutions.

6.2 Profit Margin Analysis

Below is the calculation of the average profit margin for each actor in milkfish value chain.

Table 36 Profit margin analysis for milkfish

No	Actor	Avg.Revenue/kg (IDR)	Avg. Cost/kg (Estimate) (IDR)	Profit/kg (IDR)	Margin (%)
1	Milkfish Farmer	20,000	15,000	5,000	25%
2	Collector	22,000	20,000	2,000	13%
3	Presto (non Boxed)	40,000	33,000	7,000	18%
4	Presto (Boxed product)	55,000	33,000	22,000	40%

Note:

- *The numbers in the table are approximations (generalizations from common case whilst for the detailed breakdown of calculations and assumptions used based on data and information gathered in FGD, see Annex 1)*
- *The calculation for the Presto (pressure cooked) milkfish presented here just to illustrate the comparison at the farmer level (without value addition) and the processor level (with value addition), more specific calculation is presented in the report on the Processed Milkfish*

Based on this calculation the highest profit margin belongs to pressure cooked milkfish with fully packed product.

- Farmers:
  - Based on one study, generally milkfish farmers can have an average income of IDR 24 million/ha/season (if we use this as benchmark).
  - However, milkfish farmers often face decreasing profits due to price fluctuations, especially during oversupply.
  - The FGD indicates farmers struggle with capital for feed and borrow from middlemen, which may limit their profit by obligating them to sell at agreed prices.
- Collectors/Middlemen:
  - One study indicated collectors obtain a margin of IDR 2,000 – 3000 (however, since they work with large numbers then by total sum, they are still wealthier than average farmers).
- Processors:

- Processors appear to capture the largest margin in the value chain. One processor obtained revenue of IDR 55,000 (51.4%), and another IDR 32,000 (28.6%), which individual cost may vary. This suggests significant value addition through processing.
- The added value for processed products like Omega-3 thornless milkfish can be substantial, with a price increase from IDR 30,000/kg to IDR 55,000/kg after average processing costs of Rp 2,000/kg, resulting in a value increase of IDR 25,000/kg or 70%.

6.2.1 Average Profit of Each Value Chain Actor

Milkfish Farmer

- Total Revenue: IDR 20,000,000 (per 5-month cycle)
- Total Cost: IDR 19,073,000 (per 0.3 ha pond, the average size of farming field owned by farmers in the FGD)
- Profit = IDR 20,000,000 - IDR 19,073,000 = **IDR 927,000**
  - Revenue: Selling price ranges from IDR 19,000 to IDR 21,000 per kg. Direct sales to presto businesses can yield higher prices (IDR 2,000-3,000 per head, for specific sizes).
  - Costs (as per FGD information): Significant input costs for seeds (IDR 1,500,000 for 10,000 seeds) , feed (e.g., IDR 200,000 per sack of Shark brand , IDR 270,000 per bag Alfred , IDR 325,000 per bag Turbo), netting (IDR 5,000,000) , bamboo poles (IDR 18,000 per piece, 100 pieces needed) , labor for cleaning (IDR 150,000 per person for 3 days, minimum 2 people) , labor for net repair (IDR 110,000 per day for 2 people for 5 days) , and harvest labor (IDR 170,000 per quintal)
  - Total sum of the cost incurred: IDR 19,073,000 (for detailed calculations please see Annex 1)
  - Working Capital: Farmers need ranging IDR 10,000,000 - IDR 15,000,000 working capital. Many farmers borrow from collectors, indicating a cash flow constraint.
  - Challenges impacting margins: ***Poor seed quality affecting survival rates, uncertain selling prices , and increased costs due to pond changes (deeper ponds, wider netting).***

Village-level Collectors/Middlemen

- Assuming they buy at IDR 20,000/kg and sell at IDR 22,000/kg, and have 5% operating cost:
- Revenue per ton: IDR 22,000,000
- Cost per ton: IDR 21,000,000
- Profit per ton = IDR 1,000,000 (This is just an example; actual profit depends on their volume and efficiency).
  - Likely operate on a slim margin, buying low from farmers and selling to larger buyers. They profit from volume and their role in providing access to market and working capital to farmers.

⇒ Presto Milkfish Businesses:
- Potentially higher margins due to value addition (processing) and catering to consumers willing to pay more for processed products. They also have specific

quality requirements (e.g., intact scales for fresh appearance)➔ Discussed in detail in the separate report for processed milk fish.

Along the value chain of milkfish as commodity, areas where value is captured and squeezed:

- **Value Captured:** By processors (due to value addition) and potentially by collectors who provide upfront capital and secure harvest. Large companies buying directly from farmers also offer higher prices.
- **Margins Squeezed:** Farmers face squeezed margins due to high input costs, fluctuating selling prices, low survival rates, and reliance on middlemen for capital. The damaged scales during harvesting also lead to lower prices or rejection by some consumers.

Analysis: Farmer's profit margin of IDR 927,000 over 5 months is extremely low, highlighting the severe financial squeeze faced by farmers. **This calculation underscores the farmer's stated concern about the need for capital and why they resort to borrowing from collectors**. **A single case of bad harvest or unforeseen expense could easily push them into a loss.**

6.3 Cost-Benefit Ratio Analysis (RC & BC Ratio), Productivity (Yield) Analysis & Break Even Point

Table 37 Cost-benefit analysis for milkfish

Actor	Total Revenue per year (2 cycles) (IDR/ha)	Total Cost per year (2 cycles) (IDR/ha)	Benefit-Cost Ratio (BCR)
Milkfish Farmer	40,000,000	28,000,000	1.43
Collector	42,000,000	40,000,000	1.05

From FGD we gathered the following details of information:

- Survival rate: 60–70%
- Harvest cycle: every 5 months
- Input: 10,000 seed/0.5 ha → 6,000 harvested
- Harvest Weight: 1 ton/0.5 ha ➔ 2 tons/ha/cycle ➔ 4 tons/ha/year
- Fixed costs include land tax if self-owned and has certification (Pajak Bumi Bangunan), rent (if farming field is not owned), and tool depreciation, while variable costs include fingerlings (*nener*), fertilizer, feed, medicine, and labor.
- The B/C ratio value for milkfish farming more than 1, technically indicating feasibility.
- However, the FGD mentions that farmers using extensive operations with less fertilizer and feed may experience a loss. Intensive operations with more fertilizer and

feed can yield higher profits and a better return on investment (but harmful for environment)
- Minimum optimum productivity: Assuming 0.3 ha average of pond area ➔ Minimum viable output = 1.2 tons/year
- For Break Event Point estimation: ~1.4 tons/year this is based on average cost IDR 15,000/kg

6.3.1 Analysis of Return Cost Ratio (RC Ratio)

The Return Cost (RC) ratio is a profitability indicator, similar to Benefit-Cost Ratio, but often calculated as Total Revenue / Total Cost.

Milkfish Farmer (0.3 ha pond, 1 cycle):

- Total Revenue: IDR 20,000,000
- Total Cost: IDR 19,073,000
- **RC Ratio = IDR 20,000,000 / IDR 19,073,000 = 1.048**

Interpretation for Farmer

An RC ratio of 1.048 means that for every IDR 1 invested, the farmer gets back IDR 1.048. This is a very low return, indicating marginal profitability. An RC ratio just above 1 suggests the business is barely viable. Ideally, an RC ratio significantly greater than 1 (e.g., 1.2, 1.3 or higher) is desired for healthy profitability and business resilience.

6.3.2 Benefit Cost Ratio (BC Ratio) Analysis

The Benefit-Cost Ratio (BCR) is often used for project appraisal, comparing the present value of benefits to the present value of costs. For a single cycle of operation, it can be similar to the RC ratio if "benefits" are equated to revenue (for other actors: such as for collectors add value if any, and benefit from economies of scale, higher volume; while for the processors value added through differentiated products as well as volume)

Milkfish Farmer (0.3 ha pond, 1 cycle):

- Assuming "Benefits" = Total Revenue and "Costs" = Total Cost:
- BC Ratio = IDR 20,000,000 / IDR 19,073,000 = 1.048

Interpretation for Farmer

Similar to the RC ratio, a BCR of 1.048 is very low. While technically above 1 (meaning benefits slightly outweigh costs), it suggests that the business (milkfish farming) is marginally attractive financially. It makes it difficult for farmers to reinvest, absorb shocks, or improve their living standards.

Based on calculating the numbers provided by farmers (using averaging techniques), the assessment suggests that farmers' CBR is likely low due to high input costs and various risks impacting yield and price.

Costs:

- **Seeds**: IDR 150 per tail. For 0.5 ha, 10,000 seeds cost **IDR 1,500,000.**
- **Feed**: Varies significantly based on fish age and brand.
    - For 0.3 ha, 3 bags of Shark brand feed (IDR 200,000/sack) are needed per cycle.
    - For 10,000 seeds, Alfred Brand feed costs IDR 270,000 per bag (2 bags/month for 1-2 months).
    - Turbo Brand feed for later stages costs IDR 325,000 per bag (60 bags needed for 5-6 month old fish).
- **Netting & Poles**: Netting IDR 5,000,000. Bamboo poles 100 pieces x IDR 18,000 = IDR1,800,000. These are long-term assets but require replacement every 2 years.
- **Labor**: Cleaning (IDR 150,000 x 2 labor x 3 days = IDR 900,000 per cleaning) , net repair (IDR 110,000 x 2 labor x 5 days = IDR 1,100,000) , harvest (IDR 170,000 per quintal).
- **Pesticides**: Used for pest control, but no specific cost is mentioned in FGD.

Benefits:

- Revenue from Milkfish Sales: Average harvest of 1 ton per cycle. Selling price IDR 19,000 - IDR 21,000 per kg.
- Higher prices for specific markets ➔ Demand from Presto businesses offer higher

6.3.3 Productivity

The "average land ownership" as stated by farmers are 0.3 - 0.5 hectare, this is based on the estimation of the submerged rice field farming land and now converted into ponds.

Considering the average survival rate of 70% from seeds purchased (or 60% actual success rate), and 10,000 seeds are needed for 0.5 ha, the following is the calculation of estimated potential output if survival rates were improved:

- For 0.5 ha, 10,000 seeds.
- If 60% survive harvest: 10,000 seeds x 60% = 6,000 milkfish.
- If 1 kg contains 5-6 fish , then the average 5.5 fish/kg.
- Total harvest: 6,000 fish / 5.5 fish = 1,090.9 kg (equal to 1.1 tons for the pond size 0.5 ha).
- Then for the size of pond 1 hectare; we derived the number ➔1090.9 kg / 0.5 ha = **2,181.8 kg per hectare (2.2 tons yield per hectare)**.

Assuming, if aiming for higher productivity (e.g., 80% survival rate, which is achievable with better seed quality and pond management):

- 80% survival: 10,000 seeds x 0.80 = 8,000 fish.
- Total harvest: 8,000 fish divided by 5.5 fish/kg = 1,454.5 kg (equal to 1.45 tons for 0.5 ha).
- This translates to (1454.5 kg / 0.5 ha) = **2,909 kg per hectare (about 3 tons per ha).**

Given the current average harvest is 1 ton for 0.3 ha (3,333 kg/ha), the "minimum optimum" should at least match or exceed this, while achieving higher survival rates. A target productivity of 2,500 - 3,000 kg per hectare (or higher) with consistent quality and reduced losses would be a reasonable optimum to aim for, ensuring better financial viability and resilience.

However, from the farmer's perspective, optimal productivity would mean achieving a yield that covers all costs and provides a reasonable profit, given the existing constraints.

6.3.4 Break Even Point

- **Break-Even Point in Quantity (BEP)**: Fixed Costs / Contribution Margin per unit
  - BEP **=** IDR 1,700,000 / IDR 2,627 **= 647.9 kg**
- **Break-Even Point in Revenue (BEP)**: Fixed Costs / (1 - (Total Variable Costs / Total Revenue))
  - BEP = IDR 1,700,000 / (1 - (IDR 17,373,000 / IDR 20,000,000)) = **IDR 12,942,596**

Interpretation for Farmer:

- The farmer needs to produce and sell at least 648 kg of milkfish (from their average 1,000 kg harvest) to cover all their costs.
- They need to generate at least IDR 12.94 million in revenue to break even.
- Since their average harvest is 1,000 kg (IDR 20 million revenue), they are currently operating above their break-even point. However, the slim profit margin (IDR 927,000) means they are very close to it, and any significant drop in yield, price, or increase in costs would put them at a loss.

6.4 SWOT Analysis

Table 38 SWOT analysis for milkfish

Strengths	Opportunities
• Experience in aquaculture (former farmer in agriculture) • Access to collectors • Local group cultivation	• Presto & value-added market • Potential to increase productivity through improved fingerling quality and farming practices • Access to financial products tailored to agricultural cycles if available. • Adoption of environmentally friendly practices could reduce pollution and improve fish health • Government support
Weaknesses	**Threats**

• Low standard seeds/ Inconsistent quality of fingerlings • Low survival rate of fish (60-70%). • High FCR (Feed Conversion Ratio) • Limited working capital, leading to dependence on collectors/middlemen • High input costs • Poor infrastructure (cages) & net quality • Reliance on external water circulation, prone to natural disasters and pollution	• Tidal floods (both from sea and river), water intrusion from sea and river • Climate change impacts (extreme weather, sea-level rise, increased disease risk). • water pollution (excessive use of chemical in the estuary) • Vulnerability to predatory pests (sea birds) • Contradiction with natural conservation efforts (negative perception of mangrove forests as bird nests). • Waste from factories (e.g., batik industry) polluting water • Collapse of netting due to strong winds and big waves. • Unstable milkfish prices in the market.

6.4.1 Strengths

- **Experienced Farmers:** Many farmers are former rice farmers with agricultural experience.
- **Established Local Markets**: Presence of village-level collectors and pressure-cooked milkfish (bandeng presto) businesses provides market access.
- **Community-based Fisheries**: Existence of cultivation groups (community patterns) can facilitate knowledge sharing and collective action.
- **Potential for Value-Added Products**: The presence of pressure-cooked milkfish businesses indicate a demand for processed products, offering potential for higher returns.

6.4.2 Weaknesses

- **Poor Seed Quality**: Inconsistent quality of purchased milkfish seeds leads to low survival rates.
- **High Input Costs:** Significant expenses for seeds, feed, and infrastructure (netting, poles).
- **Limited Capital & Debt Reliance**: Farmers often lack sufficient capital and resort to borrowing from collectors, leading to unfavorable agreements.
- **Uncertain Selling Prices**: Fluctuations in milkfish prices create income instability for farmers.
- **Suboptimal Harvesting Techniques:** Manual netting leads to scale damage, reducing marketability.
- **Environmental Degradation & Unsustainable Practices:** Use of chemical pesticides harmful to other fish. Contamination from factory waste in rivers.
- **Vulnerability to Natural Elements:** Ponds are prone to collapse in strong winds/waves. Fish can escape during floods/tidal overflows.
- **Limited Knowledge:** Farmers lack knowledge about feed content and probiotics.
- **Infrastructure Issues:** Bamboo poles have a short lifespan (2 years). Ponds are getting deeper, requiring longer poles and wider nets.

- **Lack of Financial Products:** Inadequate financial products from banks (e.g., unsuitable repayment schedules, no specific insurance) deter farmers from formal loans.
- **Perception of High Loan Interest:** Farmers perceive bank loan interest as high.

6.4.3 Opportunities

- **Increased Demand for Processed Products:** Growing market for presto milkfish and other processed products could offer higher profit margins.
- **Direct Sales to Larger Buyers:** Opportunities to sell directly to larger companies for better prices.
- **Improved Seed Quality Control:** Implementing standards for seed quality could significantly improve survival rates and yields.
- **Sustainable Aquaculture Practices:** Adoption of environmentally friendly methods can lead to better product quality and market access (e.g., certified organic).
- **Technological Advancement:** Introduction of floating net systems for better resilience against sea-level rise and storms, despite initial high cost.
- **Financial Inclusion:** Development of tailored financial products (loans, insurance) for aquaculture by financial institutions.
- **Capacity Building:** Training programs for farmers on feed formulation, probiotics, and sustainable practices.

6.4.4 Threats

- **Seawater Intrusion:** Rising sea levels are sinking rice fields and deepening existing ponds, leading to increased costs and risks.
- **Climate Change Impacts:** Increased frequency of heavy rains and tidal flooding can cause fish to escape. Dry seasons lead to higher salinity, stunting fish growth.
- **Environmental Pollution:** Factory waste from batik industry in rivers contaminates ponds. Pesticide use by farmers contaminates surrounding waters.
- **Predatory Pests:** Barracuda offspring and sea birds prey on milkfish, leading to losses.
- **Market Price Volatility:** Unpredictable selling prices pose a continuous risk to farmer income.
- **Dependence on Middlemen:** Debt to collectors limits farmers' bargaining power and market access.
- **Infrastructure Degradation:** Netting and bamboo poles are prone to damage from strong winds and waves.
- **Conflicting Conservation Efforts:** Mangrove forests, while for conservation, can also serve as nests for predatory birds.

6.5 Benchmarking Analysis

Table 39 Benchmarking analysis for milkfish

Indicator (metric)	Local Practice	Best Practice (Benchmark)
Feed Conversion Rate	2:1	1.5–1.7:1 (semi intensive)
Pond System	Static (bamboo nets)	Floating cages (durable)
Disease Control	Pesticides	Probiotics & biosecurity
Harvesting	Manual nets	Trawl Net

- **Survival Rate**: The average survival rate of 70% (from seeds to harvest) and actual success rate of 60% are low compared to industry best practices. Sustainable aquaculture often aims for survival rates above 80-90%.
- **Harvest Cycle:** A 5-month harvest cycle is relatively standard for milkfish.
- **Feed Conversion Ratio (FCR):** An FCR of 2:1 indicates that for every 2 kg of feed, 1 kg of fish is produced. This can be improved; competitive FCRs in milkfish farming can be lower (e.g., 1.5:1).
- **Infrastructure Lifespan:** A 2-year lifespan for netting with bamboo poles is short. Floating net systems offer a much longer lifespan (5-10 years) but are considered expensive initially. This highlights a need for investment in more durable infrastructure.
- **Salinity Tolerance:** The impact of high salinity during dry season leading to stunted growth suggests that current farming practices or milkfish strains may not be optimally resilient to salinity fluctuations.

6.5.1 Recommendations for Improvement

- **Seed Quality:** Implementing quality control measures or sourcing from reputable hatcheries.
- **Feed Efficiency:** Exploring alternative feed formulations, better feeding practices, and potentially higher-quality feed brands to improve FCR.
- **Infrastructure Investment:** Encouraging adoption of more durable and climate-resilient infrastructure like floating nets.
- **Pest Management:** Implementing environmentally friendly pest control methods instead of harmful pesticides.
- **Market Access & Price Stability:** Exploring collective marketing or direct sales channels to reduce reliance on middlemen and stabilize prices.

6.6 Institutional Analysis

6.6.1 Informal Institutions (Community Groups/Cultivation Groups)

- Farmer groups (community-based)/ Community Groups/Cultivation Groups (Fisheries patterns at the village level are community-based, with existing cultivation/harvesting groups).
- These groups serve as informal institutions for knowledge sharing and potentially communal action in the fish farming activities.
- Potential for collective bargaining, training dissemination, and shared resource management (tools, equipment etc)

6.6.2 Village-level Collectors

- Act as key informal institutions in the value chain, providing a direct purchasing channel
- And, in many cases, provision of working capital to fishery farmers and also other liquidity needs. By this design, while facilitating market access, however, also creates dependency for farmers.

6.6.3 Formal Institutions

Fisheries Dept. Office (local Govt)., Village Government, Village owned enterprise (BUMDES)

- typically play a role in providing technical assistance, regulations, and potentially subsidies.
- farmers' openly concern about the need for "technical cultivation skill for fish milkfish" implies a gap in current formal institutional support.

6.6.4 Presto (Pressure Cooked Milkfish) Entrepreneurs/Processors

- These are local businesses that add value to the fresh milkfish
- Indication of the existing of a localized processing industry (MSME)
- expanding market outreach and potentially offering higher prices for specific quality (such as non-mud smell fish) and good shape of fish (intact fish scales).

6.6.5 Banks/Financial Institutions

- Currently, farmers perceive bank loans as having high interest and unsuitable repayment schedules, leading to low engagement.
- This suggests a disconnecting relation between formal financial institutions and the specific needs of milkfish farmers
- It is crucial for providing appropriate capital and insurance products to reduce farmer reliance on informal lenders.

6.6.6 Government/Fisheries Agencies

- While not explicitly mentioned in the document, these agencies typically play a role in providing technical assistance, regulations, and potentially subsidies.
- The farmers' concern about the need for "technical cultivation milkfish" implies a gap in current institutional support.

6.6.7 Roles in the market value chain

- **Community Groups:** Potential for collective bargaining, training dissemination, and shared resource management.
- **Collectors:** Facilitate market access and provide immediate liquidity.
- **Processors:** Create value-added products, expanding market reach and potentially offering higher prices for specific quality.
- **Financial Institutions:** Crucial for providing appropriate capital and insurance products to reduce farmer reliance on informal lenders.

6.7 Stakeholder Analysis

Table 40 Stakeholder analysis for milkfish

Stakeholders	Role	Influence
Farmer groups	Production	High, mutual support
Collectors	Aggregation & market access	High, Stable supply
Processors	Value addition	Medium, Quality
Local Gov't & DKP (Dinas)	Licensing, festivals, limited support	Medium, Livelihoods
NGOs/University	potential for training & technical help	Low, Social impact
Financial Institutions	Limited role due to low financial literacy	Low, access to finance

6.7.1 Key Stakeholders and Their Influence

- **Milkfish Farmers (Primary Stakeholders)**:
  - Interests: Higher profits, stable prices, improved yields, access to capital, better technical knowledge, reduced risks from pests and climate change.
  - Objectives: Sustainable livelihood through milkfish farming.
  - Influence: Directly impact the quantity and quality of milkfish produced. Limited individual bargaining power but significant collective potential.
- **Seed Suppliers:**
  - Interests: Selling seeds, ensuring quality.
  - Objectives: Profitable business.
  - Influence: Direct impact on initial fish health and survival rates.
- **Feed Producers:**
  - Interests: Selling feed, developing efficient formulations.
  - Objectives: Market share and profitability.
  - Influence: Impact on fish growth rate, FCR, and overall production costs.
- **Village-level Collectors/Middlemen**:
  - Interests: Buying at low prices, selling at higher prices, ensuring consistent supply, recovering loans.
  - Objectives: Maximize profit through arbitrage and informal lending.
  - Influence: Strong influence on farmer prices due to direct market access and financial leverage.
- **Presto Milkfish Businesses/Processors**:
  - Interests: Consistent supply of quality milkfish, production of value-added products, market expansion.
  - Objectives: Profitability through processing and differentiated products.
  - Influence: Can offer higher prices for specific quality, potentially reducing farmer reliance on collectors.
- **Laborers:**

    - Interests: Fair wages, consistent employment.
    - Objectives: Livelihood.
    - Influence: Essential for pond maintenance and harvesting.
- **Financial Institutions (BRI, PT PNM MEKAR, Local Microfinance Institution):**
    - Interests: Lending, deposit mobilization, portfolio growth.
    - Objectives: Profitability, financial inclusion.
    - Influence: Potential to transform the value chain by providing accessible and appropriate financial products, reducing farmer debt burdens.
- **Government Agencies** (e.g., Ministry of Marine Affairs and Fisheries, Dept. of Fisheries Pekalongan City, Village Government):
    - Interests: Food security, rural development, sustainable fisheries, environmental protection, economic growth.
    - Objectives: Implement policies, provide technical support, regulate the sector.
    - Influence: High potential to shape the industry through policies, subsidies, infrastructure development, and extension services.
- **NGOs/Research Institutions**:
    - Interests: Sustainable development, community empowerment, research and innovation.
    - Objectives: Improve farming practices, introduce new technologies, advocate for policy changes.
    - Influence: Can provide technical assistance, training, and advocate for farmers' interests.
- **Environmental Groups**:
    - Interests: Protection of marine ecosystems, prevention of pollution.
    - Objectives: Promote sustainable practices, raise awareness about environmental impacts.
    - Influence: Can influence public opinion and policy regarding chemical use and environmental management.
- **Consumers:**
    - Interests: Affordable, high-quality, safe, and sustainably sourced milkfish products.
    - Objectives: Satisfy dietary needs and preferences.
    - Influence: Drive market demand and influence product standards.

6.7.2 Interactions and Gaps

The most critical interaction gap is the conflict between milkfish farmers and other fisheries farmers, over overuse of chemicals by milkfish farmers. There is a lack of strong, and insufficient ongoing support/regulation from local government to address this environmental and ecological hazard issues.

6.8 Policy and Regulatory Analysis

6.8.1 Policy Gaps/Weaknesses (Either Implied or Direct)

- **Lack of Suitable Financial Policies:** The current financial products from banks are not suitable for milkfish farmers due to high perceived interest rates and inflexible repayment schedules (monthly vs. 5-month harvest cycle). This indicates a gap in policy or regulatory frameworks that encourage financial institutions to develop tailored products for aquaculture.

- **Absence of Specific Fishery Insurance:** The lack of special insurance products for milkfish fishery losses leaves farmers highly vulnerable to risks like disease, environmental changes, and market fluctuations.
- **Environmental Regulations (Enforcement/Awareness)**: The widespread use of chemical pesticides by farmers and factory waste discharge into rivers suggests either a lack of strict environmental regulations, inadequate enforcement, or insufficient awareness among farmers regarding environmentally harmful practices. Policies promoting sustainable aquaculture and penalizing pollution are crucial.
- **Conservation vs. Livelihood Conflicts:** The issue of predatory birds nesting in mangrove forests eating milkfish from ponds highlights a potential conflict between environmental conservation policies (mangrove protection) and aquaculture livelihoods. Policies need to address such trade-offs.
- **Potential for Seed Quality Regulation:** While not explicitly stated, the issue of non-standard seed quality suggests a need for regulations on seed production and distribution to ensure minimum quality standards.

6.8.2 Recommendations for Policy and Regulatory Improvements

- Enforce industrial waste regulation, this is a very broad issue encompassing the policy not only related with many people economic activities in fisheries sector, but also in a broader sense industrialization policy and regional economic landscape.
- Strong monitoring of pollution from batik industries, this is not particularly related with the fisheries sector only, but tapping in to environmental issue and associated policies
- Provide incentives for organic and sustainable farming, both in agriculture and aquaculture practices, this incentives could be linked with tailored financial products (eco friendly financial products)
- In collaboration with the private sector in insurance industry, endorse the development of insurance products for milkfish farming sector.
- Support the initiatives on standardization, from inputs aspect to the farming output aspects.

6.9 Gender Analysis

The conversation during the Focus Group Discussion provides limited direct information on the specific roles of men and women in the milkfish value chain. However, based on typical aquaculture contexts, we can infer:

- **Primary Farmers:** milkfish farming, especially pond management and physically demanding tasks like netting and pole installation, is more likely male-dominated. However, women may play significant roles in lighter tasks or supporting roles.
- **Laborers**: Laborers for net cleaning, repair, and harvesting are mentioned. It's common for both men and women to be involved in agricultural and aquaculture labor, though roles might be gender-segregated based on physical demands.
- **Post-Harvest & Marketing:** Women often play crucial roles in post-harvest activities such as sorting, processing (e.g., preparing for presto milkfish), and direct selling in local markets.
- **Financial Decision-making:** The statement about farmers lacking capital and borrowing from collectors might refer primarily to male heads of households, but women's financial literacy and access to credit are also important considerations.

- **Household Income:** Milkfish farming contributes to household income. The distribution of this income and decision-making power within the household could vary and need attention too.

To conduct a thorough gender analysis, and future gender sensitive programs in the implementation phase of the project, **the following is the specific data recommended to obtain**:

- Gender-Sensitive Data Collection, Division of labor by gender in farming and post-harvest activities. Collect data on male and female participation across all value chain segments, including labor, ownership, income, and decision-making.
- Gender access to resources (land, capital, training and skill development). Need specific gender-disaggregated data on access to land, capital, or training. However, typically in rural settings, men often have more direct control over productive assets (land, large loans), while women might have less formal access but manage informal savings or micro-loans.
- Gender differences and influences in decision-making power. Decisions related to large investments (netting, major repairs), debt, and large-scale sales might be primarily made by men, while daily operational decisions or smaller sales may involve women.
- Design training programs that are accessible to both men and women, considering their literacy levels, time availability, and specific roles. For example, training on financial literacy, processing techniques, and small business management might be particularly beneficial for women.
- Access to Finance: Ensure financial products are accessible to women farmers, potentially through women's groups or by accepting alternative collateral.
- Impact of value chain improvements on men and women, we need an impact study on who’s most benefited from the improvement along the value chain and how to narrow gap if the difference is substantailly large

6.10 Social and Sustainability Impact Analysis

6.10.1 Social Impact of Milkfish Farming

- **Livelihood Transformation**: Many farmers transitioned from rice farming due to seawater intrusion, indicating a significant social and livelihood adaptation to environmental changes. Gradually there is a transition of norms and social values from agriculture societies becoming aquaculture societies
- **Economic Vulnerability:** Farmers face significant economic vulnerability due to uncertain prices, high input costs, and reliance on debt from middlemen.
- **Health and Safety**: The use of chemical pesticides could pose health risks to farmers and consumers if not handled properly.
- **Community Cohesion**: The existence of cultivation groups actually suggests a degree of social cohesion and collective action potential. However, "the incident of each other harm" from chemical contamination indicates a breakdown in cooperation in environmental management ecological issues.
- **Food Security:** Milkfish farming contributes to local food supply, particularly provision of animal protein/fish based protein, which is by nutrient standard is more beneficial than land based animal source of protein.

- **Labor Conditions:** Wage rates for laborers are specified and indicated an average normal payment rate of labor wages, indicating a formal (albeit potentially informal in practice) labor market within the value chain (employment creation of this sector)

6.10.2 Environmental Impact Analysis

Current Environmental Impacts

- **Chemical Pollution in Farming Practice:**
  - **Pesticides:** Farmers widely use common chemical pesticides from land agriculture to kill nuisance fish pests. The widespread use of common chemical pesticides for nuisance fish control is a significant concern.
  - **Spill over effects**: These pesticides kill small pest fish but can also contaminate neighboring fish ponds (e.g., grouper ponds), leading to widespread fish mortality. This highlights the direct harm and social conflict between farmers due to unsustainable practices.
  - **Water Contamination:** This practice results in "alarming pollution" of surrounding waters, posing risks to aquatic biodiversity and potentially human health (chemical contaminated consumptions).
- **Industrial Pollution:** Factory waste (especially dye from the batik industry) is directly discharged into rivers near milkfish ponds, causing significant harm. This is an external, systemic pollution issue beyond the farmers' immediate control but severely impacts their livelihood. This is a major external environmental threat.
- **Pond Infrastructure Impact /Waste**: The short lifespan of bamboo poles and nets and their prone-ness to collapse could lead to accumulation of material waste and debris in the marine environment. The use of bamboo poles and netting, while traditional, is less durable and prone to collapse, potentially leading to material waste or fish escapes during extreme weather.
- **Financial Risk:**
  - **High Repair/Replacement Costs**: The short lifespan of current infrastructure (2 years for nets/poles) results in frequent and significant replacement costs, especially given the low profit margins.
  - **Losses from Fish Escape/Mortality**: Fish escape during floods or mortality due to pollution/salinity directly translates to financial losses for farmers, exacerbating their already precarious economic situation.
- **Resource Depletion (Potential)**: Heavy reliance on formulated feed with a 2:1 FCR might indicate use of fishmeal from wild capture, contributing to overfishing elsewhere.
- **Mangrove Conflict:** The conflict between mangrove conservation (as bird nests) and milkfish predation highlights a challenge in balancing ecological preservation with aquaculture livelihoods
- **Salinity Changes:** High salinity during the dry season leads to stunted growth, indicating environmental stress on the fish.

6.10.3 Recommendations for Environmentally Friendly Practice

- **Integrated Pest Management (*Pengedalian Hama Terpadu/PHT)*:**
  - **Biological Control:** Introduce natural predators of nuisance fish (if feasible and safe for milkfish) or encourage manual removal methods, instead of chemical pesticides
  - **Pond Design**: Implement pond designs (e.g., screens, water flow control) that prevent entry of pest fish.

    - **Training:** Educate farmers on the severe ecological and economic consequences of chemical pesticide use and provide alternatives.
- **Sustainable Water Management**:
    - **Water Quality Monitoring**: Regular monitoring of salinity, pH, oxygen level, and pollutant levels.
    - **Waste Treatment**: Implement simple bio-filtration systems pond outlets to treat waste before discharge, reducing nutrient and chemical loads.
    - **Reduced Water Exchange:** Optimize water exchange rates to minimize discharge of polluted water.
- **Responsible Feed Management**:
    - **Improved FCR**: Implement best feeding practices (e.g., feed trays, timed feeding) to reduce waste and improve FCR.
    - **Sustainable Feed Ingredients**: Promote research and use of alternative protein sources for feed (e.g., insect meal, single-cell proteins, agricultural by-products) to reduce reliance on wild fishmeal.
- **Eco-friendly Infrastructure**:
    - **Floating Net Systems**: Promote investment in more durable and climate-resilient floating net systems that have a longer lifespan (5-10 years) and are less prone to collapse, reducing material waste and environmental contamination from damaged structures.
    - **Durable Materials**: Encourage the use of more durable and environmentally inert materials (such as PVC) for pond lining and structures where appropriate.
- **Advocacy for Industrial Pollution Control**:
    - Collaborate with local government and environmental agencies to enforce stricter regulations on industrial waste discharge into rivers. Support community efforts to monitor and report pollution incidents.
    - Waste Management: Advocate policies for stricter enforcement of industrial waste discharge regulations and promote sustainable industrial practices in nearby factories.
- **Mangrove Reforestation & Integrated Systems**:
    - Promote strategic mangrove reforestation around ponds as a buffer against tidal surges and a natural habitat, (such as the sylfo-fishery method if applicable) while exploring designs that minimize bird predation. This could involve selective netting or deeper ponds in vulnerable areas. Integrated Aquaculture-Mangrove Systems:
    - Explore sustainable aquaculture practices that integrate with mangrove ecosystems, potentially providing benefits to both (e.g., better water quality, natural shelters for fish while minimizing predation).
- **Certification and Best Practices:**
    - Encourage farmers to adopt aquaculture best management practices (BMPs) and potentially pursue sustainability certifications (e.g., ASC, CBIB, GlobalGAP) which mandate environmentally responsible practices.
    - Closed-Loop Systems: Implement strategies (best practices) to minimize waste and maximize resource efficiency (discussed further below).

6.10.4 Specific Analysis of Land/Pond Status and Risks that May Arise from the Land/Pond Status

- **Former Rice Fields Sunk by Seawater Intrusion**: Many milkfish farmers were previously rice farmers whose land is now submerged. This indicates a forced adaptation due to environmental change, primarily rising sea levels and coastal subsidence.

- **Coastal/Estuarine Location**: Ponds rely on direct seawater circulation and are located on the coast or river estuaries. This proximity to the sea and rivers makes them highly susceptible to external environmental factors.
- **Proximity to Factories:** Many ponds are located near river estuaries (located in the downstream of the river) that receive industrial waste, especially from the batik industry.

Risks Arising from Land/Pond Status:

- **Environmental Pollution Risk/Industrial Waste Contamination:** As discussed previously, the close proximity to industrial waste discharge points (batik industry) poses a severe risk of chemical pollution to ponds, potentially leading to fish mortality and rendering fish unsafe for consumption.
- **Land Tenure Issues (Implicit):** While not explicitly discussed, the shifting from rice fields to fish ponds due to seawater intrusion might lead to ambiguities in land ownership or usage rights, especially if the land becomes officially classified as "water body" or “disappeared land” status, as the owner of the land my lose their “de facto ownership” by law. This could affect farmers' ability to secure formal loans or long-term investments.

6.10.5 Risks and Impacts of Climate and Weather Changes in Pekalongan and Batang Regency

- **Rising Sea Levels, Increased Seawater Intrusion & Pond Deepening**:
  - Already occurring, leading to former rice fields sinking and existing ponds becoming deeper. This increases infrastructure costs (longer poles needed gradually, wider nets required) and the risk of fish escaping. Ponds becoming deeper and nets drowning due to rising sea levels pose a long-term environmental and economic challenge
  - Increasing Depth: Pond depth has increased from 2 meters to about 3 to 4 meters, confirming the impact of rising sea levels
  - Fixed Pond System with Bamboo Poles: The current system uses fixed netting with bamboo poles , which is inexpensive initially but has a short lifespan (2 years) and is vulnerable to extreme weather.
  - Long-term Submergence: The continuous deepening of ponds implies a long-term risk of complete submergence of current pond areas.
- **Tidal Flooding and River Overflow:** During rainy seasons, heavy rainfall and tidal flooding can cause fish to drift out of ponds. This leads to significant harvest losses.

Figure 16 Weather forecast tool

- **Increased Salinity during Dry Season**: Higher salinity during the dry season results in stunted growth and dwarfism in milkfish, reducing their weight and market value.
- **Extreme Weather Events (Strong Winds & Big Waves)**: Pond netting with bamboo poles is very prone to collapse (damaged) during strong winds and large sea waves, causing structural damage and fish escape.
- **Impact on Water Quality**: Changes in rainfall patterns and sea level can affect water quality (e.g., increased turbidity, altered nutrient levels), impacting fish health and growth.
- **Coastal Erosion:** Rising sea levels and stronger waves can lead to coastal erosion, further threatening pond infrastructure and land availability.

6.10.6 Recommendations for Adaptation to Climate Change

- **Climate-Resilient Infrastructure**: Promote and incentivize the adoption of floating net systems which are more resilient to rising sea levels and strong waves.
- **Pond Design Modification**: Design ponds with higher dikes or improved water control mechanisms to prevent fish escape during floods.
- **Salt-Tolerant Milkfish Seed Strains/varieties**: Research and introduce milkfish strains that are more tolerant to high salinity levels.
- **Early Warning Systems**: Implement localized weather and tidal flood early warning systems for farmers.
- **Diversification**: Encourage diversification of aquaculture species that might be more resilient to changing conditions.
- **Integrated Coastal Zone Management**: Develop and implement comprehensive coastal zone management plans that integrate aquaculture with mangrove rehabilitation and other coastal protection measures.
- **Participatory Land/Pond Use Planning and Free Prior Informed Consent (FPIC)**: using PLUP and FPIC methods in applying regulation regarding the zoning and free chemical use in cultivation of milkfish

Figure 17 Fixed net cage pond and floating net cage pond

6.11 Financial Literacy Analysis

It was implied a low to moderate level of financial literacy among milkfish farmers, particularly regarding formal financial products.

- Perception of high loan interest rates from banks: This might be a genuine concern or a misunderstanding of interest calculations and repayment structures.
- Unsuitable financial products: Farmers highlight that bank products require monthly installments, whereas their harvest cycle is every 5 months. This indicates a lack of understanding or awareness of flexible financing options or microfinance models tailored to seasonal incomes.
- Reliance on informal lenders (collectors): Many farmers debt to collectors, suggesting either a lack of access to formal credit or a preference for the simplicity and immediacy of informal loans, despite potentially unfavorable terms. This indicates limited knowledge of formal credit mechanisms and their potential long-term benefits.
- Lack of insurance awareness: The absence of special insurance products for fishery losses is a concern, but farmers' awareness and demand for such products are also indicators of financial literacy.

6.11.1 Recommendations to improve Financial Literacy

- Targeted Training Programs: Implement financial literacy workshops focusing on:
    - Basic accounting: Tracking income and expenses.
    - Understanding different types of loan: Interest rates, repayment schedules, and the concept of annual percentage rate (APR).
    - Benefits of formal financial institutions: Access to larger capital, lower interest rates in the long run, and building credit history.
    - Risk management: The importance of savings, emergency funds, and insurance products.
- Partnerships with Financial Institutions: Facilitate dialogue between farmers and banks to co-design financial products that match the aquaculture cycle.
- Mobile Banking/Digital Finance: Introduce simple digital financial tools for managing finances, making payments, and accessing small loans.
- Community Financial Groups: Support farmer groups in establishing informal savings and loan groups that can transition to formal financial linkages.

6.12 Market System Development (MSD) Framework

Table 41 MDS Framework for milkfish

	Actor	Constraint	Potential Solutions
Core Function	• Milkfish Farmers • Seed Suppliers • Feed Producers • Village-level Collectors/Middlemen • Presto Business	• Poor seed quality • high input costs, • limited capital, reliance on middlemen, • uncertain prices, • technical knowledge gaps, harvested fish sometimes not in good shape due to the use of traditional netting technique • vulnerability to climate change and pests, environmental pollution • Potentially low-quality control, lack of standardization • High cost of feed, potential for inconsistent quality • Potentially exploitative lending practices, limited value addition	• Access to quality seeds, • appropriate feed, • sufficient working capital, • technical knowledge in cultivation and pest management, • market access, and stable selling prices. • Form stronger farmer cooperatives for collective bargaining on inputs (seeds, feed) and outputs (selling price • Consistent quality, reliability, adoption of best practices in hatchery management • Cost-effective, nutritionally balanced feed, good FCR • market connections,
Supporting Function	• Financial Institutions	• Unsuitable loan products, high-interest perception, no specific fishery insurance. • No tailored credit product (5-month cycle mismatch)	• financial access • Develop flexible loan repayment schedules aligned with harvest cycles. • Create specialized aquaculture insurance products. • Conduct financial literacy training for farmers
Enabling Environment	• Government Agencies • NGOs and Industry Associations • Conservation Groups	• Gaps in suitable policies, • limited extension services, • regulation enforcement issues, • lack of coordinated climate change adaptation strategies	• Supportive policies, effective regulations, • technical assistance, • infrastructure development. • Advocacy, capacity building, facilitating partnerships

	Actor	Constraint	Potential Solutions
		• Limited resources for farmers empowerment programs • Implied by the conflict between mangrove forests (bird nests) and milkfish farming.	• Provide training on best practices, facilitate market linkages, advocate for farmer-friendly policies • Net protective for bird of prey

6.12.1 Actors in the Core Value Chain Function

- **Milkfish Farmers**:
  - **Identified Needs:** Access to quality seeds, appropriate feed, sufficient working capital, technical knowledge in cultivation and pest management, market access, and stable selling prices.
  - **Constraint:** Poor seed quality, high input costs, limited capital, reliance on middlemen, uncertain prices, technical knowledge gaps, vulnerability to climate change and pests, environmental pollution.
  - **Recommendations:**
    - Form stronger farmer cooperatives for collective bargaining on inputs (seeds, feed) and outputs (selling price). Adopt improved farming techniques (e.g., polyculture, selective breeding for resilience). Invest in basic water quality testing kits.
    - Implement on-farm waste management (e.g., using pond sludge as fertilizer for other crops, if applicable). Explore integrated multi-trophic aquaculture where waste from milkfish can be utilized by other organisms. Develop local hatcheries to improve seed quality and reduce dependence.
- **Seed Suppliers**:
  - **Identified Needs**: Consistent quality, reliability, competitive pricing, adoption of best practices in hatchery management.
  - **Constraint**: Potentially low-quality control, lack of standardization.
  - **Recommendations:**
    - Implement strict quality control measures and certifications for seeds. Invest in research and development for disease-resistant and fast-growing milkfish strains.
    - Develop partnerships with farmers for feedback on seed performance. Invest in broodstock management to ensure genetic diversity and quality.
- **Feed Producers**:
  - **Identified Needs**: Cost-effective, nutritionally balanced feed, good FCR, availability.
  - **Constraint**: High cost of feed, potential for inconsistent quality.
  - **Recommendations:**
    - Develop more affordable and efficient feed formulations tailored to local milkfish strains and conditions. Provide technical support to farmers on optimal feeding practices.
    - Explore alternative, locally sourced, and sustainable feed ingredients (e.g., insect meal, algae).

- **Village-level Collectors/Middlemen**:
  - **Identified Needs**: Efficient logistics, market connections, financial access.
  - **Constraint**: Potentially exploitative lending practices, limited value addition.
  - **Recommendations**:
    - Transition from purely transactional relationships to more collaborative partnerships with farmers. Explore opportunities for aggregation and basic processing to add value.
    - Formalize lending practices with transparent terms. Engage in contract farming arrangements that benefit both parties.
- **Presto Milkfish Businesses/Processors**:
  - **Identified Needs**: Quality processing, market demand for processed products, efficient supply chain.
  - **Constraint**: Consistent supply of specific quality fish, potential for limited market reach.
  - **Recommendations**:
    - Diversify product offerings. Invest in better processing technology to ensure product quality and shelf life.
    - Establish direct sourcing agreements with farmer groups, providing incentives for quality and consistency. Explore using fish waste for by-products (e.g., fish meal, fish oil).

6.12.2 Actors in Supporting Functions

- **Financial Institutions**:
  - **Identified Needs**: Accessible, tailored financial products (loans, insurance).
  - **Constraint**: Unsuitable loan products, high-interest perception, lack of specific fishery insurance.
  - **Recommendations**:
    - Develop flexible loan repayment schedules aligned with harvest cycles. Create specialized aquaculture insurance products. Conduct financial literacy training for farmers.
    - Introduce green finance products for sustainable aquaculture practices.

6.12.3 Enabling Environment

- **Government Agencies (Local & National):**
  - **Identified Needs**: Supportive policies, effective regulations, technical assistance, infrastructure development.
  - **Constraint**: Gaps in suitable policies, limited extension services, enforcement issues, lack of coordinated climate change adaptation strategies.
  - **Recommendations**:
    - Implement policies for sustainable aquaculture, provide subsidies for climate-resilient infrastructure (e.g., floating nets), strengthen extension services with technical experts, enforce environmental regulations (e.g., industrial waste discharge).
    - Promote research and development in sustainable aquaculture technologies. Facilitate public-private partnerships for value chain development. Establish regulations for responsible waste management in aquaculture.
- **Research and Academic Institutions**:
  - **Identified Needs**: Innovation, knowledge transfer, problem-solving research.

    - **Constraint**: Disconnect between research and farmer needs, limited funding for applied research.
    - **Recommendations**:
        - Conduct research on climate-resilient milkfish strains, improved feed formulations, and environmentally friendly pest control. Disseminate findings directly to farmers.
        - Research on converting aquaculture waste into valuable resources.
- **NGOs and Industry Associations**:
    - **Identified Needs**: Advocacy, capacity building, facilitating partnerships.
    - **Constraint**: Limited resources, reach.
    - **Recommendations**:
        - Provide training on best practices, facilitate market linkages, advocate for farmer-friendly policies.
        - Promote sustainable aquaculture certifications.

6.13 Closed Loop System Strategy

6.13.1 Current Actors & Institutions Involved

- **Core Actors**: Milkfish Farmers, Village-level Collectors/Middlemen, Presto Milkfish Businesses/Processors.
- **Supporting Actors**: Seed Suppliers, Feed Producers, Material Suppliers (netting, bamboo), Laborers (cleaning, repair, harvest).
- **Informal Institutions**: Community cultivation groups , informal lending by collectors.

6.13.2 Potential Involvement of Other Actors for a Closed Loop System

- **Research & Development Institutions (Universities, Research Centers)**:
    - Developing improved fish strains (e.g., disease-resistant, salinity-tolerant), optimizing feed formulations (using local by-products), researching waste-to-resource technologies (e.g., converting fish waste to fertilizer/feed), and promoting sustainable aquaculture practices.
    - Scientific expertise for resource efficiency and waste minimization.
- **Biotechnology/Bio-Product Companies**:
    - Developing and marketing probiotics for fish health, enzymes for feed digestion, or solutions for wastewater treatment.
    - Enhancing fish health, reducing reliance on chemicals, and improving water quality.
- **Compost/Fertilizer Producers:**
    - Processing fish pond sludge and fish waste (from processing) into organic fertilizers.
    - Turning waste into a valuable agricultural input, reducing chemical fertilizer use.
- **Integrated Aquaculture-Agriculture Initiatives:**
    - Facilitating integration between milkfish farming and other agricultural practices (e.g., using pond water for irrigation, sludge for crops).
    - Maximizing resource utilization across different production systems.
- **Renewable Energy Providers:**
    - Installing solar panels or other renewable energy sources for pond aeration or processing facilities.
    - Reducing carbon footprint and operational costs.

- **Environmental Technology Companies**:
  - Providing solutions for water treatment (e.g., biological filters), waste segregation, and pollution control.
  - Improving water quality, reducing discharge impact.
- **Financial Institutions**:
  - Offering "green" loans for sustainable aquaculture technologies (e.g., floating nets, bio-filters) and tailored insurance products.
  - Enabling investment in environmentally friendly practices.
- **Certification Bodies** (e.g., ASC, Global GAP):
  - Providing certifications for sustainable aquaculture, potentially opening access to premium markets.
  - Incentivizing adoption of sustainable practices.

6.13.3 Closed Loop System Development Strategies

- Develop local hatcheries to improve seed quality and reduce seed dependence and reduce cost
- Implement on-farm waste management (e.g., using pond sludge as fertilizer for other crops, if applicable). Waste from milkfish can be utilized by other organisms.
- Develop partnerships between hatchery and farmers for feedback on seed performance
- Explore alternative, locally sourced, and sustainable feed ingredients (e.g., insect meal, algae).
- Promote lending practices with transparent terms. Engage in contract farming arrangements that benefit both parties
- Promote research and development in sustainable aquaculture technologies. Aquaculture Technology Providers:
  - To introduce sustainable farming practices, water treatment systems, and feed optimization.
  - To improve fingerling quality, disease resistance, feed efficiency, and processing techniques
- Facilitate public-private partnerships for value chain development.
- Establish regulations for responsible waste management in aquaculture
- Collaboration with Waste Management/Recycling Companies: To manage pond waste and factory waste (e.g., batik industry) that impacts water quality
- Promote sustainable aquaculture certifications. Certification Bodies: For sustainable aquaculture practices (e.g., ASC certification) to enhance market access and consumer trust
- Local Authorities/Regulators: To enforce environmental regulations and support sustainable aquaculture zones.
- Off takers/Large Retailers: To provide stable demand and potentially invest in the supply chain for quality assurance.
- Introduce green finance products for sustainable aquaculture practices.
- Financial Institutions: To develop suitable financial products (e.g., loans with flexible repayment based on harvest cycles) and insurance for aquaculture losses.
- Microfinance Institutions/Cooperatives: To provide accessible and tailored financial product.

6.14 Recommendations for Improvements to Value Chain Actors (Especially at the Milkfish Farmers Level) with Market System Development Perspective

These recommendations aim to address the identified weaknesses and threats, leverage opportunities, and improve the overall sustainability/environmental resilience and profitability of the milkfish value chain, especially for the farmers at its core; and with the support and endorsement from actor in Supporting Function as well as The Enabler in the Enabling Environment**.**

6.14.1 Focused For Milkfish Farmers (Central Actor in Core Value Chain Function)

1. Improve Seed Quality and Management:
    - Market System Development Aspect:
        - Core Actors ➔ Farmers (demand aggregation function).
        - Supporting Functions ➔ Seed suppliers (quality assurance, certification).
        - Enabling Environment➔Government (setting quality standards, supporting local hatcheries business development).
    - **Recommendation**:
        - *Farmers' groups should collectively source high-quality, certified milkfish seeds from reputable hatcheries.*
        - *Explore local cooperative hatcheries if feasible. Implement basic on-farm sorting and acclimatization of seeds to improve survival rates.*
2. Optimize Feed Management and Nutrition:
    - Market System Development Aspect:
        - Core Actors ➔ Farmers (improved practices and activities).
        - Supporting Functions ➔ Feed producers (technical assistance, quality feed development).
        - Enabling Environment➔ Research institutions (R&D on local feed ingredients, probiotics).
    - **Recommendation:**
        - *Conduct training on proper feeding techniques (amount, frequency) to reduce waste and **improve Feed Conversion Ratio (FCR).***
        - *Introduce farmers to the concept of balanced nutrition and the benefits of probiotics.*
3. Invest in Climate-Resilient Infrastructure:
    - Market System Development Aspect:
        - Core Actors ➔Farmers (collective investment initiative).
        - Supporting Functions ➔ Material suppliers (innovative, durable materials).
        - Enabling Environment ➔ Financial institutions (green loans), Government (subsidies, policy incentives).
    - **Recommendation**:
        - *Explore collective investment or micro-financing for transitioning to floating net systems, despite the higher initial cost.*
        - *Advocate for government subsidies or grants for such investments.*
4. Adopt Sustainable Pest and Disease Management:
    - Market System Development Aspect:
        - Core Actors ➔Farmers (adopt new practices).

- Supporting Functions ➔***Extension services /PPL/ Aquaculturist*** (training).
- Enabling Environment➔ Government (regulations on chemical use, R&D on alternatives), NGOs (awareness campaigns).

- **Recommendation**:
  - *Implement Integrated Pest Management (IPM) strategies focusing on biological control (e.g., natural predators, physical barriers) and improved pond hygiene instead of chemical pesticides.*
  - *Train farmers on identifying fish diseases and non-chemical treatments.*

5. Enhance Harvesting and Post-Harvest Practices:
   - Market System Development Aspect:
     - Core Actors ➔Farmers (adopt new techniques).
     - Supporting Functions➔Local trainers, equipment suppliers, **local Champion as "*Guru*"**.
     - Enabling Environment ➔Processors (demand for quality, provide feedback).
   - **Recommendation**:
     - *Train farmers on harvesting techniques that minimize fish damage (e.g., scales peeling off).*
     - *Explore more efficient and less damaging harvesting tools for smaller ponds. Implement immediate chilling/icing to maintain fish freshness and quality.*
6. Strengthen Financial Access and Literacy:
   - Market System Development Aspect:
     - Core Actors➔Farmers (group formation, financial education activities).
     - Supporting Functions ➔ Financial institutions (develop tailored products), **Microfinance institutions**.
     - Enabling Environment ➔ Government (policy to encourage fishery finance, consumer protection).
   - **Recommendation**:
     - *Formally organize farmer groups to collectively negotiate with banks for tailored loan products with flexible repayment schedules aligned with harvest cycles.*
     - *Advocate for specific fishery insurance products.*
     - *Provide comprehensive financial literacy training.*
7. Explore Diversified Market Channels and Value Addition:
   - Market System Development Aspect:
     - Core Actors ➔ Farmers (direct sales, basic processing).
     - Supporting Functions ➔ Processors (contract farming, technical support).
     - Enabling Environment ➔ Government (market information systems, trade promotion).
   - **Recommendation**:
     - *Empower farmer groups to directly engage with larger buyers or processors to bypass intermediaries and secure better prices.*
     - *Invest in basic value-addition at the farmer level (e.g., gutting, cleaning, basic processing) to increase product value and reduce post-harvest losses.*

6.14.2 Focused For Other Value Chain Actors (Supporting Functions & The Enabler of Enabling Environment)

1. Financial Institutions:
    - Market System Development Aspect ➔ Develop innovative financial instruments for aquaculture.
    - **Recommendation**:
        - *Develop flexible loan products for milkfish farmers with repayment schedules tied to harvest cycles (e.g., 5-month installments or grace periods).*
        - *Create specific insurance products to cover losses from climate events (floods, salinity changes) and disease*.
2. Feed Producers:
    - Market System Development Aspect ➔ Product innovation, technical support **Recommendation**:
        - Research and develop more affordable, nutritionally optimized, and environmentally sustainable feed formulations using local ingredients.
        - Provide technical guidance to farmers on efficient feeding.
3. Seed Suppliers:
    - Market System Development Aspect ➔ Quality assurance, R&D.
    - **Recommendation**:
        - Implement stringent quality control and certification for milkfish seeds.
        - Invest in breeding programs to develop disease-resistant and fast-growing strains.
4. Collectors/Middlemen:
    - Market System Development Aspect ➔ Improved contract farming, fair and ethical trade, mutually beneficial relations with farmers
    - **Recommendation**:
        - Formalize lending agreements with transparent terms and fair interest rates.
        - Consider forming partnerships with farmer groups to ensure consistent supply and fair pricing,
        - moving towards a more collaborative relationship.
5. Presto Milkfish Businesses/Processors:
    - Market System Development Aspect ➔ Direct market linkages, value-added processing.
    - **Recommendation**:
        - Establish direct sourcing relationships with farmer groups, offering premium prices for quality and consistency.
        - Provide inputs or required quality standards to farmers to ensure desired raw material quality.
        - Explore full utilization of fish by-products to enhance profitability and contribute to a closed-loop system.
6. Government (Local and National):
    - Market System Development Aspect ➔ Policy and regulatory reform, public infrastructure development, **R&D funding**.
    - **Recommendation:**
        - *Enforce strict environmental regulations on industrial waste discharge into rivers to protect aquaculture areas.*
        - *Provide subsidies or low-interest loans for farmers to adopt climate-resilient infrastructure (floating nets) and sustainable practices.*
        - *Invest in extension services (PPL) that provide technical training on improved cultivation, pest management, and post-harvest handling.*

- *Establish price stabilization mechanisms or market information systems to reduce price volatility for farmers.*
- *Support research into climate-resilient milkfish strains and sustainable feed alternatives.*

In addition, closed-loop system should also aim to minimize waste and maximize resource utilization within the value chain, the recommendations are:

- **Integrated Waste Management at Farm Level**:
  - **Bioremediation** ➔ Utilize aquatic plants or certain microorganisms within the pond system to naturally filter water and reduce nutrient load before discharge.
  - **Minimizing Chemical Use** ➔ Shift from chemical pesticides to biological pest control methods or integrated pest management (IPM) to reduce water contamination and harm to other aquatic life. This directly addresses the current issue of chemical pollution.
- **Feed Optimization and By-Product Utilization:**
  - **Efficient Feed Use** ➔ Improve FCR through better feed quality and feeding practices, reducing feed waste.
  - **Alternative Feed Ingredients** ➔ Research and develop feed using local, sustainable by-products (e.g., agricultural waste, insect meal, microalgae) to reduce reliance on conventional ingredients and lower environmental footprint.
- **Fish Waste to Value-Added Products**:
  - **Fish Offal Processing** ➔ Explore processing fish offal (from harvest or processing plants) into fish meal or fish oil for animal feed, fertilizers, or other industrial uses. This can be particularly relevant for presto milkfish businesses.
  - Collagen/Gelatin Extraction ➔ Extracting and further processing From fish skins and bones.
- **Water Recirculation Systems**:
  - While large-scale Recirculating Aquaculture Systems might be too costly for individual farmers, exploring smaller technology, semi-closed systems or incorporating biological filters can reduce water dependence on exchange/circulation and improve water quality, especially in areas with increasing salinity or pollution.
- **Energy Efficiency**:
  - Explore renewable energy sources (e.g., solar power for aeration pumps if needed) to reduce the carbon footprint of operations.
- **Circular Economy Principles in Infrastructure:**
  - Promote durable and recyclable materials for pond construction and netting, reducing the frequency of replacement and waste.
  - Invest in floating net systems that have a longer lifespan **(KJA)**.
- **Knowledge Sharing and Best Practices**:
  - Establish platforms for farmers to share knowledge on successful closed-loop practices and innovative solutions.
  - It could be utilizing the existing social media platform or developing dedicated online applications.

7 Value Chain Analysis for Vacuum-Packed Pressure-Cooked Milkfish in Pekalongan and Batang Regency

This document is an in-depth analysis of the **Vacuum-Packed Pressure-Cooked Milkfish (*Bandeng Presto*)** commodity value chain in Pekalongan and Batang Regency. The analysis was conducted based on Focus Group Discussion (FGDs), field interviews, and complemented with secondary references (mostly from websites sources and common information from various source). We tried to combine quantitative analysis (using ratio calculation) and a descriptive qualitative analysis (using table and diagram/graph); henceforth referring to the various method of value chain analysis and market system development approaches. At the end of this document, conclusions and recommendations will be presented as references for future actions that is conceivable in the implementation stages of BRAVE Project.

7.1 Value Chain Stream Mapping

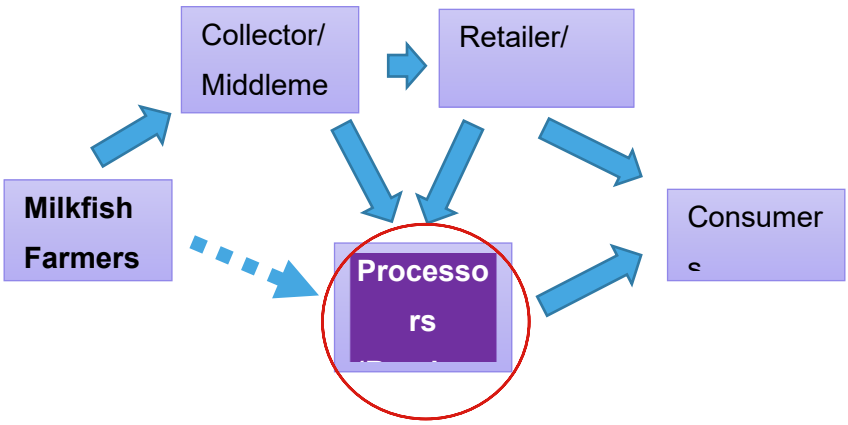


Figure 18 Supply chain diagram for processed milkfish

7.1.1 Key Actors in the Value Chain

Table 42 Key actors in processed milkfish value chain

Stage	Key Actors
Upstream	Milkfish Farmers, Fish Collectors, Local Market Vendors
Midstream	Processed Milkfish Entrepreneurs (producers)

Stage	Key Actors
Downstream	Individual Consumers, Traditional Markets, Catering Businesses,
Support	Local Government, (Potential) Associations, Social Media Platforms

- Raw milkfish flows from farmers, collectors, and through local markets to the processed milkfish entrepreneurs. Some flows (not many) directly to processors.
- Entrepreneurs process the milkfish, which includes cooking, cooling, and vacuum packaging.
- Packaged products are then distributed to local individual buyers (some with direct delivery), traditional markets, and food catering businesses.
- Participation in exhibitions and festivals expands reaching out to customers beyond the local area, sometimes requiring expedition services for delivery.
- Social media platforms like WhatsApp and Facebook are used for marketing and direct communication with end buyers.

The milkfish value chain in the Pekalongan and Batang regencies, centered around processed milkfish, exhibits a relatively straightforward structure with distinct upstream, midstream, and downstream activities.

7.1.2 Upstream of Value Chain (Supply of Raw Materials)

The upstream segment primarily involves the sourcing of fresh milkfish. Entrepreneurs obtain their raw materials from three main channels:

- **Local Markets**: This is a common source, though it comes with a higher price of approximately IDR 33,000 per kilogram. The advantage here is the ability to request specific fish sizes for uniformity, reducing sorting effort.
- **Fish Collectors**: Sourcing from collectors offers a lower price of around IDR 28,000 per kilogram. However, fish size tends to be more varied, requiring extra sorting, and there's a higher chance of physically damaged fish (e.g., peeled scales), which can negatively impact consumer perception.
- **Direct from Pond Farmers**: Similar to collectors, this source also presents variations in fish size and potential physical imperfections, necessitating additional sorting.

The average fresh milkfish input requirement for processors is 10-20 kilograms per week. Standard size milkfish typically weigh 3-4 fish per kilogram, while special orders might require larger fish, with 1-2 fish per kilogram.

7.1.3 Midstream Value Chain (Processing and Production)

This stage is dominated by the processed milkfish entrepreneurs.

- **Production Process**: The production process for pressure-cooked milkfish typically occurs twice a week. It involves cooking in a pressure cooker or heating in an oven for 6 hours , followed by a cooling process of 10-20 hours.
- **Inputs for Processing**:

    - Electricity: Around IDR 300,000 per month, primarily for vacuum and freezer machines.
    - LPG Gas: 3 kg LPG gas cylinders are used for cooking, costing around IDR 25,000 per unit. Typically, 1-2 units are needed per week.
    - Manpower: 2-3 people are required per production process, with wages of IDR 100,000 per day.
- **Packaging:** After processing, milkfish are vacuum-packed in plastic, with packaging costing IDR 2,000 per fish. A typical packing box contains two fish.
- **Product Diversification**: Some entrepreneurs also produce other milkfish-based products, such as grilled fish cake, which requires additional chicken eggs (1 kg per kg of milkfish raw material) and a longer production time.
- **Production Constraints**: Frequent obstacles include leakage in pressure cookers, incurring repair costs of around IDR 500,000 and disrupting production. Difficulty in obtaining bamboo leaves, a standard processing material, is also noted. Entrepreneurs also face issues with product quality (flesh too soft, damaged scale/body/fins) and inability to address muddy smell in raw milkfish. There are also limitations in mass production capacity for large orders.

7.1.4 Downstream Value Chain (Marketing and Distribution)

The processed milkfish products reach consumers through various channels:

- **Local Sales:** Marketing is generally concentrated within Pekalongan city. A significant portion of sales are individual buyers who place direct orders. Some entrepreneurs offer direct delivery for these bookings.
- **Exhibitions and Festivals:** Participation in local exhibitions and festivals in Pekalongan City has attracted customers from outside Pekalongan region and even outside Central Java Province.
- **Out-of-City Delivery**: For deliveries outside the city, expedition services are utilized.
- **Pricing**:
    - Boxed products (2 fish per box) are sold at IDR 55,000 per box.
    - Individual fish are sold at IDR 20,000 - IDR 25,000 per fish, especially those not packed in boxes.
    - Smaller sized milkfish (contain 8-9 fish per kg) are sold at IDR 15,000 per fish to traditional markets or catering businesses, without cardboard packaging.
- **Marketing Challenges**: Current marketing efforts are still largely localized , with a reliance on government-initiated exhibitions. Online sales through e-commerce platforms like Tokopedia or Shopee are not yet common, although some entrepreneurs use social media like WhatsApp and Facebook for marketing. Packaging design is considered simple and unappealing. There are also challenges in marketing reach beyond Pekalongan region, even within Central Java Province and to other provinces.
- **Permitting**: Obtaining permits, particularly BPOM certification, and the cost of packaging are identified as constraints. However, there is government support for licensing and permits, offering some convenience.

7.1.5 Support Functions

- **Government**: Provides ease for licensing and permits. Also initiates exhibitions and festivals that entrepreneurs could participate in.
- **Need for Associations**: Entrepreneurs express a need for an association to strengthen marketing, potentially forming a joint outlet or online store.

7.2 Profit Margin Analysis

Table 43 Comparison of the average profit margin for each actor in value chain

No	Actor	Avg.Revenue/kg (IDR)	Avg. Cost/kg (Estimate) (IDR)	Profit/kg (IDR)	Margin (%)
1	Milkfish Farmer	20,000	15,000	5,000	25%
2	Collector	23,000	20,000	3,000	13%
3	Presto (non Boxed)	40,000	33,000	7,000	18%
4	Presto (Boxed product)	55,000	33,000	22,000	40%

Note: The numbers in the table are approximations (generalizations from common case whilst for the specific calculations of the milkfish farmers are presented in the report for Fresh Milkfish Market Value Chain)

Based on the above figure, the highest profit margin belongs to pressure cooked milkfish with fully packed product.

- Revenue per Box (2 fish): IDR 55,000
- Revenue per individual fish (not boxed): IDR 20,000 – IDR 25,000
- Revenue per small fish (for traditional market/catering): IDR 15,000
- Processors appear to capture the largest margin in the value chain. One processor obtained revenue of IDR 55,000 (51.4%), and another IDR 32,000 (28.6%), which individual cost may vary. This suggests significant value addition through processing.
- The added value for processed products like Omega-3 thornless milkfish can be substantial, with a price increase from IDR 30,000/kg to IDR 55,000/kg after average processing costs of Rp 2,000/kg, resulting in a value increase of IDR 25,000/kg or 70%.

Based on the information gathered from FGD, we could work on to estimate the profit margins (for more detailed calculations, please see Annex 1)

7.2.1 Revenue Processed Milkfish Entrepreneurs

- Revenue per Box (2 fish): IDR 55,000
- Revenue per individual fish (not boxed): IDR 20,000 – IDR 25,000
- Revenue per small fish (for traditional market/catering): IDR 15,000

The buying price difference for raw milkfish (input cost):

- From Market Source: IDR 33,000 per kilogram
- From Collector Source: IDR 28,000 per kilogram

Cost Components for Processed Milkfish Entrepreneurs with 15 kg milkfish (means of 10-20 kg of raw milkfish, processed twice a week):

Table 44 Cost component for processed milkfish

Cost Item	Market Source (IDR)	Collector Source (IDR)
Raw Material	495,000	420,000
LPG Gas	25,000	25,000
Manpower	200,000	200,000
Electricity	37,500	37,500
Packaging	105,000	105,000
Total Cost	**862,500**	**787,500**

Estimated Revenue per Production Cycle for 15 kg milkfish, assuming all 52.5 fish are sold as boxed products (2 fish/box), resulting in approximately 26 boxes.

- 26 boxes x IDR 55,000/box = **IDR 1,430,000.**
- For buying from Market Source, Estimated Total Cost = IDR 862,500
- For buying from Collector Source, Estimated Total Cost = IDR 787,500

As calculated above, the estimated profit per production cycle (15 kg milkfish):

- Market Source: IDR 567,500
- Collector Source: IDR 642,500

Table 45 Estimated profit for processed milkfish

Sourcing Channel	Estimated Revenue (IDR)	Estimated Total Cost (IDR)	Estimated Profit (IDR)	Profit Margin (%)
Market	1,430,000	862,500	567,500	39.7%
Collector	1,430,000	787,500	642,500	44.9%

Therefore, sourcing from collectors, despite potential quality issues, offers a higher profit margin due to lower raw material costs. The cost of packaging and labor are significant components. This indicates a healthy profit margin for the processing stage.

This suggests that processed milkfish entrepreneurs capture significant value, and sourcing raw materials from collectors can yield a higher profit margin for them due to lower input costs.

Analysis: The profit margins for processed milkfish entrepreneurs are relatively strong, ranging from nearly 40% to 45%. Sourcing from collectors, despite the potential for varied fish sizes and physical imperfections, yields a higher profit margin due to the lower raw material cost. This highlights the importance of raw material procurement in influencing profitability.

7.3 Cost-Benefit Ratio Analysis & Productivity (Yield) Analysis

Table 46 Cost-benefit ratio for processed milkfish

Actor	Revenue (IDR)	Cost (IDR)	Profit (IDR)	Return-Cost Ratio (RC)	Benefit-Cost Ratio (BC)
Processor with sale per box (2 pcs of fish)	55,000	42,000	13,000	1.31	0.24
Processor with sale per fish (non boxed)	20,000–25,000	16,500	3,500–8,500	1.29	0.29

Note: Processed fish cost includes gas LPG (2×25,000/week), labor (2 people × 100,000), electricity (300,000/month), and vacuum packing (2,000/unit).

The following are details of **Cost Components** for Processed Milkfish Entrepreneurs (per 10-20 kg of raw milkfish, processed twice a week):

- Assuming 15 kg of milkfish processed per production cycle, twice a week (average of 10-20 kg per week, assuming two cycles).
- Raw Material Cost:
  - Purchase from Local Market ➔15 kg x IDR 33,000/kg = IDR 495,000
  - Purchase from Collector ➔ 15 kg x IDR 28,000/kg = IDR 420,000
- LPG Gas: 1 unit per production cycle (assuming 1-2 units per week, average 1.5 units per week). For 2 cycles, 2 units ➔2 units x IDR 25,000/unit = IDR 50,000
- Manpower: 2-3 people per production. Assuming 2 people x IDR 100,000/day = IDR 200,000 per production cycle ➔ For 2 cycles: IDR 400,000.
- Electricity: IDR 300,000 per month. Per production cycle (assuming 8 cycles a month) ➔ IDR 300,000 / 8 = IDR 37,500.
- Packaging: Assuming 1 kg contains 3-4 fish (average 3.5 fish)➔ 15 kg x 3.5 fish/kg = 52.5 fish.
  - Cost per fish = IDR 2,000.
  - Total packaging cost ➔ 52.5 fish x IDR 2,000/fish = IDR 105,000

Here is the summary of Estimated Cost per Production Cycle (15 kg milkfish):

Table 47 Estimated cost per production cycle

Cost Item	Market Source (IDR)	Collector Source (IDR)
Raw Material	495,000	420,000
LPG Gas	25,000	25,000
Manpower	200,000	200,000
Electricity	37,500	37,500
Packaging	105,000	105,000
Total Cost	**862,500**	**787,500**

Note: Purchasing from Local Market, although incurred higher cost but mostly preferable since the fish size relatively the same (sorted out) and in good shape (fish scale intact, preferred by consumer)

Estimated **Revenue** per Production Cycle (15 kg milkfish):

- Assuming all 52.5 fish are sold as boxed products (2 fish/box) ➔ resulting in approximately 26 boxes.
- Hence 26 boxes x IDR 55,000/box = IDR 1,430,000.

Estimated **Profit** per Production Cycle:

- Fish from Market Source: IDR 1,430,000 (Revenue) - IDR 862,500 (Cost) = IDR 567,500
- Fish from Collector Source: IDR 1,430,000 (Revenue) - IDR 787,500 (Cost) = IDR 642,500

Therefore, sourcing raw material fish from collectors, despite potential quality issues, offers a higher profit margin due to lower raw material costs. ***The cost of packaging and labor are significant components.***

We can analyze the **Cost-Benefit Ratio (CBR)** based on the estimated figures above for a single production cycle (15 kg milkfish).

- CBR = Total Cost / Total Benefit (Revenue)
- Market Source: CBR = IDR 862,500 / IDR 1,430,000 approx 0.60
- Collector Source: CBR = IDR 787,500 / IDR 1,430,000 approx 0.55

A CBR less than 1 indicates that the benefits outweigh the costs. The lower CBR for sourcing from collectors suggests a more favorable cost-benefit scenario for the entrepreneurs.

Benefits beyond direct financial:

- Market Sourcing: Benefit of consistent fish size and reduced sorting effort, potentially leading to higher customer satisfaction and less product rejection.
- Collector/Farmer Sourcing: Benefit of lower raw material cost, potentially leading to higher profit margins despite the extra effort for sorting and potential physical defects.

As calculated previously, the Cost-Benefit Ratio (CBR = Total Cost / Total Benefit (Revenue)) for a single production cycle (15 kg milkfish) is:

- Market Source: CBR approx. 0.60
- Collector Source: CBR approx. 0.55

Analysis: A CBR less than 1 indicates that the benefits (revenue) outweigh the costs. Both sourcing channels show a favorable CBR, suggesting the business is financially viable. The lower CBR when sourcing from collectors (0.55 vs. 0.60 for market) indicates a better return on investment from a cost perspective, even with the associated challenges of sorting and potential lower physical quality.

These ratios suggest that the processed milkfish business is financially viable, with benefits exceeding costs. The lower CBR for collector-sourced milkfish indicates better cost efficiency.

7.4 SWOT Analysis

Table 48 SWOT analysis for processed milkfish

Strengths	Opportunities
• Established local demand, Local demand is strong • Processing knowledge exists • Local Government support (permit, festival & bazaar) • Availability of raw fish (Direct access to raw milkfish materials) • Affordable input costs • High value addition potential through processing	• Online market expansion • Festival/exhibition exposure • Regional market expansion • Digital marketing & e-commerce • Association for processors • Development of products with higher added value (e.g., Omega-3 thornless milkfish) • Increased consumer preference for processed milkfish
Weaknesses	**Threats**
• Poor packaging, low shelf life (not durable) • No bookkeeping practices • Low financial literacy • Limited processing innovation and processing techniques	• Equipment breakdowns (pressure pan leaks) • Fish supply variability and mud smell (bad odor) • Dependence on inconsistent raw material quality and size from different sources.

• weak marketing capabilities, dependence on exhibitions. • No standardization or certification • Product quality inconsistencies (fish too soft, damaged, muddy smell). • Low preservation and long-term storage ability. • Limited mass production capacity for large orders/exports • Constraints with licensing (BPOM) and high packaging costs.	• Processed Fish for consumption contaminated with substances from Pollution from industry & pesticides • High equipment & packaging costs • Competition with other regional processors • High costs of licensing and packaging • Unstable processed milkfish prices in the market

7.5 Benchmarking/Comparative Analysis

Table 49 Benchmarking and comparative analysis for processed milkfish

Component	Local Practice	Best Practice (Benchmark)
Packaging	Simple, unattractive	Branded, multi-layer vacuum, eco-friendly
Sales	Mostly local	multi-channel including e-commerce
Processing time	6–8 hours (plus cooling)	Can be optimized using modern equipment
Preservation	Short-term	Use freezing or Modified Atmospheric Packaging (MAP) /cryogenic for longer distribution

- **Local Competitors/Industry Standards**: current entrepreneurs face challenges with product standardization (too soft, damaged fish) and quality control (muddy smell). This suggests that there might be local competitors or industry leaders who have overcome these issues, setting a higher standard.
- **Packaging**: The current packaging is described as "very simple, not yet interesting". This highlights an area where benchmarking against more successful local or regional food products could lead to significant improvements in market appeal.
- **Marketing**: The reliance on local government exhibitions and limited online presence suggests that other local food businesses might be utilizing more diversified and effective marketing strategies, including stronger online marketing and branding.
- **Innovation**: Entrepreneurs feel their innovation and processing techniques are limited. Benchmarking against other successful processed food businesses, even beyond milkfish, could provide inspiration and best practices for product diversification and quality enhancement.

7.5.1 Recommendations

- **Product Quality:** Research and adopt best practices from other successful processed milkfish producers to address issues like fish texture, damage during processing, and muddy smell. This could involve exploring different cooking times, pressure settings, or pre-processing techniques.
- **Packaging Design**: Invest in professional packaging design. Look at successful local food brands for inspiration on attractive and informative packaging that appeals to consumers and highlights product quality and safety (e.g., BPOM certification).

- **Marketing Strategies:** Learn from successful local businesses that have effectively utilized online platforms (e.g., Tokopedia, Shopee, dedicated e-commerce websites) and diverse social media marketing campaigns.
- **Product Diversification**: Explore other value-added milkfish products that are popular in the region or have potential for wider appeal, potentially learning from other fish processing businesses.

7.6 Institutional & Stakeholder Analysis

Table 50 Institutional and stakeholder analysis for processed milkfish

Institution/Stakeholders	Role	Influence
Government (local)	Licensing, facilitation	Medium–High
NGOs (potential)	Capacity building, financial access	Medium
Collectors	Key supplier middleman	High
Entrepreneurs	Main processor	High
Consumers	Demand drivers	Medium

The following is the analysis of the existing institutional and Stakeholders aspect:

- The primary existing institution playing a role is the local government, which facilitates and organizes exhibitions.
- Local Government (Pekalongan City Regency) ➔ Acts as an enabler by simplifying licensing and permits and by providing marketing platforms/stands through exhibitions
- Most processors operate independently.
- No formal associations or cooperatives.
- Licensing for BPOM is still an issue.
- However, a significant gap identified is the absence of a formal association for processed milkfish entrepreneurs.
- Missing/Desired Institutions ➔ Processed Milkfish Entrepreneurs Association. Entrepreneurs explicitly state the need for an association to strengthen marketing, potentially through a joint outlet or online store. This indicates a strong desire for collective action and mutual support.

Potential Roles of a Milkfish Entrepreneurs Association:

1. Collective Marketing ➔ Developing a shared brand or platform for online sales (e.g., joint online store, collaboration on marketplace platforms).
2. Knowledge Sharing ➔ Facilitating the exchange of best practices in processing techniques, quality control, and business management.

3. Input Sourcing ➔ Potentially negotiating better prices or more consistent quality for raw materials and other inputs (e.g., bamboo leaves necessary for processing) through bulk purchasing.
4. Advocacy ➔ Representing the interests of entrepreneurs to the government for policy support (e.g., easier access to BPOM, subsidies for packaging).
5. Innovation Hub/Center (could be initiated by other program, NGO, in collaboration with local university/training institution) ➔ Collaborating on research and development for new products or improved processing methods.
6. Financial Literacy Training ➔ Providing training on bookkeeping and financial management, as many entrepreneurs currently lack these skills (potential collaboration with financial institutions)

7.7 Policy and Regulatory Analysis

7.7.1 Current Landscape

- Ease of Licensing and Free local permits available. The local government offers convenience for licensing and free permits, which is a significant advantage for entrepreneurs. This positive policy environment reduces initial barriers to entry and operational costs related to basic compliance.
- Exhibition Support: Local government-initiated exhibitions and festivals provide crucial marketing platforms for entrepreneurs, extending their reach beyond the local market. This demonstrates government support for market access
- Difficulties with BPOM ➔ perceived as bottleneck in the business
- Hurdles and barriers to national market access
- No support scheme for standardized packaging or technology upgrading ➔ formal packaging compliance

7.7.2 Challenges and Gaps

- BPOM Certification: Despite the ease of general permits, entrepreneurs face constraints and costs related to obtaining BPOM certification (*Badan Pengawas Obat dan Makanan* - National Agency of Drug and Food Control). BPOM is critical for expanding into wider retail channels and ensuring consumer trust in packaged food products.
- Packaging costs are considered expensive, which could be exacerbated by specific regulatory requirements for food-grade packaging that might be more costly to meet.
- Lack of Standardization: The absence of clear product standards (e.g., in terms of softness, physical integrity, or addressing muddy smell)

7.7.3 Recommendations for Policy and Regulatory Improvements

- **BPOM Facilitation Programs**: The local government could introduce specific programs to assist processed milkfish entrepreneurs in obtaining BPOM certification. This could include:
    - Subsidies or grants for the application process and necessary facility upgrades.
    - Workshops and technical assistance on BPOM requirements, Good Manufacturing Practices (GMP), and hygiene standards.
    - Streamlined application processes specifically for local SMEs.
- **Packaging Cost Reduction Initiatives**:

    - Bulk purchasing schemes facilitated by the government or an association to reduce per-unit packaging costs.
    - Research and development support for more affordable, food-grade, and environmentally friendly packaging materials.
    - Incentives for packaging suppliers to offer competitive pricing to local SMEs.
- **Quality Standards Development**: Collaboration between the government, a potential entrepreneurs' association, and food technology experts to develop and promote industry standards for processed milkfish. This could include:
    - Guidelines for raw material selection (e.g., addressing muddy smell).
    - Processing parameters to achieve optimal texture and minimize physical damage.
    - Quality control protocols.
- **Market Access Beyond Local**: Policies to support entrepreneurs in accessing markets beyond Central Java, such as:
    - Trade mission participation.
    - Connecting them with larger distributors or retailers.
    - Promotional campaigns at a provincial or national level.
- **Financial Literacy Programs**: While not strictly regulatory, government or affiliated agencies could provide training on bookkeeping and financial management to improve business sustainability (this topic will be analyzed in a specific section later)

7.8 Gender Analysis

- The FGD participants were predominantly women, with only one male participant. This strongly suggests that Majority of processed milkfish entrepreneurs are women; and men are a small minority; women are the primary entrepreneurs and workforce in the processed milkfish industry in this region.
- Women's entrepreneurship is key in this segment but lacks formal support/training in finance, packaging, and marketing
- In the Focus Group Discussion for processed milkfish entrepreneurs, it was noted that the indication of a strong female presence in the processed milkfish sector, suggesting women play a dominant role in value-added activities.
- This strongly suggests that women are the primary entrepreneurs and workforce in the processed milkfish industry in this region. This aligns with broader trends in many small and medium-sized food processing enterprises in Indonesia, where women often play a central role.

7.8.1 Implications of Female Dominance

- Economic Empowerment ➔ The industry provides a significant source of income and economic empowerment for women in the community.
- Household Income ➔ The revenue generated likely contributes directly to household income and family well-being.
- Potential for Bottlenecks ➔ While positive, a heavy reliance on female labor might also expose the industry to specific challenges, if women face constraints related to time management (due to domestic responsibilities), access to finance, or limitations in physical mobility for market access.
- Specific Needs ➔ Women entrepreneurs might have distinct needs regarding training, access to technology, or networking opportunities that cater to their specific circumstances.

7.8.2 Recommendations for Gender-Sensitive Development

- Targeted Training Programs: Design training programs on processing techniques, quality control, financial literacy, and marketing specifically for women entrepreneurs, considering their schedules and learning preferences.
- Access to Finance: Facilitate access to microfinance or women-specific business loans that cater to the needs of small-scale female entrepreneurs.
- Leadership and Networking: Support the establishment of a strong women-led entrepreneurs' association to foster peer-to-peer learning, advocacy, and collective action. Encourage women to take leadership roles.
- Childcare Support: Explore the possibility of providing or facilitating access to childcare services, which could enable women to dedicate more time to their businesses and attend training or networking events.
- Technology Adoption: Ensure that new technologies or processing methods introduced are accessible and user-friendly for women, potentially providing training on their operation.
- Addressing Time Poverty: Recognize the dual burden often faced by women entrepreneurs and explore ways to simplify processes or introduce labor-saving technologies.
- Promote Inclusivity: While female dominance is observed, efforts should also be made to ensure that men who wish to participate in or contribute to the industry are also supported.

7.9 Sustainability and Social Impact Analysis

7.9.1 Environmental / Sustainability Issue

- Waste Management ➔ Potential for fish waste. In fish processing, proper disposal of offal and wastewater is crucial to prevent environmental pollution (e.g., water contamination, odor to the neighborhood).
- Energy Consumption ➔ Electricity is used for vacuum and freezer machines, and LPG gas for cooking. While not explicitly stated as an environmental problem, energy consumption contributes to carbon emissions.
- Packaging Waste ➔ The use of vacuum plastic packaging will contribute to plastic waste, especially since the packaging is described as "very simple" and not necessarily optimized for recyclability.
- Raw Material Sourcing ➔ sourcing from local markets, collectors, and farmers, while generally sustainable, issues like unsustainable aquaculture practices could arise in the broader milkfish supply chain A potential issue may arise from fish input namely use of chemicals, the issue mentioned intensely in the FGD with Milkfish Farmers (Potentil Recommendation for Eco-certification / green product)
- Chemical Use: Participants of FGD do not mention the use of chemicals in the processing practices. This is a positive sign, as it suggests the current methods are primarily traditional cooking. However, for future expansion or if external sources are used, the risk of chemical use for preservation or coloring should be monitored. (potential Recommendatin : Natural preservatives)
- Plastic Packaging: The use of vacuum plastic contributes to plastic waste. The current simple packaging design might not prioritize recyclability.
- Energy Consumption: Electricity and LPG gas consumption contribute to carbon emissions.
- Upstream Impacts: Potential unsustainable aquaculture practices (though not detailed in the document) from farmers could impact water quality and ecosystems.

7.9.2 Social Impact

- Livelihood Creation ➔The processed milkfish industry provides livelihoods for entrepreneurs and their families, as well as employment for 2-3 people per production cycle. This has a positive social impact by reducing unemployment and poverty.
- Women's Empowerment ➔ As noted in the gender analysis, the industry significantly empowers women economically.
- Local Economic Development ➔ The business contributes to the local economy of Pekalongan through purchases of raw materials, labor, and local sales.
- Food Security issue ➔ Provides a local source of processed food, contribute to the national government vision regarding Food Security

7.9.3 Recommendations for Environmentally Friendly Aspects

- Sustainable Raw Material Sourcing:
    - Encourage and support milkfish farmers in adopting sustainable aquaculture practices (e.g., responsible feed use, water quality management, avoiding antibiotics/harmful chemicals).
    - Develop direct relationships with farmers who practice sustainable farming to ensure a consistent and environmentally conscious supply.
- Waste Management in Processing and By-product Utilization:
    - Implement proper fish waste management techniques (e.g., composting fish offal for fertilizer, converting waste into fish meal if feasible at a larger scale).
    - Ensure wastewater treatment to prevent water pollution. Implement basic wastewater treatment systems to ensure that water discharged from processing facilities meets environmental standards. This could involve simple sedimentation tanks or biofilters.
    - Fish Waste Composting/Fertilizer Production: Encourage entrepreneurs to collect fish offal (heads, bones, guts) and compost it to create organic fertilizer for local agriculture or even for their own purposes if they have gardens. This reduces waste volume and provides a valuable resource.
    - Explore Higher-Value By-products: As part of a closed-loop system, explore partnerships with research institutions or companies to extract valuable compounds from milkfish waste (e.g., fish oil, collagen, gelatin from bones and skin).
- Eco-Friendly and Sustainable Packaging:
    - Explore biodegradable or recyclable packaging materials as alternatives to conventional plastics. Transition to Eco-Friendly Materials: Gradually shift towards biodegradable, compostable, or easily recyclable packaging materials. Research local suppliers for these options.
    - Reduce Plastic Use: Explore alternative packaging formats that minimize plastic, such as paper-based packaging with a thin, compostable liner. Investigate packaging designs that use less material or are easier to recycle.
    - Collaborate with local waste management initiatives to ensure proper disposal and recycling of current packaging.
    - Promote Recycling: Educate consumers on how to dispose of packaging responsibly and encourage participation in local recycling programs. Collaborate with local waste management authorities to ensure collected plastic is indeed recycled.
- Energy Efficiency:

    - Conduct an energy audit to identify areas for reducing electricity consumption. Conduct an audit to identify inefficient appliances (e.g., old freezers, vacuum machines) and upgrade to more energy-efficient models.
    - Optimize Production Schedule: Plan cooking and freezing cycles to maximize energy efficiency and minimize idle equipment time, cooking schedules to minimize LPG gas consumption.
    - Solar Power: Investigate the feasibility of installing small-scale solar panels to power vacuum and freezer machines (if financially feasible), reducing reliance on grid electricity and lowering carbon footprint. Government incentives for renewable energy adoption could be explored.
    - Encourage alternative clean energy for processing (e.g., induction stove instead of gas stove)
- Supply Chain Diversification: To mitigate risks from localized climate impacts, entrepreneurs could consider diversifying their raw material sourcing geographically within the region, if possible, to reduce reliance on a single vulnerable area.
- Chemical Use: The FGD does not explicitly mention the use of chemicals in the processing of pressure-cooked milkfish. This suggests that the current methods primarily rely on cooking and vacuum packaging for preservation, which is a positive sign from an environmental and food safety perspective.
- However, if future expansion or different processing methods are adopted, there is a risk of introducing chemicals for extended shelf life, artificial flavoring, or coloring. This should be carefully monitored.
- Traceability: Establishing systems to trace milkfish back to farms that employ sustainable practices.
- Addressing Muddy Smell Naturally: Research and implement natural methods to eliminate the muddy smell in raw milkfish, rather than resorting to chemical treatments. This could involve purging fish in clean water or specific pond management techniques.

7.10 Financial Literacy Analysis

Almost all businessman pressure cooked milkfish admits: Not yet do bookkeeping and good record keeping start from material raw materials, production process costs and recording sale.

The financial literacy level among the processed milkfish entrepreneurs is low, as evidenced by their admission of not practicing proper bookkeeping and record-keeping for raw materials, production costs, and sales. This is a critical weakness that can hinder business growth and decision-making.

7.10.1 Challenges of Low Financial Literacy

- **Poor Decision Making:** Without accurate records, entrepreneurs cannot effectively track profitability, identify cost inefficiencies, or make informed decisions about pricing, expansion, or investment.
- **Difficulty in Accessing Finance:** Banks and other financial institutions typically require proper financial records for loan applications.
- **Inability to Scale:** Lack of clear financial data makes it challenging to plan for mass production, manage cash flow for large orders, or assess the viability of new ventures.

- **Tax Compliance Issues:** Inaccurate records can lead to difficulties in complying with tax regulations, especially tax imposed on entrepreneurs that fall into the category MSME
- **Vulnerability to Shocks:** Without a clear financial picture, businesses are less resilient to economic downturns or unexpected costs (e.g., cooker repair, which is vital and leads to disruption of operations when occur).

7.10.2 Recommendations for Improving Financial Literacy

- **Basic Bookkeeping Training:** Organize workshops on simple bookkeeping methods tailored for small businesses. This could involve manual ledgers, simple spreadsheet templates, or user-friendly mobile accounting applications.
- **Record-Keeping Templates:** Provide easy-to-use templates for tracking raw material purchases, production costs (labor, energy, gas), sales by product type (boxed, individual, small), and other expenses.
- **Mentorship Programs**: Pair experienced business owners (if any exist) or financial advisors with entrepreneurs for personalized guidance on financial management.
- **Financial Technology (FinTech) Adoption**: Introduce relevant FinTech tools that simplify expense tracking, invoicing, and sales recording.
- **Association-Led Initiatives**: A future entrepreneurs' association could play a crucial role in organizing and funding these financial literacy programs.
- **Government Support**: Local government or relevant agencies (e.g., Cooperatives and MSMEs Agency) should offer subsidized or free training programs.

7.11 Market System Development (MSD) Framework

Table 51 MSD framework for processed milkfish

	Actor	Constraint	Potential Solutions
Core Function	• Processed Milkfish Enterprenuer	• Leakage in pressure cookers • limited innovation • limited mass production capacity • Localized sales, reliance on exhibitions • expensive packaging	• Provide hands-on training on optimal cooking parameters (pressure, time) to ensure consistent quality • Explore collective purchasing of new, more resilient equipment • Conduct intensive training on setting up and managing online stores • Explore partnerships with regional distributors
Supporting Function	• Cold storage, • Logistics company • packaging units,	• Still not connected with company that specialized in logistics and storage	• Exploring collaboration with private companes based to establish good

	Actor	Constraint	Potential Solutions
	• Financial Institutions	• low access to various financial products	business model and win-win solution • Potential collaboration with Financial institution since the business is credit worthy and viable
Enabling Environment	• Government Agencies • BPOM • digital marketplace platforms	• potentially limited local budget for extensive support programs. • BPOM complexity, perceived high packaging costs, lack of clear quality standards	• Develop and fund programs that connect local entrepreneurs with regional and national markets, not just exhibitions • streamlining BPOM, addressing packaging costs, and developing quality standards • explore potential collaboration with digital marketplace platform

7.12 Closed Loop System Strategy

Current Actors and Institutions (as identified previously):

- Core Value Chain Actors:
  - Milkfish Farmers
  - Fish Collectors
  - Local Market Vendors
  - Processed Milkfish Entrepreneurs (Dominant actor in the midstream)
  - Individual Consumers
  - Traditional Markets
  - Catering Businesses
  - Expedition Services
- Supporting Functions:
  - Local Government (licensing, exhibitions)
  - Social Media Platforms (WhatsApp, Facebook Marketplace)

Identification of Value Chain Channels; several key value chain channels for processed milkfish (for illustration depiction of Closed Loop Business Model, see Annex 2**):**

1. Direct-to-Consumer (Local Individual Buyers):

   Processed Milkfish Entrepreneurs ➔ Individual Buyers (often through booking) ➔ Direct Delivery (by entrepreneur) or pick-up.

Characteristics: High direct interaction, personalized service, often local.

2. Traditional Market/Catering Channel:

   Processed Milkfish Entrepreneurs ➔ Traditional Markets / Catering Entrepreneurs.

   Characteristics: Often involves smaller-sized fish, no specific packaging, bulk sales at a lower unit price.

3. Exhibition/Festival Channel:

   Processed Milkfish Entrepreneurs ➔ Exhibitions/Festivals (organized by local government) ➔ Consumers (local and from outside Pekalongan/Central Java).

   Characteristics: Event-driven, opportunity for wider reach, brand exposure.

4. Expedition Service Channel (for out-of-city sales):

   Processed Milkfish Entrepreneurs ➔ Expedition Services rightarrow Consumers (outside Pekalongan/Central Java).

   Characteristics: Necessary for distant markets, adds logistics costs.

5. Social Media Channel (Supplementary):

   Processed Milkfish Entrepreneurs ➔ Consumers (via WhatsApp, Facebook for marketing/ordering).

   Characteristics: Informal, direct communication, currently used as a marketing tool, not a full e-commerce platform.

Missing/Underdeveloped Channels:

- E-commerce Marketplaces: No online sales via Tokopedia or Shopee. This is a significant untapped channel for wider market reach.
- Modern Retail: No mention of sales to supermarkets or modern grocery stores.
- Wholesalers/Distributors (beyond local collectors): While collectors exist for raw materials, there's no mention of distributors for finished products to broader markets.

Potential Involvement of Other Actors for a Closed-Loop System

An ecological closed-loop system aims to minimize waste and maximize resource utilization, often by turning waste into valuable inputs and ideally involving the following important actors:

- Waste Management/Recycling Companies:
  - Role: Collect plastic packaging waste from entrepreneurs and consumers for recycling. Potentially process fish waste into fertilizer or other by-products.
  - Contribution to Closed-Loop: Reduce plastic pollution and convert organic waste into resources.
- Biotechnology/Bioproduct Companies:
  - Role: Research and develop methods to utilize milkfish processing by-products (e.g., bones, scales, offal) into higher-value products such as fish collagen, chitin, or fish oil.
  - Contribution to Closed-Loop: Create new revenue streams from waste, reduce waste volume.
- Packaging Innovations/Manufacturers:
  - Role: Develop and supply biodegradable, compostable, or easily recyclable packaging materials.
  - Contribution to Closed-Loop: Reduce reliance on virgin plastics and mitigate plastic waste.
- Agricultural/Aquaculture Research Institutions:
  - Role: Conduct research on sustainable milkfish farming practices (e.g., feed optimization, waste reduction in ponds) and improve resilience to climate change.
  - Contribution to Closed-Loop: Improve resource efficiency at the farming level.
- Financial Institutions (Microfinance, Banks):
  - Role: Provide specific loan products for entrepreneurs to invest in eco-friendly technologies (e.g., energy-efficient machines, waste processing equipment) or sustainable farming practices.
  - Contribution to Closed-Loop: Enable financial investment in sustainable practices.
- Universities/Training Center or Schools:
  - Role: Provide training on sustainable processing techniques, waste valorization, and environmental management for entrepreneurs and farmers.
  - Contribution to Closed-Loop: Build capacity for sustainable practices.
- Local Community Groups/NGOs:
  - Role: Promote environmental awareness, organize community recycling initiatives, and support the adoption of sustainable practices among small businesses.
  - Contribution to Closed-Loop: Foster a culture of sustainability and collective action.

7.13 Closed Loop System Development Strategies

To move towards a closed-loop system, the following strategies are recommended, targeting key areas of waste and resource flow:

1. Waste Valorization at Processing Level:
   - Strategy: Implement a system for collecting and processing milkfish offal (heads, bones, viscera) from the entrepreneurs.

- Actors Involved: Processed Milkfish Entrepreneurs (collectors), Local Government/Entrepreneurs Association (facilitators), Local Agricultural Sector (users of fertilizer), Potential Biotechnology/Processing Companies (for higher-value products).
- Mechanism: Establish a centralized collection point or small-scale processing unit for fish waste. This waste can be composted into organic fertilizer or, for a more advanced loop, processed into fish meal, fish oil, or collagen.
- Benefit: Reduces landfill waste, creates new revenue streams, provides valuable inputs for agriculture or other industries.

2. Sustainable Packaging Loop:
   - Strategy: Shift towards reusable, recyclable, or compostable packaging materials and establish a collection/recycling infrastructure.
   - Actors Involved: Processed Milkfish Entrepreneurs (adopters of new packaging), Packaging Manufacturers (developers/suppliers of eco-friendly packaging), Consumers (responsible disposal), Recycling Companies/Local Waste Management (collectors/processors).
   - Mechanism: Incentivize entrepreneurs to switch to certified eco-friendly packaging. Partner with local recycling initiatives to ensure proper collection and processing of packaging waste. Explore a deposit-return scheme for certain packaging if feasible.
   - Benefit: Reduces plastic pollution, enhances brand image, aligns with consumer environmental values.
3. Water and Energy Efficiency:
   - Strategy: Optimize water and energy consumption throughout the value chain, from aquaculture to processing.
   - Actors Involved: Milkfish Farmers (water management), Processed Milkfish Entrepreneurs (energy efficiency), Local Government (policy/incentives), Technology Providers.
   - Mechanism: Provide training and subsidies for farmers to implement water-saving pond management. For entrepreneurs, conduct energy audits, incentivize adoption of energy-efficient equipment (e.g., more efficient vacuum pumps, freezers), and explore solar power solutions.
   - Benefit: Reduces operational costs, lowers environmental footprint (reduced emissions, water conservation).
4. Information and Knowledge Loop:
   - Strategy: Foster continuous learning and knowledge exchange across the value chain, particularly on sustainable practices and market demands.
   - Actors Involved: Entrepreneurs Association (facilitator), Universities/Research Institutions (knowledge providers), Local Government (coordinator).
   - Mechanism: Regular workshops, seminars, and field visits. Establish a knowledge hub or online platform for sharing best practices. Feedback mechanisms from consumers to entrepreneurs regarding product quality and preferences.
   - Benefit: Continuous improvement, adaptation to market changes, informed decision-making on sustainability.

By integrating these strategies, the milkfish and processed milkfish value chain in Pekalongan and Batang can evolve into a more resilient, environmentally responsible, and economically robust system.

7.14 Recommendations for Improvements to Value Chain Actors (Especially at the Milkfish Processor Level) with Market System Development Perspective

7.14.1 Actors in the Core Value Chain Function:

1. Milkfish Farmers (Note: Broader Analysis presented in the Milkfish Value Chain Report) :
    - Key Factors for Success: Access to good quality fingerlings, sustainable pond management knowledge, stable market demand, and resilience to climate change.
    - Obstacles: Vulnerability to climate impacts (flooding, water quality changes), potential for disease outbreaks, lack of access to finance for pond improvements, limited knowledge of sustainable practices.
    - **Recommendations:**
        - Climate-Resilient Aquaculture: Implement programs for farmers to upgrade pond infrastructure (higher dikes, better drainage), adopt water-saving techniques, and diversify species to withstand environmental changes.
        - Sustainable Practices Training: Provide training on responsible feed use, water quality monitoring, disease prevention, and natural methods to reduce muddy smell.
        - Access to Capital: Facilitate access to micro-loans or grants for pond rehabilitation, equipment upgrades, and adoption of new technologies.
        - Direct Sourcing Relationships: Encourage entrepreneurs to build long-term, fair-trade relationships with farmers to ensure consistent supply and fair prices, potentially offering technical assistance.
2. Processed Milkfish Entrepreneurs:
    - Key Factors for Success: Product quality and consistency, effective marketing and distribution, efficient production, financial management, and innovation.
    - Obstacles:
        - Production: Leakage in pressure cookers (costly repairs, disruption), limited innovation/processing techniques (too soft fish, damaged body, muddy smell issues), limited mass production capacity.
        - Marketing: Localized sales, reliance on exhibitions, no online store presence, simple/unattractive packaging, limited marketing capability.
        - Enabling Environment: Difficulty getting BPOM, expensive packaging, lack of bookkeeping.
    - **Recommendations:**
        - Product Quality & Innovation:
            - Technical Training: Provide hands-on training on optimal cooking parameters (pressure, time) to ensure consistent texture, minimize damage, and eliminate muddy smell. This could involve food technologists.
            - R&D Support: Facilitate access to R&D for new product development (e.g., ready-to-eat milkfish meals, milkfish floss) and improved processing methods.
            - Equipment Maintenance: Provide training on basic pressure cooker maintenance and connect entrepreneurs with reliable and affordable repair services. Explore collective purchasing of new, more robust equipment.
        - Marketing & Branding:

        - Professional Packaging: Invest in professional graphic designers for attractive, informative, and marketable packaging designs. Highlight BPOM certification (once obtained).
        - Digital Marketing Training: Conduct intensive training on setting up and managing online stores (Tokopedia, Shopee), effective social media marketing (beyond WhatsApp/Facebook), and content creation.
        - Expand Distribution: Explore partnerships with regional distributors or modern retail chains beyond Pekalongan.
    - Financial Management: Implement mandatory and accessible financial literacy programs focused on basic bookkeeping, cost accounting, and profit/loss analysis.
    - Production Capacity: Assess current production bottlenecks and provide solutions for scaling up (e.g., larger pressure cookers, more efficient layouts, better inventory management).
3. Consumers:
    - Key Factors for Success: Access to quality, affordable, and safe processed milkfish products; convenience in purchasing.
    - Obstacles: Limited accessibility outside Pekalongan, lack of varied product offerings, inconsistent quality for some (physical defects from collector-sourced fish).
    - **Recommendations**: Improved marketing and distribution will increase consumer access and awareness. Consistent quality and attractive packaging will enhance consumer preference.

7.14.2 Actors in Supporting Functions:

1. Local Government:
    - Key Factors for Success: Proactive policy making, effective program implementation, responsive to industry needs.
    - Obstacles: Bureaucratic hurdles for some permits (BPOM), potentially limited budget for extensive support programs.
    - **Recommendations:**
        - BPOM Facilitation: Establish a dedicated unit to guide and assist SMEs through the BPOM certification process, offering subsidies or grants if possible.
        - Market Access Programs: Develop and fund programs that connect local entrepreneurs with regional and national markets, not just exhibitions.
        - Infrastructure Support: Invest in improved infrastructure that benefits the supply chain (e.g., roads to fishponds, cold storage facilities).
        - Climate Change Adaptation Planning: Integrate climate change risks into regional development plans for the aquaculture sector.
2. Potential Processed Milkfish Entrepreneurs Association:
    - Key Factors for Success: Strong leadership, active member participation, clear objectives, ability to secure funding.
    - Obstacles: Lack of current formal structure, potential for internal disagreements, limited funding.
    - **Recommendations:**
        - Facilitate Formation: Government or NGOs should facilitate the establishment of this association, providing initial organizational and legal support.

- Collective Action: Empower the association to lead collective marketing efforts (joint online store), bulk purchasing of raw materials/packaging, and peer-to-peer knowledge exchange.
- Advocacy: Enable the association to effectively advocate for the needs of its members to government and other stakeholders.

7.14.3 Enabling Environment:

1. Policy and Regulatory Framework:
    - Key Factors for Success: Supportive and clear policies, efficient enforcement, incentives for growth and sustainability.
    - Obstacles: BPOM complexity, perceived high packaging costs, lack of clear quality standards.
    - **Recommendations:** As detailed in Policy and Regulatory Analysis. Focus on streamlining BPOM, addressing packaging costs, and developing quality standards.
2. Access to Finance:
    - Key Factors for Success: Availability of appropriate financial products, ease of access, financial literacy of entrepreneurs.
    - Obstacles: Lack of bookkeeping hindering loan applications, limited awareness of suitable financial products.
    - **Recommendations:** Financial literacy training, simplified loan applications for SMEs, microfinance options, and potentially green loans for sustainable investments.
3. Technology and Innovation:
    - Key Factors for Success: Awareness of new technologies, access to affordable technology, capacity to adapt.
    - Obstacles: Limited innovation ability, lack of exposure to new techniques.
    - **Recommendations:** Technology transfer programs, R&D partnerships with universities, subsidies for adopting efficient equipment.

Annex A Details of calculations for coffee

Farmer's Accounting (Revenue Vs Costs)

Average Total Revenue, Total Cost, and Profit of Each Value Chain Actor

Calculating this accurately is very difficult with the limited available data gathered during the FGD, as farmer cost and income data vary widely and are often based on memorizing of the farmers and not based on solid recording. However, we could only make estimates based on The Information Available.

Farmer's Data

Farmers in Jolotigo Village

- Selling price of wet coffee: IDR 11,000/kg
- Selling price of dry coffee (green beans): IDR 54,000/kg. (one farmers, Mr A, once reached IDR 63,000/kg).
- Sharing of results with PERHUTANI: 40% of the harvest is handed over to PERHUTANI. This means that farmers only receive 60% of the total harvest.

Farmers in Silurah Village:

- Wet coffee selling price: IDR 10,000/kg
- Selling price of dry coffee (moisture content 13%): IDR 51,000/kg
- Selling price of grade A coffee (sorted): IDR 90,000/kg (by farmers who apply GAP)
- Harvest waste: IDR 400/kg (for cattle feed)

Coffee Farmers (Estimate per Hectare per Year)

Assumption: 1 hectare of land (around total 1667 trees), productivity 694 kg green bean/ha (Jolotigo average).

- Total Revenue:
  - Green bean sales income: 694 kg x IDR 54,000/kg (Jolotigo price) = IDR 37,476,000.
  - After deduction to PERHUTANI profit sharing (60% for farmers): IDR 37,476,000 x 0.60 = **IDR 22,485,600**
- Total Cost:
  - Fertilizer: IDR 450,000/ha.
  - Pesticides/Herbicides: IDR 20,000 (estimated per application, assume 2 times a year) = IDR 40,000.
  - Seedlings: Generally free. But If farmer buy from nursery then 1667 seedlings x IDR 4000 = IDR 6,668,000 (initial outlays, not annual cost).

  - Labor: If independent, labor cost = 0. If using laborers (Silurah, 0.25 ha = IDR 2.8 million), then 1 ha = IDR 11,200,000. This is very high. Assume the majority are independent labor by farmers.
  - Indirect costs (equipment, light maintenance, etc.) are not recorded.
  - Estimated Total Cost (direct input): IDR 450,000 + IDR 40,000 **= IDR 490,000 .**
- **Profit: IDR 22,485,600 - IDR 490,000 = IDR 21,995,600/ha/year (before taking into account self-labor costs and depreciation).**

  Note: This figure is very sensitive to productivity and profit sharing scheme. If there is no profit sharing, the income will be higher. If productivity is low (such as Silurah's average of 208 kg/ha), the profit will be much lower.

Collectors

During field visit we also interview a local collector (by the Name of Mr. BC) and If we try to calculate this collector margin, then the following is the calculation:

Local Collectors (Mr. BC - Jolotigo):

- Purchase price of wet coffee from farmers: IDR 11,000/kg
- Purchase price for dry coffee from farmers: IDR 54,000/kg
- Green bean selling price to wholesalers: IDR 56,000/kg (lowest IDR 40,000/kg)
- Gross margin: Approximately 20%
- Input Price difference profit: Around IDR 2,500/kg

Example of Margin Calculation (Mr. BC, if buying wet and selling dry): Assuming 4 kg of wet coffee becomes 1 kg of dry coffee (generally a ratio of 4:1 or 5:1 from wet to dry).

- Cost of buying 4 kg of wet coffee: 4 kg x IDR 11,000/kg = IDR 44,000
- Drying cost: IDR 750,000/ton = IDR 750/kg
- Transportation costs to the drying location: IDR 100,000/ton = IDR 100/kg
- Total cost per kg of green beans (from wet coffee): IDR 44,000 (purchase price) + IDR 750 (drying) + IDR 100 (transport) = IDR 44,850
- Green bean selling price: IDR 56,000/kg
- **Margin per kg green beans: IDR 56,000 - IDR 44,850 = IDR 11,150/kg.. *This shows that collectors can earn quite good margins, despite the risk of price fluctuations.***

Return Cost Ratio (RC Ratio) and Benefit Cost Ratio (BC Ratio)

RC Ratio = Total Revenue / Total Cost

BC Ratio = Total Benefit / Total Cost (Benefit can include non-financial)

For Farmers (per hectare, illustration):

- Total Revenue = IDR 22,485,600
- Total Cost (estimated direct input) = IDR 490,000
- RC (BC) Ratio = IDR 22,485,600 / IDR 490,000 approx 45.88.
- *This figure is very high because we do not include profit sharing costs as costs (but as a reduction in revenue) and do not include independent labor costs. If PERHUTANI's profit sharing is considered a cost , or independent labor costs are calculated, the RC ratio will be much lower.*

For Collectors (per month, illustration):

- Total Revenue = IDR 1,400,000,000
- Total Cost = IDR 1,371,250,000
- RC (BC) Ratio = IDR 1,400,000,000 / IDR 1,371,250,000 approx 1.02.
- *This means that every 1 rupiah of cost generates 1.02 rupiah of income. This shows a thin but consistent profitability, which is common in commodity trading with small margins but large volumes.*

Productivity

Productivity Calculation (kg/ha):

1. Jolotigo Farmers (Average):
    - Assuming 1 tree produces 2-3 kg of wet coffee beans. Take an average of 2.5 kg of wet beans/tree.
    - The assumption of the ratio of wet coffee to dry coffee (green bean) is 4:1 (4 kg wet = 1 kg dry). So 2.5 kg wet = 0.625 kg green bean/tree.
    - Land area: ***Hard to get exact data.***
    - However, according to Mr. CD mentioned around 700 trees with a planting distance of 3x3 meters, covering around 6,300 m² (0.63 ha). Then, We can use this number as a reference for larger farmers.
    - **Productivity = (0.625 kg/tree x 700 trees) / 0.63 ha = 437.5 kg / 0.63 ha approx 694.4 kg green bean/ha/year .**
    - Mr CD Productivity:
        1. The highest production of 1 ton of dry coffee rice (1000 kg) from 0.63 ha = approx 1587 kg green bean/ha/year .
        2. The lowest is 0.3 tons (300 kg) from 0.63 ha = approx 476 kg green bean/ha/year .
2. Silurah Farmers (Average):
    - Average 0.5 kg wet coffee/tree. Assuming 0.5 kg wet = 0.125 kg green bean/tree.
    - The general planting distance is 3x2 meters. In 1 hectare (10,000 m²), the number of trees = 10,000 / (3 x 2) = 10,000 / 6 = approx 1667 trees/ha.
    - Productivity = 0.125 kg/tree x 1667 trees/ha = approx 208 kg green bean/ha/year .
3. Silurah Farmers (with nursery & GAP seeds):
    - 1 tree produces up to 5 kg of coffee beans. Assuming 5 kg of green beans/tree.
    - Productivity = 5 kg/tree x 1667 trees/ha = approx 8335 kg green bean/ha/year . This is a very high figure and may be an over-estimate information.

Minimum Optimum Productivity:

- One coffee tree should produce 3 kg green beans on the average.
- Using the assumption of 1667 trees/ha (from a planting distance of 3x2m in Silurah):
    - **Minimum Optimum Productivity = 3 kg green bean/tree x 1667 trees/ha = 5001 kg green bean/ha/year .**
- ***If Jolotigo farmers have 250 trees (land area unknown, but assumed to be around 0.15-0.2 ha with close planting distance), they could produce 200 kg, which is around 1000-1333 kg green bean/ha/year . This is still far from optimal.***

Productivity Gaps

Productivity comparison table:

Coffee Farmers	Productivity (kg green bean/ha/year)	Description
Jolotigo Farmers (Average)	approx 694	Using local seedlings, less maintenance |
Mr. CD (Jolotigo - Low)	approx 476	Mr. CD productivity variation
Mr. CD (Jolotigo - High)	approx 1587	Mr. CD productivity variation
Silurah Farmers (Average)	approx 208	Using local seedlings, less maintenance
Silurah Farmers (Nursery & GAP Seedlings)	approx 8335	Example of farmers implementing good practices
Minimum Optimum Productivity (Mr. BC Benchmark)	**approx 5001**	**Based on the potential of 3 kg green bean/tree**

"It is clear that there is enormous potential for increased productivity in both villages".

BREAK EVEN POINT

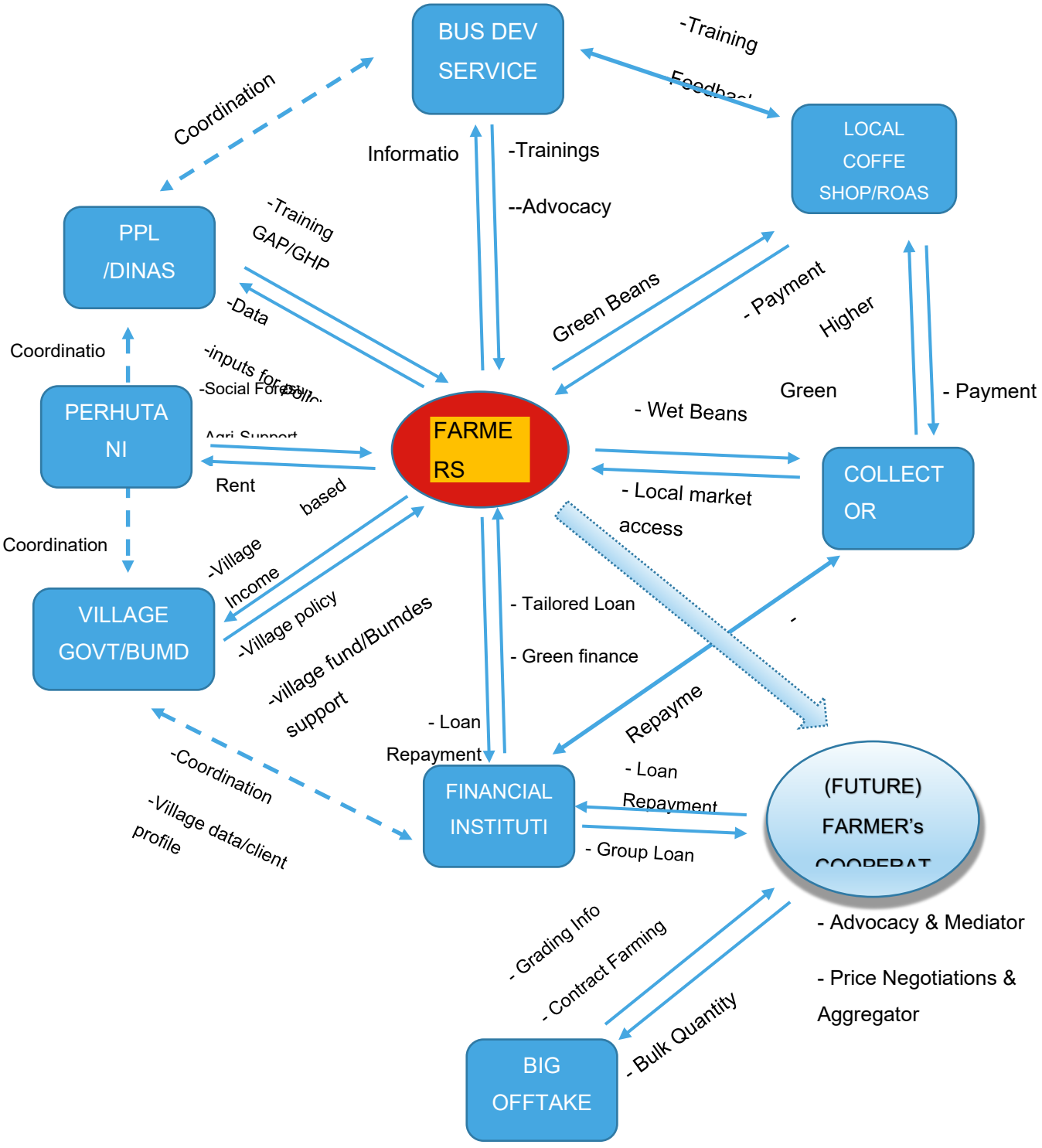
Break Even Point (BEP) Analysis and Financial Ratios

Break Even Point (BEP) – Illustrative figure (per year for farmers,)

For Farmers (per hectare, productivity 694 kg green bean/ha, selling price IDR 54,000/kg):

- Total Fixed Cost (FC): Difficult to estimate because many costs are variable (e.g. fertilizer based on need). If we consider non-input costs (equipment depreciation, etc.) as Fixed Cost, then these are not recorded by farmers.
- Total Variable Cost (VC) per kg:
    - If we assume the input cost per kg of yield: IDR 490,000 (fertilizer + pesticide) / 694 kg = approx IDR 706 / kg.
    - Plus the profit sharing "cost" to Perhutani: (40% of the selling price) = 0.40 x IDR 54,000 = IDR 21,600/kg.
    - **Total VC per kg = IDR 706 + IDR 21,600 = IDR 22,306/kg.**
- Selling Price per kg = IDR 54,000.
- **Contribution Margin per kg = IDR 54,000 - IDR 22,306 = IDR 31,694/kg.**
- If there is Fixed Cost, then BEP = FC / Contribution Margin per kg. Without Fixed Cost data, it is difficult to calculate accurately.

Annex B Comprehensive Business Model with Closed Loop System for Coffee



Annex C GCF Investment Criteria and Intervention Recommendations for Coffee

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Farmers (core function)	Low Productivity	Activity : Training /coaching 1. GAP & GHP Training 2. Climate Literacy Training 3. Financial Literacy Training 4. Gender Training 5. Field School	Recommended for project funding for: - Comprehensive climate field school for coffee commodity, which involves a series of trainings on climate literacy (incl. impacts on coffee), climate-adaptive agriculture practise (and the use of climate information system), GAP, and GHP - Through scientifically-sound yet participatory manner, expanding the existing climate information system development and contextualizing it with the needs and characteristic of coffee farming process and ensuring its utilisation in informing the climate-adaptive and GAP practices - Financial literacy and gender training	Boosting Yield, Reducing Cost, Increasing technical knowledge, financial knowledge, gender awareness and climate awareness

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Farmers Cooperative or Association	Activity : Capacity Building 1. Group development 2. Continuous Facilitation on farmers group	Recommended for project funding for: - Farmers group and cooperative formation - Community institutional capacity gap and need assessment, strengthening, fish farmers' organizations and encourage local institutions to become centers for innovation and training, especially in organisational management, business management and other relevant technical aspect. This include in building stronger representation of community-led organisation in BUMDES (if necessary) and village planning process Recommended for project funding for Demoplots that showcase: - climate-adaptive (incl. uses of climate information system/CIS) and conservation-based practices (incl. incentive scheme for conservation practice) - GAP and GHP principles	Need Institutionalisation at Farmer Level for effectiveness of the Project at recipient level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Adoption	Activity: Demonstration Plot Showcasing the Process and output of best practices	- improved networks to high-quality agriculture input providers (seed providers, organic fertilizers etc.) and offtakers (incl. financing scheme) - collaboration with Local Govt (PPL designation and Subsidy/grant program) - Contract farming with agri input providers or offtakers, including on the farm management technical capacity building and assistance Recommended for project funding for: - Procurement of drying machine - Build/rent special warehouse for coffee - youth and women group involvement in post-harvesting process	"Seeing is Believing" is idiom for mindset change at farmer level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Equipment	Activity: 1. Provision of Drying Machine 2. Building a Special Warehouse for Coffee		Post Harvest Process for coffee requires special treatment to produce high quality coffee beans
Seed Provider (core function)	Quality seed not used	Activity: 1. Promoting Seed 2. Allocating dedicated personnel (Agronomist) 3. Establishing Input Shop/selecting New Agent	Recommended activities: Collaborative scheme with high-quality agri-input providers (potential scheme could include co-Financing and/or collaboration in farm management technical assistance)	Incentive for involvement: • Product Promotion • New Market Penetration/Development • Revenue
Financial Institution (Supporting Function)	Low / No Access to Finance	Activity: 1. Developing Tailored financial product and/or scheme for farmers 2. Introducing Green Financing 3. Financial Literacy Training (CSR activity)	Recommended activities: - Collaborate with private sectors (CSR) or financial institutions on financial literacy training and explore access to finance - Improve coffee farmers' access to bundling of savings, parametric insurance products, credits, and digital marketing in collaboration with the	Incentive for involvement: • Expanding Portfolio • New Client Base

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
		4. Crop and Weather Insurance	Financial Services Providers (FSPs) and Marketplace companies - Introduce access to Green Financing	
PERHUTANI (Enabler)	Fair Yield Sharing	Activity: 1. Advocating Win-Win Solution 2. Advocating Agri Support for farmers 3. Advocating Issuance of HHBK Certificate for Farmers (Non Timber Forest Product)	Recommended activities: - Facilitate discussion between farmers, village government and land owner (PERHUTANI) regarding transparency and formalisation of the cooperation scheme; for instance, regarding profit sharing scheme, issuance of HHBK certificate, LMDH document etc.	Interest: • Reducing potential social conflict • Reducing potential land tenurial risks
Village Government (Enabler)	Low Involvement	Activity: 1. Mediation with PERHUTANI 2. Support in Village Level policy & Safeguarding project 3. Mediation in potential social conflict 4. Potential utilization of BUMDES (Village owned	Recommended activities: - Advocacy to include climate resilience and climate-adaptive livelihood into village development plan. This would include series of meetings or discussions. Community institutional capacity gap and need assessment, strengthening, fish farmers' organizations and encourage local institutions to become centers for innovation and training, especially in organisational management, business	Interest: Village Officials and Apparatus are key stakeholder when doing livelihood project at village level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
		Enterprise) as supporting function such as providing services / Agri Shop selling agri-inputs/providing equipments	management and other relevant technical aspect. This include in building stronger representation of community-led organisation in BUMDES (if necessary) and village planning process - Collaborative scheme with BUMDES	
University/Research/ConsultingInstitution (Market Apps Developer)			Develop a market information app that integrated to CIS and offer training for farmers on its use. Link farmers to domestic and national distribution networks, including modern retail and e-commerce.	

Potential Candidate for Training/Capacity building Provider:

1. PPL /Extension Services from Regency Office (Badan Pelaksana Penyuluhan Pertanian, Perikanan & Kehutanan / BP4K Kota Pekalongan)
2. Balai Penyuluhan Pertanian/BPP - TIRTO
3. Big Offtakers
4. Pekalongan University/Diponegoro University
5. Private Consultant
6. Lead Farmer/Champion

7. NGO ➔Training and also Group/Cooperative Formation
8. Local roastery in Pekalongan area (such as Coffee and Beyond)

Potential Candidate Actors for Seed Provider:

1. CV Sumber Agung (Kebumen)
2. CV Agung Sejahtera
3. Sentra Bibit Kopi (Temanggung)

Potential Candidate Actors for Financial Institution:

1. BRI - medium size loan up to IDR 100 million and micro Loan up to IDR 25 million
2. PT PNM – micro loan up to IDR 10 million
3. Bank Mandiri – Green Financing
4. BPD Jateng – productive and consumption loan
5. Allianz – Crop and Weather Insurance
6. ACA – Crop Insurance
7. Zurich Sharia – Crop and Weather Insurance
8. Microfinance Institution
9. Potential Candidate Actors for Offtaker and Market (including e-commerece)

GCF Investment Criteria for Coffee

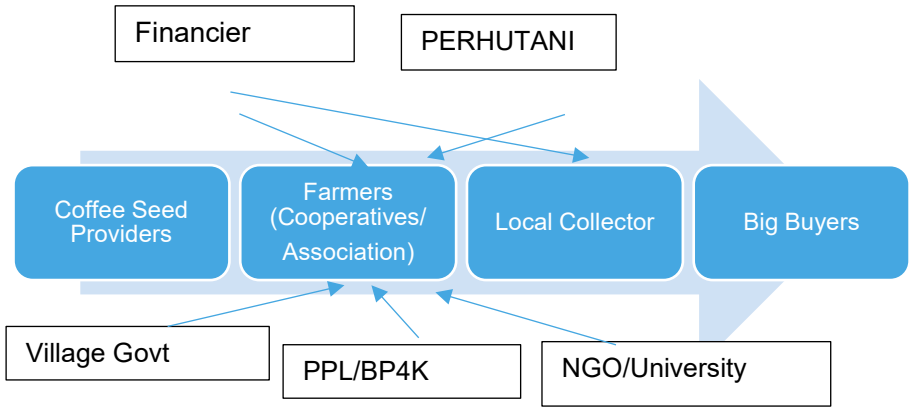
Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
Agroforestry coffee has both climate adaptation and mitigation benefits	Potential for specialty coffee (besides the already known Petungkriyono Coffee in Central Java), a high quality Robusta beans with acknowledgement and acceptance by regional and national wide market	With proper attention and monitoring, environmentally friendly practices could be applied	Coffee can be main source of Income for farmers, increased income for household, shifting farmers from the current subsistence livelihood, reduce poverty and economic vulnerability for farmers	National government vision to make high value commodity to be priority of agriculture sector. Coffee is one of those basket commodities	If Best Practices applied, productivity could be boost up to 200% - 300% (current yield max 1 ton/ha, best practices average 2.5 – 3.5 ton/ha
Suitable agro-climate farming (Perhutani Area)	Potential for scalable in terms of tonnage produced and reaching further market channel	Youth in the village showed interest in Coffee production		Regency Government may foresee coffee as Brand new “regional flagship product”	

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
	and it will attract Financial Institution				
Robusta coffee in Jolotigo and Silurah is highly sensitive to climate extremes that are becoming more frequent under climate change. **When annual rainfall exceeds 2,600 mm, flowering is disrupted, fruits drop prematurely, and ripe cherries crack—reducing sweetness**	Improvement in farming method with green practice could be bundled with “green financing” from Banks to scale	introduction of climate-adaptive and conservation-based agriculture practise, the use of CIS for risk-informed decision making process, and the possibility to be embedded in the village development plan (legalized by village regulation /Peraturan Desa)			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
and bean size—while humid conditions accelerate the spread of pests and diseases such as leaf rust and coffee berry borer. Studies show that heavy rainfall can reduce yields by up to 500 kg/ha, while prolonged drought can cause up to 30% tree mortality and production declines of 27% in larger estates.		The combined stresses for coffee farming due to heavy rain and prolonged drought resulting in inconsistent harvests, reduced quality, and unstable farmer incomes. Beyond its economic role, coffee farming also maintains vegetation cover in critical catchment areas, linking climate-resilient coffee production to both livelihood security and water resource protection.			

SCORING FOR COFFEE: HIGHLY RECOMMENDED COMMODITY

MARKET MAP FOR COFFEE



The intervention for systemic change for coffee should focus on increasing productivity and technical knowledge, getting support from financial institution as well as establishing institutionalization at the farmer level. Key entry points for this paradigm shift should include activities as follows:

- At farmers level: Training and coaching in Good Agricultural Practices (GAP) and Training in Good Handling Practices (GHP) by PPL trainers from BP4K Pekalongan or BPP Tirto, together with climate literacy, environmental awareness, financial literacy, and gender training as well as Farmers group/cooperative formation by selected local NGO. Climate information system expansion to serve the needs of coffee commodity, along with the establishment of Field School, evidence-based experience should be conducted through Demonstration Plots activities that showcase the process and output of best practices, with close monitoring from the trainers or designated local farmer champion. The project should also explore possibility of provisioning drying machine and/or establishing warehouse for coffee product, which would be handed over to farmers group
- Seed Provider: The project should seek collaboration with seed providers (CV Sumber Agung) to promote the use of quality seeds, and if possible allocate dedicated personnel (agronomists) for the project. Co-financing scheme from this private sector will be explored.
- Financial Institution: To address the lack of access to finance and other relevant financial product such as parametric insurance, the intervention is to develop tailored bundled-financial product/schemes for farmers by BRI, and provide financial product literacy training as an add-on service (CSR program), therefore activities would involve approaching and exploring potential agreement of collaboration with this Financier
- PERHUTANI: The intervention for PERHUTANI is to advocate for a win-win solution relation with farmers and provide agri-support for farmers, and advocate for the issuance of Non-Timber Forest Product (HHBK) certificates to farmers, therefore the project should research the options for best scenarios for fair yield sharing. The HHBK certificate potentially could be the basis for introducing green financing from financier (BRI)
- Village Government: The village government can support the project by mediating with PERHUTANI, support safeguarding the project, and supporting village-level policy. They can also utilize Village-owned Enterprises (BUMDES), with the stronger representation of the agriculture community-led organisation, to provide services or sell agri-inputs. Therefore, the project activities would involve approaching the village official and getting official commitment of cooperation from the village government.

Annex D Details of calculation for carrot

Farmer's Accountng (Revenue Vs Costs)

A. Farmers' Average Total Revenue (using per 1.5 hectares per harvest cycle, as most farmers admits having 1.5 ha):

- Estimated Yield: 37,500 kg (for 1.5 ha)
- Average Selling Price to Collectors: The price ranges from IDR 600/kg (lowest quality TO) to IDR 2,500/kg (best quality AB). Let's assume an average price of IDR 1,500/kg (mid-point, as quality varies).
- **Average Total Revenue for Farmers: 37,500 kg x IDR 1,500/kg = IDR 56,250,000 per 1.5 hectares per harvest cycle.**

B, Farmers' Average Total Cost (per 1.5 hectares per harvest cycle):

- Manure: 100 sacks/hectare. For 1.5 ha, 150 sacks. Assuming 50 kg/sack, total 7,500 kg. Cost: 7,500 kg x IDR 2,200/kg = **IDR 16,500,000.**
- Herbicides: IDR 65,000 – IDR 70,000. Let's use IDR 67,500 per application (assuming one application per cycle) x 1.5 ha = **IDR 101,250.**
- Additional Fertilizer (Gandasil): IDR 40,000, used twice. Total IDR 80,000. For 1.5 ha = **IDR 120,000.**
- Chemical Fertilizers (Urea, Ponska, NPK, KCL): No specific prices given. Secondary data suggests these can be significant costs. Let's estimate conservatively based on general farm input costs, e.g., IDR 3,000,000 per hectare for a mix of these (this is a broad estimate). For 1.5 ha, **IDR 4,500,000.**
- Insecticides: No specific price given. Let's estimate IDR 500,000 per hectare. For 1.5 ha, I**DR 750,000.**
- Fuel for Water Pump (Dry Season): 6 liters/day x IDR 12,500/liter = IDR 75,000/day. Water spraying for 5-6 days. Let's assume an average of 5.5 days per dry cycle. Total fuel cost: IDR 75,000/day x 5.5 days = IDR 412,500. Assuming one pump per 1.5 ha.
- Seeds: Berastagi type seeds are more expensive. While initially free, farmers still use derived seeds. If they had to purchase, 6-8 kg/ha. Let's assume 7 kg/ha. For 1.5 ha, 10.5 kg. Price of Berastagi carrot seeds varies greatly, but can be IDR 150,000 - IDR 300,000 per kg. Let's use IDR 200,000/kg for new seeds. Cost: 10.5 kg x IDR 200,000/kg = **IDR 2,100,000.**

  (Note: This cost is currently not incurred by farmers as they use derived seeds, but it represents a potential future cost or opportunity cost of not buying new seeds). For actual cost calculation based on current practice, we would put this at IDR 0.

- Labor: Cost of labor for land preparation, planting, weeding, spraying, harvesting. Highly variable, but a significant cost component not informed. we estimate based on typical rural daily wages in Indonesia, assuming 100 man-days/hectare at IDR 75,000/day. For 1.5 ha, 150 man-days. Cost: 150 days x IDR 75,000/day = **IDR 11,250,000.**

Total Estimated Farmer Costs (per 1.5 ha per harvest cycle, excluding new seed purchase for current practice):Manure: IDR 16,500,000 + IDR 101,250 + IDR 120,000 + IDR 4,500,000 + IDR 750,000 + IDR 412,500 + IDR 11,250,000

Subtotal: IDR 33,633,750

Farmers' Average Profit (per 1.5 hectares per harvest cycle):

- Average Total Revenue: IDR 56,250,000
- Average Total Cost: IDR 33,633,750

Average Profit: IDR 56,250,000 - IDR 33,633,750 = IDR 22,616,250 per 1.5 hectares per harvest cycle.

Note: This profit is an estimate based on assumptions about average price and costs. If the selling price is at the lowest end (IDR 600/kg), the profit would be significantly lower, potentially leading to losses. The farmers' complaint of low selling prices suggests this estimated profit might not always be realized or considered sufficient.

Analysis of return cost ratio (RC ratio) of value chain institutions/actors

RC Ratio = Revenue / Cost

Farmers' RC Ratio (per 1.5 hectares per harvest cycle):

RC Ratio = IDR 56,250,000 (Revenue) / IDR 33,633,750 (Cost) = 1.67

This means for every IDR 1 spent by farmers, they receive IDR 1.67 in revenue. An RC ratio > 1 indicates profitability. However, this is an average, and the low price complaints suggest this isn't consistently achieved or perceived as sufficient.

Benefit cost ratio (BC ratio) analysis of value chain

BC Ratio = (Benefits - Costs) / Costs = Profit / Costs + 1 (or Net Benefits / Costs)

AFarmers' BC Ratio (per 1.5 hectares per harvest cycle):

- Profit = IDR 22,616,250
- Cost = IDR 33,633,750
- BC Ratio = IDR 22,616,250 / IDR 33,633,750 = 0.67

BC ratio of 0.67 means that for every IDR 1 of cost, farmers generate IDR 0.67 in net benefit (profit). This is equivalent to an RC Ratio of 1.67 (1 + 0.67). A BC ratio > 0 implies profit.

Productivity Gaps

Calculation of Productivity or Yield of Harvest for each hectare (kilograms per ha)

It was mentioned in FGD, collectors buy up to a total of 1,800 kilograms to 3,000 kilograms of carrots per day. It also mentions that farmers generally have an average land area of 1.5 hectares. To estimate productivity per hectare, considering the harvest cycle that is the carrot plant cycle is about 4 months.

Let's assume the daily purchase by collectors represents the total harvest from the collective farmers in Simego Village over a certain period. However, we can make an estimation based on potential yield if the collector purchase range represents a typical harvest from some number of hectares. Without total cultivated area data, a direct calculation of kg/ha from collector purchase volume is challenging.

Based on seed usage and an assumption of average seed-to-yield ratio from secondary sources.

- For 1 hectare of land, an average of 6-8 kg of Berastagi carrot seeds are needed.
- Average carrot yield for Berastagi type can range from 20-40 tons/hectare (secondary information, e.g., from agricultural extension services in Indonesia). Let's use a conservative estimate of 25 tons/hectare for calculation, considering the suboptimal planting method (random spreading) mentioned.

    - 25 tons/hectare = 25,000 kg/hectare.

Therefore, estimated productivity or yield of harvest for each hectare is approximately 25,000 kg/ha.

Note: This is an estimation based on typical Berastagi carrot yields and adjusted for potential impact of suboptimal planting..

The minimum optimum productivity that should be produced from the average land ownership of carrot farmers

Information from Farmers in FGD: The average land ownership is **1.5 hectares.**

Based on the estimated productivity of 25,000 kg/ha: Minimum optimum productivity for an average land ownership of 1.5 hectares = 25,000 kg/ha x 1.5 ha = 37,500 kg (or 37.5 tons) per harvest cycle.

This "optimum" assumes adherence to good practices that can achieve the potential yield of the Berastagi variety, which currently is hampered by the random seed spreading.

Break Even Point

Break-Even Point (BEP) for Farmers (per 1.5 hectares per harvest cycle):

- Fixed Costs: Costs that do not change with output (e.g., land preparation, some labor costs that are semi-fixed, depreciation of equipment if owned). We assume most input costs are variable, but labor for land prep and some fixed asset costs (if any) are fixed. For simplicity, let's treat total costs as mostly variable for short-term BEP.
- Variable Costs per kg: Total estimated farmer costs (IDR 33,633,750) divided by estimated yield (37,500 kg) = IDR 896.9/kg.
- Average Selling Price: IDR 1,500/kg.
- BEP in Volume (kg): Total Fixed Costs / (Selling Price per unit - Variable Cost per unit)
    - Since we don't have clear fixed costs, let's assume a simplified BEP where profit is zero.
    - To break even, the farmer needs to sell enough carrots to cover their total costs.
    - **BEP (kg) = Total Costs / Average Selling Price = IDR 33,633,750 / IDR 1,500/kg = 22,422.5 kg.**

Therefore, a farmer with 1.5 hectares needs to produce and sell approximately 22,423 kg of carrots per harvest cycle to cover their costs at an average selling price of IDR 1,500/kg.

Annex E Comprehensive Business Model with Closed Loop System for Carrot

Annex F GCF Investment Criteria for Carrot

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Farmers (core function)	Low Productivity	Activity: Training /coaching 1. GAP & GHP Training 2. Climate Literacy Training 3. Financial Literacy Training 4. Gender Training 5. Field School Activity : Capacity Building 1. Group development 2. Continuous Facilitation on farmers group	Recommended for project funding for: - Comprehensive climate field school for carrot commodity, which involves a series of trainings on climate literacy (incl. impacts on carrot), climate-adaptive and conservation-based agriculture practise (inc smart irrigation) and the use of climate information system), GAP, and GHP - Financial literacy and gender training - Capacity building and technical assistance on farm-management Recommended for project funding for - Formation and strengthening of farmers group	Boosting Yield, Reducing Cost, Increasing technical knowledge, financial knowledge, gender awareness and climate awareness

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Farmers Cooperative or Association		- Community institutional capacity gap and need assessment, strengthening, fish farmers' organizations and encourage local institutions to become centers for innovation and training, especially in organisational management, business management and other relevant technical aspect. This include in building stronger representation of community-led organisation in BUMDES (if necessary) and village planning process - Capacity building and technical assistance on farm-management, with integration of CIS information delivery Recommended for project funding for Demoplots that showcase: - climate-adaptive (incl. uses of climate information system/CIS) and conservation-based practices (incl. incentive scheme for conservation practice) - GAP and GHP principles - water-efficient irrigation system - intercropping method	Need Institutionalisation at Farmer Level for effectiveness of the Project at recipient level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Adoption	Activity: Demonstration Plot Showcasing Process and output of best practices	- improved networks to high-quality agriculture input providers (seed providers, organic fertilizers etc.) and offtakers (incl. financing scheme) - collaboration with Local Govt (PPL designation and Subsidy/grant program) Recommended for project funding for: - Procurement of Equipment for line planting of seed according to GAP standard for Carrot. - Procurement of water-efficient irrigation system that uses renewable energy - Build/rent cool storage for carrot	"Seeing is Believing" is idiom for mindset change at farmer level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Equipment	Activity: 1. Provision of mechanization for planting seed 2. Watering system during dry season		The method of random throwing/broadcasting seed is very affecting the very sub optimal harvest yield
Seed Provider (core function)	Quality seed not used	Activity: 1. Promoting Seed 2. Allocating dedicated personnel (Agronomist) 3. Establishing Input Shop/selecting New Agent	Recommended activities: - Increased access and networks to high quality and climate-resilient seed providers - Cooperation scheme with seed providers to ensure continuity of seed supply, and if possible on farm management	Incentive for involvement: • Product Promotion • New Market Penetration/Developmnt • Revenue
Big Buyer	No Direct Access	Activity: Contract Farming	Recommended activities: - Develop a market information app that integrated to CIS and offer training for fish farmers and fish farmers on its use. - Link farmers to domestic and national distribution networks, including modern retail and e-commerce.	Incentive for involvement: • Securing supply line

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
			- Create a closed-loop carrot business model that involve multi-actors (agri input providers, farmers, and offtakers) - Technical assistance to ensure the harvested carrots could meet the offtaker's standard	
Financial Institution (Supporting Function)	Low / No Access to Finance	Activity: 1. Developing Tailored credit Scheme for farmers 2. Introducing Green Financing 3. Financial Literacy Training (CSR activity) 4. Crop and Weather Insurance	Recommended activities: - Introduce green financing - Financing scheme with agri input providers or offtakers - Improve farmers' access to tailored bundled service of (inter alia) savings, parametric insurance products, credits, and digital marketing in collaboration with the Financial Services Providers (FSPs) and Marketplace companies	Incentive for involvement: • Expanding Portfolio • New Client Base
Village Government (Enabler)	Low Involvement	Activity: 1. Support in Village Level policy & Safeguarding project 2. Potential utilization of BUMDES (Village owned Enterprise) as supporting function such as providing	Recommended activities: - Advocacy to include climate resilience and climate-adaptive livelihood into village development plan. This would include series of meetings or discussions. - Collaborative scheme with BUMDES	Interest: Village Officials and Apparatus are key stakeholder when doing livelihood project at village level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
		services / Agri Shop selling agri-inputs/providing equipments		

Potential Candidate for Training/Capacity building Provider:

1. PPL /Extension Services from Regency Office (Badan Pelaksana Penyuluhan Pertanian, Perikanan & Kehutanan / BP4K Kota Pekalongan)
2. Balai Penyuluhan Pertanian/BPP - TIRTO
3. Pekalongan University
4. Private Consultant
5. Lead Farmer/Champion
6. NGO ➔Training and also Group/Cooperative Formation

Potential Candidate Actors Big Buyer:

- UD Dieng

Potential Candidate Actors for Seed Provider:

1. PT Petung Bumi Makmur
2. CV Agung Sejahtera
3. Toko Biji Wortel (Banjarnegara)
4. CV Lulus Tani, CV Agri Luciana (Wonogiri)

Potential Candidate Actors for Financial Institution:

1. BRI – BRI LInk
2. PT PNM
3. BPR BKK
4. ACA – Crop Insurance
5. Zurich Sharia – Crop and Weather Insurance

Potential Candidate Actors for Offtaker and Market (including e-commerece)

GCF Investment Criteria for Carrot

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
As a root crop, carrots help maintain ground cover and reduce soil erosion. However impact negative when replace vegetation.	Limited innovation of transformation except the utilization of weather predictor equipment to predict weather	With proper attention and monitoring, environmentally faming practice could be applied, avoiding over use of chemical that potential run off because	Carrot is an alternative source of Income for farmers.	National government vision of food security	If Best Practices applied, productivity could be boost up to 5-7 ton /ha (current yield max 3 ton/ha,

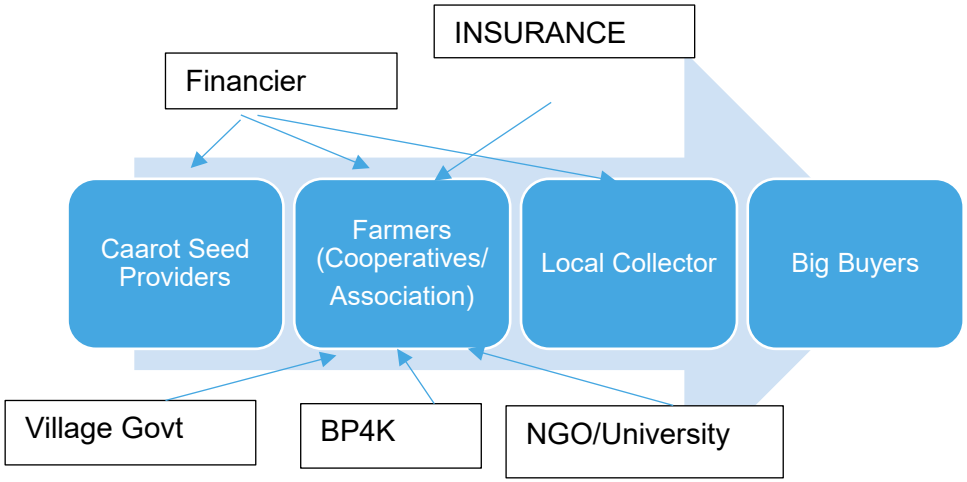
Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
		of the sloppy farming land			
Mostly land used are in steep hill and high slope then prone to landslide. **Carrot is a key crop for upstream farmers in Simego, Petungkriyono, and is more resilient than other vegetables due to its wider**	Moderate potential for scalable in terms of tonnage produced (land ownership average 1.5 ha)	Despite climate related risks, carrot remains a suitable adaptation commodity given its storability after harvest, strong market demand, and potential to provide a more climate-resilient alternative to potato.			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
temperature tolerance and partial drought resistance. However, climate change is increasingly disrupting production: prolonged drought reduces germination and yields, while excessive rainfall leads to soil erosion,					

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
waterlogging, and fungal diseases, cutting harvests by up to 50%. These climate impacts not only threaten food security but also destabilize farmers' incomes through reduced yields and price fluctuations.					

SCORING FOR CARROT: MEDIUM TO HIGH RECOMMENDED COMMODITY

MARKET MAP FOR CARROT



The intervention for systemic change for carrots should focus on addressing low productivity caused by poor farming practices, like random seed broadcasting, Environmental Risks and Climate Change, poor inputs, limited market access, low access to finance and the lack of farmer associations. Key entry points for this paradigm shift should include activities as follows:

- Given that carrots tends to be planted on sloping land, care must be taken to encourage further expansion but should focus on increasing yield in existing areas.
- Farmers Level : Activities shall be Training in technical GAP and GHP by BP4K or BPP Tirto, Training on climate literacy, financial, and gender literacy by Pekalongan University or local NGO. Then for field school and best practice example the project should fund demonstration plots that will help adoption by showing the output of best practices. The projecy should also consider the provision of Equipment for planting seeds in a line (mechanization) and watering systems for the dry season such as pump or water pipe installment (such in kind grant shall be owned by farmers group and co shared).
- Seed Provider (PT PBM or CV Agung Sejahtera): The intervention is to promote quality seeds and establish input shops. Co-financing is an incentive for their involvement. The related activities would mainly on advocating and getting engagement from those private entities.
- Big Buyer (UD Dieng): The intervention is to introduce contract farming to provide direct access and secure the supply line. Potential for co-financing, therefore activities would involve, regular meetings and organizing FGDs, designing contract farming, Terms and condition (funded by project)
- Financial Institution: The intervention is to develop tailored credit schemes (by BRI Link/BPR BKK/PT PNM), and offer crop and weather insurance (by ACA/Zurich Insurance). The activities would be around approaching those financiers, providing profile of potential clients from carrot farmers and collaborate in developing curriculum for financial product and literacy trainings.
- Village Government (Enabler): They can support the project by supporting village-level policy and utilizing BUMDES to provide services or sell agri-inputs. This would involve activities such as meetings, and co financing activities such organizing community gathering (funded by Project)

Annex G Details of Calculation for Corn

Farmer's Accounting (Revenue Vs Costs)

Average Total Revenue:

- Corn Farmers (per planting cycle):
  - General Farmers: IDR 2,880,000 (600 kg x IDR 4800/kg)
  - Farmer A: IDR 4,800,000 (1000 kg x IDR 4800/kg)
  - Average Farmer Revenue (General Case + Farmer A): (22,880,000+4,800,000) = IDR 3,840,000

Average Total Cost:

- Corn Farmers (per planting cycle):
  - General Farmer: IDR 2,100,000
  - Farmer A: IDR 2,370,000
  - Average Farmer Cost (General Case + Farmer A): (22,100,000+2,370,000) = IDR 2,235,000

Average Profit:

- Corn Farmers (per planting cycle):
  - General Farmer: IDR 780,000
  - Farmer A: IDR 2,430,000
  - Average Farmer Profit (General Case + Farmer A): (2780,000+2,430,000) = IDR 1,605,000

Analysis of Return Cost Ratio (RC Ratio) of Value Chain Institutions/Actresses

RC Ratio = Total Revenue / Total Cost

- Farmer A: RC Ratio = IDR 4,800,000 / IDR 2,370,000 = 2.02
- General Farmers: RC Ratio = IDR 2,880,000 / IDR 2,100,000 = 1.37

Analysis:

- RC Ratio > 1 indicates that every rupiah spent generates more than one rupiah of income.
- Farmer A demonstrated excellent cost efficiency with every Rp 1 invested yielding Rp 2.02.
- The general farmers are also profitable, however, with every Rp 1 invested yielding Rp 1.37. This reaffirms that there is great potential for increased efficiency and profitability among the general farmers.

Benefit Cost Ratio (BC Ratio) Analysis of Value Chain Institutions/Actors

BC Ratio = Net Benefit / Cost (Often the same as RC Ratio if Net Benefit = Total Revenue, but can also be calculated as (Profit + Cost) / Cost) In this context, we will use Total Revenue / Total Cost, which is the same as RC Ratio.

- Farmer A: BC Ratio = 2.02
- General Farmer: BC Ratio = 1.37

Analysis: Similar to RC Ratio, BC Ratio > 1 indicates investment feasibility. This figure confirms that corn farming in Jolotigo, despite the profits perceived as "not much" by ordinary farmers, is actually financially profitable.

Break Even Point (BEP) Analysis

BEP in Units (kg) for Farmers:

BEP = Selling Price per Unit−Variable Cost per Unit Fixed Cost

- Fixed Cost: Difficult to identify with certainty from the data. Assumptions of labor costs for tilling the land and renting a husking machine tend to remain the same per planting cycle, regardless of harvest volume.
    - Land preparation labor: IDR 1,000,000 (Farmer A), IDR 0 (General, assumed in variable cost or farmers themselves)
    - Rent a corn cob machine: IDR 50,000
    - Transportation: IDR 100,000
    - For this calculation, let's consider non-input costs as Fixed Costs (which must be incurred regardless of the output).
        - Farmer A: IDR 1,000,000 (land preparation labor) + IDR 200,000 (harvest labor) + IDR 50,000 (porter labor) + IDR 50,000 (pepil rental) + IDR 100,000 (transportation) = IDR 1,400,000
        - General: IDR 350,000 (harvest/preparation labor) + IDR 50,000 (pepil rental) + IDR 100,000 (transportation) = IDR 500,000
- Variable Cost (Variable Cost): Costs that are directly proportional to the amount of production (input).
    - Farmer A: Seeds (IDR 120,000) + Herbicides (IDR 150,000) + Manure (IDR 350,000) + Chemical Fertilizers (IDR 250,000) + Pesticides (IDR 100,000) = IDR 970,000
    - General: Seeds (IDR 120,000) + Herbicides (IDR 80,000) + Manure (IDR 300,000) + Urea Fertilizer (IDR 1,000,000) + Pesticides (IDR 100,000) = IDR 1,600,000
- Selling Price per Unit: IDR 4800/kg

BEP calculation per kg:

- Variable Cost per kg (based on harvest):
    - Farmer A: IDR 970,000 / 1000 kg = IDR 970/kg

  - General: IDR 1,600,000 / 600 kg = IDR 2666.67/kg
- BEP Unit for A's Farmer:

  $$BEPunit = 4800 - 9701{,}400{,}000 = 38301{,}400{,}000 \approx 365.5 \text{ kg}$$

  This means that farmer A needs to sell at least around 366 kg of corn to cover all costs. With a harvest of 1000 kg, he is already well above BEP.

- BEP Unit for General Farmers:

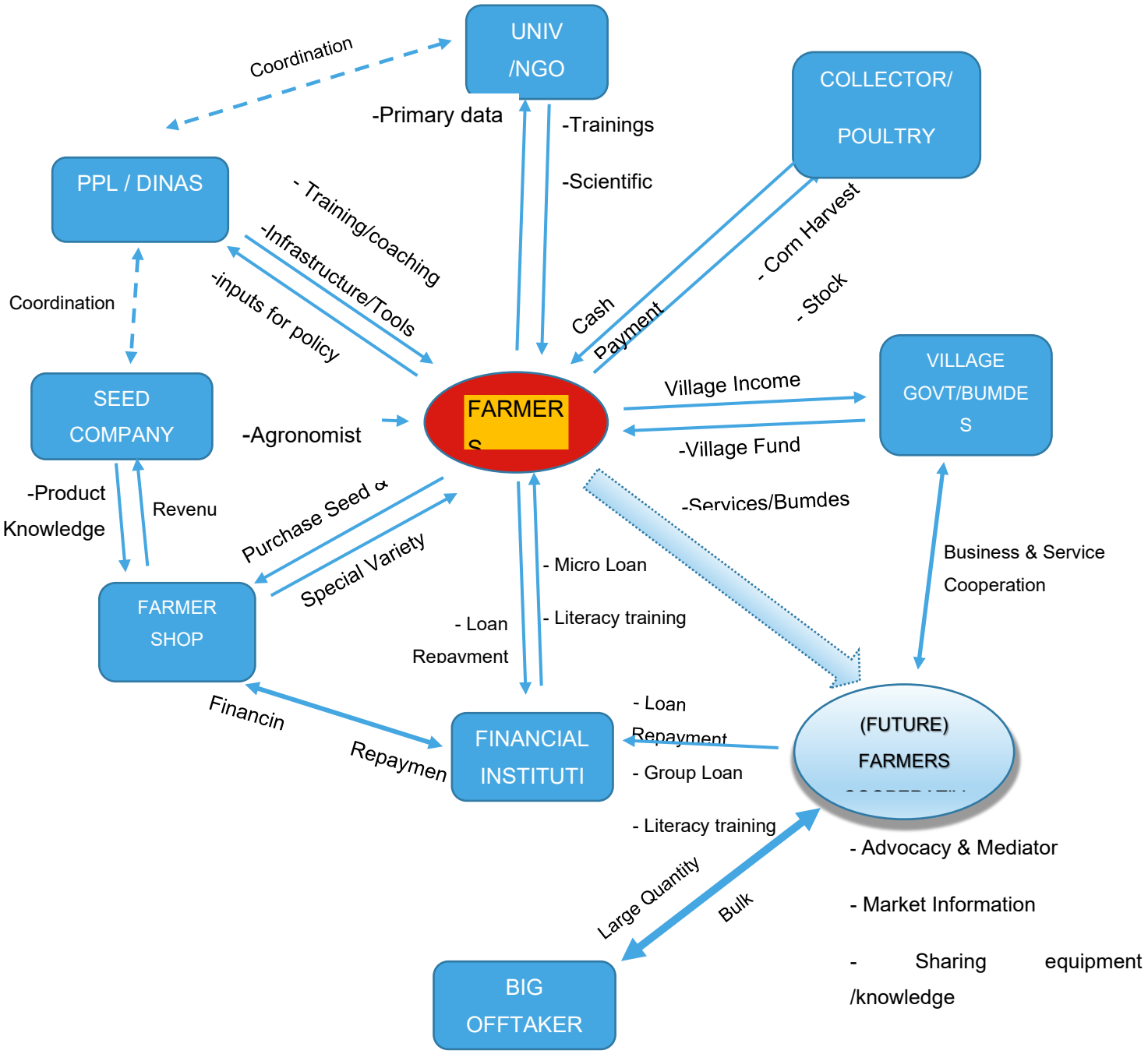
$$BEPunit = 4800 - 2666.67500.000 = 2133.33500.000 \approx 234.38 \text{ kg}$$

This means that the average farmer needs to sell at least around 235 kg of corn to cover all costs. With a harvest of 600 kg, he is also above BEP, but the margin is thinner.

Analysis:

- Farmers in Jolotigo (both farmer A and general farmers) are financially above the break-even point, meaning their businesses are profitable. However, the profit margin for general farmers is relatively small.
- BEP data for other actors (Farmers' Shops, Collectors) cannot be calculated due to the absence of their fixed and variable cost data.

Annex H Comprehensive Business Model with Closed Loop System for Corn



Annex I GCF Investment Criteria and Intervention Recommendation for Corn/Maize

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Farmers (core function)	Low Productivity	Activity : Training /coaching 1. GAP & GHP Training 2. Climate Literacy Training 3. Financial Literacy Training 4. Gender Training 5. Field School Activity : Capacity Building 1. Group development 2. Continuous Facilitation on farmers group	Recommended for project funding for Training and Field School Activities	Boosting Yield, Reducing Cost, Increasing technical knowledge, financial knowledge, gender awareness and climate awareness Need Institutionalisation at Farmer Level for effectiveness of the Project at recipient level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Farmers Cooperative or Association	Activity: Demonstration Plot Showcasing Process and output of best practices	Recommended for project funding for Group and cooperative formation	"Seeing is Believing" is idiom for mindset change at farmer level
	Lack of Adoption	Activity: 1. Provision of Drying Machine 2. Building Warehouse because Corn so easily infested with fungus	Recommended for project funding for Demoplots, and potential co-financing with Seed Producer for farming inputs and/or the Local Govt (PPL designation and Subsidy/grant program) Recommended for project funding for Procurement of Equipment	Post Harvest Process for corn requires certain level of dry level (max 15% of water in the corn)

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Equipment			
Seed Provider (core function)	Quality seed used, but without proper knowledge	Activity: 1. Promoting Seed 2. Allocating dedicated personnel (Agronomist) 3. Establishing Input Shop/selecting New Agent	Shared Financing	Incentive for involvement: • Product Promotion • New Market Penetration/Developmnt • Revenue
Big Buyer	No Direct Access	Activity: Contract Farming	Shared Financing	Incentive for involvement: • Securing supply line
Financial Institution (Supporting Function)	Low / No Access to Finance	Activity: 1. Developing Tailored credit Scheme for farmers 2. Financial Literacy Training (CSR activity)	Shared Financing	Incentive for involvement: • Expanding Portfolio • New Client Base

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Village Government (Enabler)	Low Involvement	Activity: 1. Support in Village Level policy & Safeguarding project 2. Potential utilization of BUMDES (Village owned Enterprise) as supporting function such as providing services / Agri Shop selling agri-inputs/providing equipments	Shared -Financing with potential project funding for certain project related activities such as community meetings	Interest: Village Officials and Apparatus are key stakeholder when doing livelihood project at village level

Potential Candidate for Training/Capacity building Provider:

1. PPL /Extension Services from Regency Office (Badan Pelaksana Penyuluhan Pertanian, Perikanan & Kehutanan / BP4K Kota Pekalongan)
2. Balai Penyuluhan Pertanian/BPP - TIRTO
3. Pekalongan University
4. Private Consultant
5. Lead Farmer/Champion
6. NGO ➔Training and also Group/Cooperative Formation

Potential Candidate Actors for Seed Provider:

1. PT BISI International
2. PT Dupont
3. PT Syngenta

Potential Candidate Actors for Big Buyers:

1. PT Charoen Pokphand
2. PT Surya Agro Mandiri
3. PT Changdong Utama
4. Cahaya Tiga Tunggal
5. PT Japfa Comfeed

Potential Candidate Actors for Financial Institution:

1. BRI – BRI Link
2. BTPN
3. PT PNM
4. BPR BKK
5. BPD Jateng
6. Local Microfinance Institution

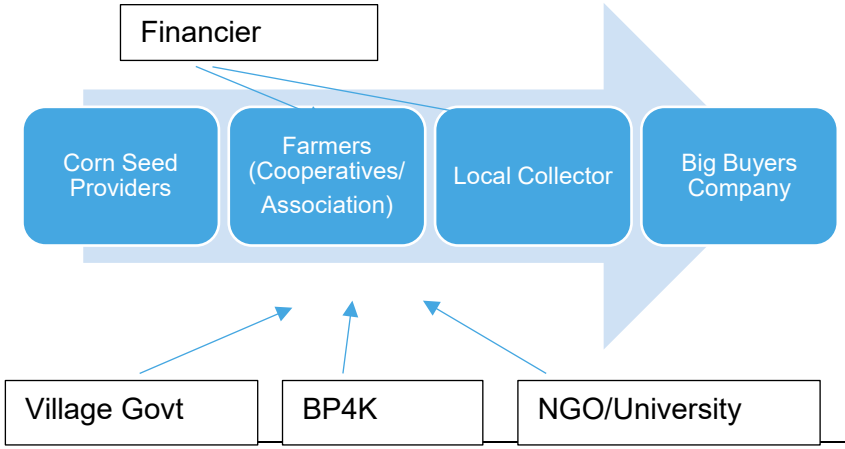
GCF Investment Criteria for CORN

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
Using reduced tillage, cover cropping, and organic amendments can help maize fields store more carbon in the soil. **Agroforestry or intercropping systems with maize can provide shade, reduce erosion, and increase carbon sequestration.**	Limited innovation of transformation except the utilization of weather predictor equipment to predict weather	With proper attention and monitoring, environmentally friendly practice could be applied, avoiding over use of chemical that potential run off because of the slopping farming land	Corn is the source of Income for farmers, and currently most corn farmers are fall into subsistence farming, their yield per cycle is only enough to repay debt from collector acquired in the first place	National government vision of food security	If Best Practices applied, productivity should be boost up to 8 ton /ha (current yield max 3 ton/ha, This a relatively complex task since it involves in boosting productivity (intensifying production per hecktare, while boosting production means more chemical inputs used

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
Intensive use of chemical inputs, hard to replace with organic	Low potential for scalable in terms of tonnage produced (land ownership very limited average 0.2-0.3 ha) not enough for high yield production farming				

SCORING FOR CORN: LOW RECOMMENDED COMMODITY

MARKET MAP FOR CORN



The intervention for systemic change for corn should address low productivity, climate change, limited access to market, lack of financial services support, the lack of farmer associations, as well as the post-harvest process. The main issue is the intensive use of chemical inputs, which is hard to replace with organic alternatives. Key entry points for this paradigm shift should include activities as follows:

- Farmers Level : Activities shall be Training in technical GAP and GHP by BP4K or BPP Tirto, Training on climate literacy, environmental awareness, financial, and gender literacy by Pekalongan University or local NGO. Then for field school and best practice example the project should fund demonstration plots that will help adoption by showing the output of best practices. The project should also consider the provision of Equipment to support post-harvest handling process.
- Seed Provider (by BISI/Dupont/Syngenta): The intervention is to promote quality seeds, ensure farmers have the proper knowledge to use them, and establish input shops as well as providing agronomist. Co-financing is an incentive for their involvement. The related activities would mainly on advocating and getting engagement from those private entities.
- Big Buyer (Charoen/Surya Agro/Changdong): The intervention is to introduce contract farming to provide direct access and secure the supply line. Potential for co-financing, therefore activities would involve, regular meetings and organizing FGDs, designing contract farming, Terms and condition (funded by project)
- Financial Institution: The intervention is to develop tailored credit schemes (by BRI Link/BTPN/PT PNM), and to provide financial product and literacy trainings (CSR activities). The activities would be around approaching those financiers, providing profile of potential clients from Corn farmers and collaborate in developing curriculum for financial product and literacy trainings
- Village Government (Enabler): They can support the project by supporting village-level policy and utilizing BUMDES to provide services or sell agri-inputs. This would involve activities such as meetings, and co financing activities such organizing community gathering (funded by Project)

Annex J Details of Calculations for Groupers

Farmer's Accounting (Revenue Vs Costs)

The common Farmer's Perspective from FGD (cultivating with initial 1000 grouper fish seeds):

- Initial Investment:
  - Seeds: IDR 6,000,000 for 1000 seeds (@ IDR 6000)
  - Cage netting equipment: IDR 4,000,000 (total setup)
  - Total Working Capital: **IDR 10,000,000.**
- Ongoing Costs (per cycle, estimates based on FGD data):
  - Feed Costs:
    - Assuming 1000 fish.
    - Initial 1.5 months: 3 ounces (0.3 kg) per day. Total feed for 1.5 months (45 days) for 1000 fish: 0.3 kg/ day x 45 days = 13.5 kg.
    - Cost: 13.5 kg x IDR2,500 /kg (average) = IDR 33,750.
    - Remaining 6.5-8.5 months (195-255 days) at 1 kg per day (for larger groupers, assuming average of 225 days and 50% mortality from chemicals):
      - Assuming 50% mortality, so 500 fish remaining (worst-case scenario).
      - Feed for 500 fish for 225 days: 1 kg/day x 225 days = 225 kg.
      - Cost: 225 kg x IDR 2,500 /kg = IDR 562,500.
    - Total estimated feed cost per cycle: IDR 33,750 + IDR 562,500 = **IDR 596,250.**
  - Labor Costs:
    - Need 2-3 laborers at IDR 100,000/day. For a 8-10 month cycle (approx. 270 days), and assuming daily tasks require some labor (e.g., feeding, cleaning nets regularly). The daily wages IDR 100,000 whose job is to clean the nets, provide feed and help with the grouper harvest". This likely refers to intermittent or task-based daily wages, not full-time employment for the entire cycle.
    - Pond cleaning every 3-4 months (e.g., 2 times per cycle), using labor. Let's assume 3 days of labor for cleaning per instance, so 6 days total. Thus 6 days x 2 laborers x IDR100,000/ day = **IDR 1,200,000.**
    - Let's assume the IDR 100,000 is for a full day's work when needed, and not every day. Let's assume an average labor cost of **IDR 5,000,000 - IDR 10,000,000 per cycle f**or intermittent tasks.
  - Net Replacement: Up to 5 times at IDR 250,000 per netting. So the calculation for net replacement : 5 x IDR 250,000 = **IDR 1,250,000.**

A. **Famer A** ➔ Revenue (Example from a farmer with 500 groupers, 250 died due to chemicals) ➔the Worst experience :

   - Harvested weight: 83 kg.
   - Selling price: IDR 76,000 per kilogram. (using market price in 2018)
   - Revenue: 83 kg x IDR 76,000/ kg = **IDR 6,308,000.**

B. **Farmer B** ➔ The Other farmer's experience (common case):

- 2000 seeds yielded 800-900 kg. then on the average is 850 kg.
- If current price (IDR 50,000-60,000/kg or the average IDR 55,000/kg): 850 kg x IDR55,000/ kg = **IDR 46,750,000.**

Therefore, if we calculate the simplified **Profit Margin (**From Farmer's Example):

- **Farmer A** (500 groupers, 250 died, 83kg harvest):
  - Revenue**: IDR 6,308,000.**
  - Estimated costs (very rough, assuming the initial working capital for 1000 seeds is relevant, and pro-rating some costs):
    - Seeds: IDR 3,000,000 (for 500 seeds)
    - Netting (prorated or initial): IDR 4,000,000 (initial investment for 1000 seeds, but applicable to pond setup)
    - Net replacement: IDR 1,250,000
    - Feed (using revised plausible estimate, scaled for 500 fish: IDR 596,250
    - Labor (estimated): IDR 5,000,000
    - Estimated Total Costs: IDR 3,000,000 + IDR 4,000,000 + IDR 1,250,000 + IDR 596,250 + IDR 5,000,000 = **IDR 13,846,250**
  - Estimated Loss: IDR 6,308,000 (Revenue) - IDR 13,846,250 (Costs) = **-IDR 7,538,,250 (loss).**
  - ***This highlights the significant financial risk due to high mortality and costs***.

- **Farmer B** (2000 seeds, 850kg harvest):
  - Revenue (at current average price @IDR 55,000): **IDR 46,750,000.**
  - Estimated costs (scaling up):
    - Seeds: IDR 12,000,000 (2000 seeds)
    - Netting: IDR 4,000,000 x 4 ponds (assuming fixed cage setup, may need more or larger, but using the above baseline) = IDR 16,000,000
    - Net replacement: IDR 1,250,000 x 4 ponds (likely per pond, so depends on the number of ponds used) = IDR 5,000,000
    - Feed (scaling based on 2000 seeds): approx. IDR 2,385,000
    - Labor (estimated, more for larger operation): IDR 10,000,000
    - Estimated Total Costs: IDR 12,000,000 + IDR 4,000,000 + IDR 1,250,000 + IDR 18,225,000 + IDR 10,000,000 = **IDR 45,385,000.**
  - Estimated Profit: IDR 46,750,000 - IDR 45,385,000 = **IDR 1,365,000.**
  - ***This demonstrates a very tight margin, especially considering the initial investment and risks.***

Another farmer's experience, Farmer C (the most successful one):

- 5000 seeds yielded 2 tons (2000 kg).
- Revenue: 2000 kg x IDR55,000/ kg = **IDR110,000,000.**

However, we did not manage to explore more information from his cultivation practice so we could not predict his cost structure and associated profit.

FARMER'S PRODUCTIVITY

Calculation of Productivity or Yield of Harvest for Each Hectare (Kilograms per ha).

- Pond Dimensions: 3 meters long, 2 meters wide, 2.5 meters deep.
- Area of one pond: 3 m x 2 m = 6 meters2.
- 1 hectare = 10,000 meters2. ➔ Number of ponds per hectare: 10,000 m2 / 6 m2 = **1667 ponds** (this is a theoretical maximum and highly unlikely in practice due to spacing, access, limitatitons etc).

Farmer A: Started with 500 groupers, harvested 83 kg. Survival rate: 250/500 = 50% survived (implied 250 died from chemicals).

➔ Productivity: 83 kg/500 seeds=0.166 kg/seed harvested. (Not per sqm or ha).

Farmer B: 2000 seeds yielded 800-900 kg. Average: 850 kg (middle).

➔ Productivity: 850 kg/2000 seeds=0.425 kg/seed harvested.

Farmer C: 5000 seeds yielded 2 tons (2000 kg).

➔Productivity: 2000 kg/5000 seeds=0.4 kg/seed harvested.

All of participants agreed that the "normal successful" survival rate is 70%. If 1000 seeds are planted and 70% survive, then 700 fish mature. If each fish could reaches 1 kg maximum (best harvest), then 700 kg could be harvested. This gives a potential productivity of 0.7 kg/seed.

Yield per Hectare (hypohtetically using successful scenario for 1 kg/fish at harvest):

- Assuming 150 groupers per pond.
- Total number of grouper fish seeds in 1 hectare (theoretical): 1667 ponds x 150 seeds/pond = 250,050 seeds.
- At 70% survival rate: 250,050 x 0.70 = 175,035 fish.
- At 1 kg/fish at harvest: 175,035 kg.
- *Theoretical productivity per hectare: approximately 175,000 kg/ha. (too over optimistic scenario)*
    - This is an extremely high theoretical figure and likely unrealistic for typical pond density and management. This is just an exercise on the scenario if everything is fully optimized and other risk factors fully controlled
    - The issue is that the provided pond area and seed density apply to small fixed cages, not broad hectare-scale open ponds.

However if we used the real case of information gathered from farmers, the calculation is the following:

According to PPL officer**, the proposed optimal pond size for the floating net system : 8m x 8m, depth 1-2m, with 5000 seeds**.

- Area of proposed pond: 8 m x 8 m = 64 m2.
- Yield for 5000 seeds: 2 tons (2000 kg).
- Productivity per 64 square meters: 2000 kg.
- Productivity per square meter: 2000 kg/64 m2 = 31.25 kg/m2.
- Productivity per hectare (10,000 m2): 31.25 kg/m2 x 10,000 m2 = **312,500kg/ha.**

➔ This is based on the potential yield from a well-managed system as indicated by one farmer's best experience. It's significantly higher than typical extensive pond productivity and reflects intensive aquaculture in a defined cage area.

Using the farmer B example (2000 seeds, 850 kg harvest, BCR of 1.028), this level of productivity barely makes a profit, and a very thin margin.

To achieve a decent profit and make this business attractive, the productivity per seed or per unit area needs to significantly increase, or else costs decrease. If we target a BCR about 1.3 (meaning 30% profit margin over costs) for Farmer B's cost structure (IDR 45,475,000):

- Required Revenue: IDR 45,475,000 x 1.3 = IDR 59,117,500.
- Required Harvest (at market price IDR 55,000/kg): IDR 59,117,500/ 55,000 = 1075 kg.
- Minimum Optimum Productivity (for 2000 seeds): 1075 kg/2000 seeds = 0.5375kg/seed.

➔ Considering a 70% survival rate (0.7 kg/seed) is achievable, this productivity of 0.5375 kg/seed is attainable by increasing individual fish weight or maintaining a higher survival rate

➔ This is far more than the farmer B example (which implies a lower survival rate than 70% to yield 0.425 kg/seed).

➔ ***This means we must be improving survival rate and/or increasing the average weight of harvested fish.***

FARMER'S BREAK EVEN POINT

Farmer's Break-Even Point (using Farmer B's cost structure as an example):

- Total Fixed Costs (initial investment, some equipment): IDR 6,000,000 (seeds) + IDR 4,000,000 (netting) = IDR 10,000,000.
- Total Costs (for 2000 seeds): = IDR 45,385,000
- selling price is IDR 55,000/kg.

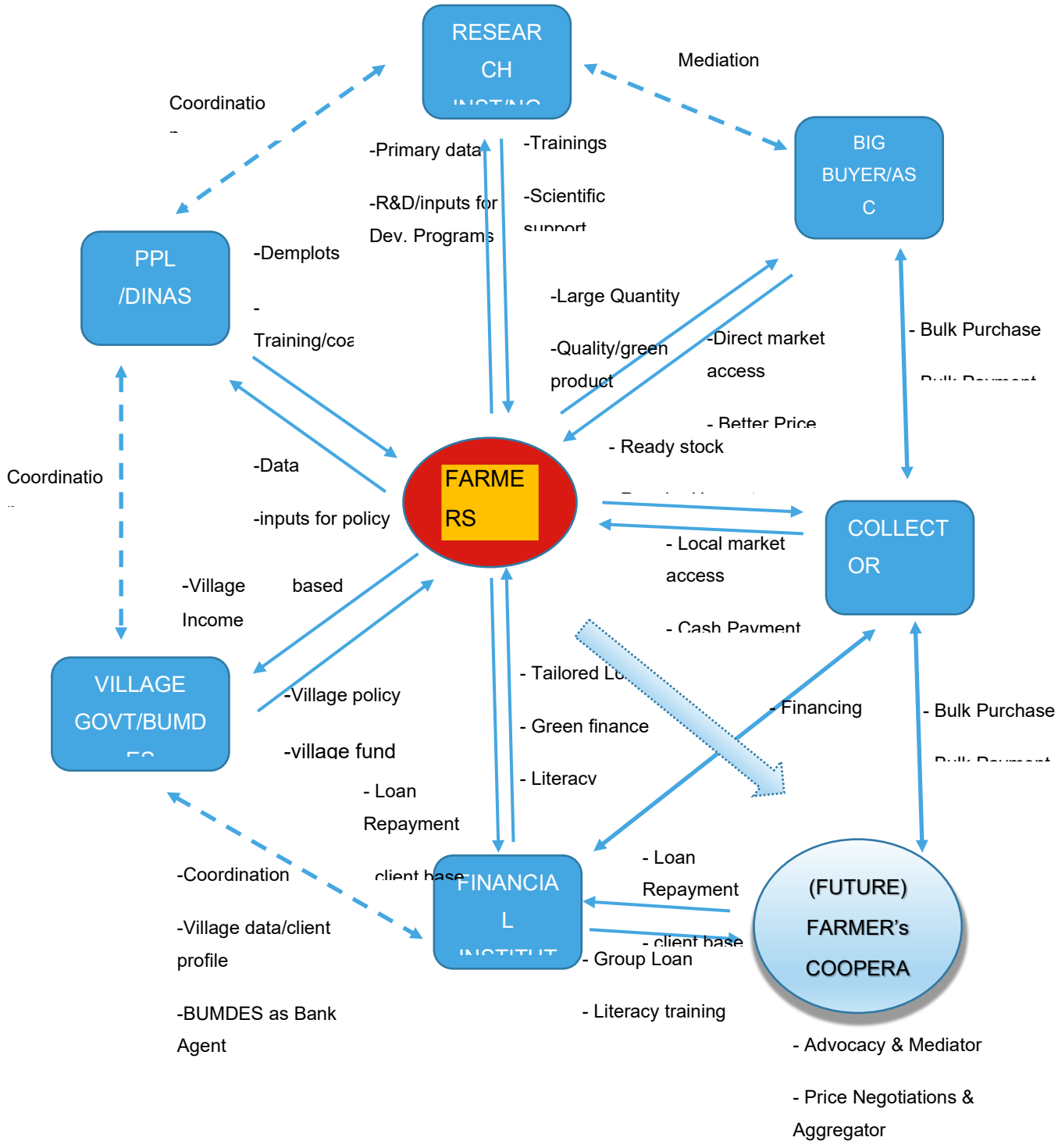
- BEP in kg: Total Costs/ Price per kg = IDR 45,385,000/ IDR55,000 = 825 kg.

If we use the case of Farmer A, which was actually suffering loss, where 500 seed used, then the break even point must be obtained:

- With Seed around 500 groupers
- Cost: approx. IDR 17,000,000
- Selling price: IDR 50.000 - 60,000/kg
- BE Point: ~310 kg needed to break even
- Most farmers average harvest 400–500 kg → ***profitable if mortality level is low***

This means if mortality rate is controlled, with the associated cost incurred by farmer A, a 310 kg yield is the minimum to get zero profit (or no loss at all).

Annex K Comprehensive Business Model with Closed Loop System for Groupers



Annex L GCF Investment Criteria and Intervention Recommendations for Groupers

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Farmers (core function)	Suffering Loss or very thin Net Farming Result from External factor (climate change as well as chemical contamination aquaculture farming practice from Neighboring Milkfish Ponds), therefore need special treatment and approach to make the	Activity : Training /coaching 1. Good Aquaculture Practice Training 2. Climate Literacy Training 3. Financial Literacy Training 4. Gender Training 5. Environmental awareness 6. Field School	Recommended for project funding for - Comprehensive climate field school for grouper commodity, which involves a series of trainings on climate literacy (incl. impacts on groupers), CBIB or Good Aquaculture Practice Certification, climate-adaptive aquaculture methods and the use of CIS, and environmental awareness (incl. pond water management) - Through scientifically-sound yet participatory manner, expanding the existing climate information system development and contextualizing it with the needs and characteristic of grouper aquaculture process and ensuring its utilisation in informing the climate-adaptive and GAP practices - Financial literacy	Boosting Yield, Reducing mortality rate, Reducing Cost, Increasing technical knowledge, financial knowledge, gender awareness and climate and environmental awareness

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	co-existence of grouper and milkfish farming Lack of Farmers Cooperative or Association	Activity : Capacity Building 1. Group development 2. Continuous Facilitation on farmers group Activity: Demonstration Plot Showcasing Process and output of best practices and controlled environment	Recommended for project funding for: - reactivating the grouper fishfarmers group and equip them with the above capacity building Recommended for project funding for Demoplots for feed production and aquaculture pond that showcase: - Climate adaptive aquaculture practice based on climate and - weather information that applies CBIB principles and in accordance with ASC standard, which include floating net system and the use of CIS - Feed production using fish waste from the Fish Auction Site	Need Institutionalisation at Farmer Level for

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Adoption	Activity: 1. Provision of Weather predictor equipment 2. Tools for testing such as PH, salinity, oxygen, contamination level etc	- Improve networks to input providers such as seed suppliers and feed suppliers (if they prefer to use production pellet) and offtakers (incl. big buyers, modern retails, restaurants in major cities and e-commerce) - Zoning system for aquaculture pond that is co-designed and followed FPIC principles - Collaboration with the Local Govt (PPL designation and Subsidy/grant program for fisheries) Recommended for project funding for: - Installation of tidal sensor and water quality monitoring system in the demoplots, which are connected to the CIS and developing the automatic mechanism that provide alert as well as a recommendation of anticipatory action and/or adaptive practice if certain thresholds are passed	effectiveness of the Project at recipient level “Seeing is Believing” is idiom for mindset change at farmer level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack Weather and Climate related Equipment		- Capacity building and technical assistance on farm-management, with integration of CIS information delivery - Build/rent cold storage facilities for fresh grouper	Climate Information System for farmers and tools for water quality monitoring and tidal sensor to improve practices as well as a means to monitoring and evaluation with environment standard. Cold storage can be used as temporary storage before the groupers are sold or transported to offtakers; preventing spoilt products, particularly when

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
				distribution is disrupted during flood event
Feed Provider (core function)	Quality Feed/Pellet Feed is not used	Activity: 1. Promoting quality feed 2. Teaching Farmers on the proper use of feed	Recommended activities: - Develop feed production facility that uses fish waste from the fish auction site. - Procurement of fish chopper/cutter - Trainings on feed production	Feed is the main issue of input factor since the manual preparation is time consuming and extra effort
Big Buyer ASC Standard (core function)	Not accessible since the required certification on farming	Activity: 1. Introducing Eco Standard 2. Providing market information 3. Buying the Eco label Grouper	Recommended activities: - Trainings on ASC standard - Cooperation scheme with potential big buyers where they provide trainings, and the fishfarmers group will provide groupers supply according to the standard quality - Develop a market information app that integrated to CIS and offer training for fish farmers and fish farmers on its use. -	Incentive for involvement: • Stock supply • Getting good quality groupers directly from farmers

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Financial Institution (Supporting Function)	Low/No Access to Finance	Activity: 1. Developing Tailored credit Scheme for farmers 2. Introducing Green Financing (bundled service with green farming) 3. Financial Literacy Training (CSR activity) 4. Weather Insurance	Recommended activities: - Introduce access to green financing - Collaborate with private sectors or financial institutions for financial literacy - Improve groupers farmers' access to tailored bundled service of (inter alia) savings, parametric insurance products, credits, and digital marketing in collaboration with the Financial Services Providers (FSPs) and Marketplace companies - Incentive scheme for fishfarmers/ fishfarmer groups who adopt climate-adaptive method	Incentive for involvement: • Expanding Portfolio • New Client Base • Introducing Green Scheme financing
Village Government (Enabler)	Low Involvement	Activity: 1. Mediation related with nonchemical use 2. Support in Village Level policy & Safeguarding project 3. Mediation in potential social conflict 4. Potential utilization of BUMDES (Village owned Enterprise) as supporting function such as providing	Recommended activities: - Advocacy to include climate resilience and climate-adaptive livelihood into village development plan. This would include series of meetings or discussions. - Advocacy for the formulation of Village Regulation regarding climate-adaptive and sustainable aquaculture, which includes the prohibition of chemicals for aquaculture and zoning system for the pond - Collaborative scheme with BUMDES to provide supporting function	Village Officials and Apparatus are key stakeholder when doing livelihood project at village level especially related with enforcement of regulation/policy and to keep conducive environment and social cohesion

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
		services / Agri Shop selling inputs/providing equipments		

Potential Candidate for Training/Capacity building Provider:

1. PPL /Extension Services from Regency Office (Badan Pelaksana Penyuluhan Pertanian, Perikanan & Kehutanan / BP4K Kota Pekalongan)
2. Pekalongan University
3. Private Consultant
4. Lead Farmer/Champion
5. NGO ➔Training and also Group/Cooperative Formation

Potential Candidate Actors for Feed Provider:

1. Unggul Jasa PS Pekalongan
2. Jaya Perkasa

Potential Candidate Actors for Big Buyer:

- PT Tilapia Nusantara Jaya (ASC Standard)

Potential Candidate Actors for Financial Institution:

1. BRI & BTPN- medium size loan up to IDR 100 million and micro Loan up to IDR 25 million
2. PT PNM – micro loan up to IDR 10 million
3. Bank Mandiri – Green Financing
4. BPD Jateng – productive and consumption loan
5. Allianz – Crop and Weather Insurance
6. ACA – Crop Insurance
7. Zurich – Crop and Weather Insurance
8. Microfinance Institution

GCF Investment Criteria for GROUPER

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
Sustainable aquaculture diversifies protein sources and helps coastal communities adapt to shifting climate	Reviving the Grouper Farming which was abandoned caused by external issue namely unfriendly ecosystem for groupers	With proper attention and monitoring to the surrounding environment especially the milkfish farming practice from neighboring ponds,	Grouper is a high value fisheries commodities even when comparing with Milkfish, grouper potential result is far higher than milkfish result, provided the	National government vision for increasing high value commodity	If a farmer used 5000 seed and moderate 80% survival rate achieved, with market price IDR 60,000/kg and cost IDR 40,000/kg then a farmer could earn IDR 80

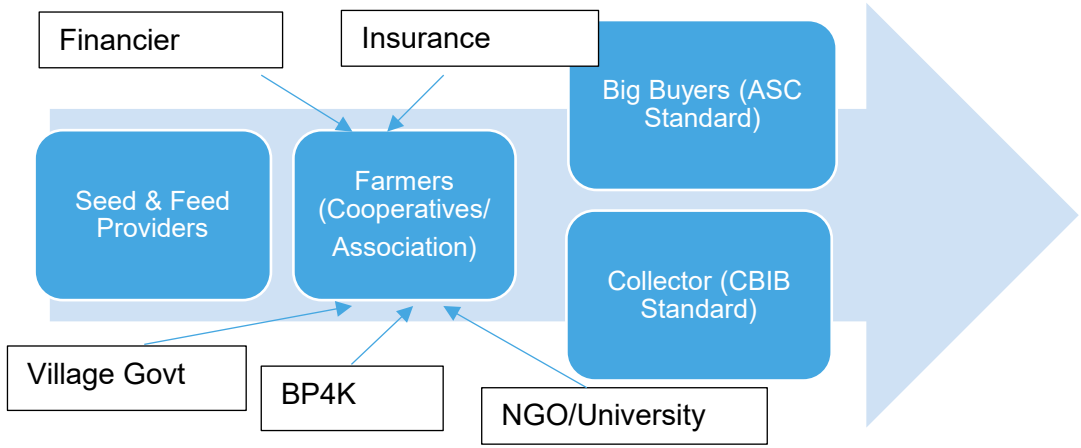
Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
conditions without clearing forests or draining peatlands	And also resume/re-establish market access and connection with large offtakers interrupted during covid 19 pandemic	Groper farming could be sustainable	ecosystem is well protected and free from chemical use		million per harvest, this is far beyond result from milkfish as comparison
Grouper is a key fisheries commodity in Pekalongan that supports local livelihoods and meets strong regional market demand, yet climate variability has significantly	Potential for scalable in terms of tonnage produced and reaching further market channel, Grouper is actually a lucrative farming would attract financier naturally	Grouper farming requires many additional labor therefore it creates employment While previous pilot efforts faced	Grouper needs financing especially for working capital and infrastructure of ponds	Grouper farming has the potential to be one of flagship high value commodities from Pekalongan Regency and will contribute to regional income	

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
reduced safe fishing periods to only six months per year, leading to declining catches and incomes. With wild capture under pressure, climate-resilient grouper aquaculture offers a viable adaptation pathway to sustain supply, stabilize fisher incomes, and meet market demand.	Potenital to scale through access to finance.	challenges such as chemical contamination, feed management, and vulnerability to coastal flooding, introducing adaptive and environmentally friendly aquaculture practices can address these barriers, reduce climate risks, and provide a sustainable alternative to over-reliance on increasingly			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
		unpredictable marine fishing.			

SCORING FOR GROUPER: HIGHLY RECOMMENDED COMMODITY

MARKET MAP FOR GROUPERS



The intervention for systemic change for grouper farming should focus on addressing losses from external factors like chemical contamination from neighboring milkfish ponds, adaptation to environmental risks and climate change, high capital cost for pond infrastructure as well as inputs cost and access to market. Key entry points for this paradigm shift should include activities as follows

- Farmers Level: Training and coaching in Good Aquaculture Practices (CBIB standard by BP4K, or ASC standard by PT Tilapia Nusantara); Training on climate, financial, gender, and environmental awareness as well as group formation by selected local NGO. The project should fund and conduct demonstration plots that will showcase best practices in a controlled environment. To address the climate issue and environmental risks, the provision of weather predictor equipment and water quality testing tools is also recommended (such equipment will be handed over to farmers group)
- Feed Provider: The intervention is to promote quality feed and teach farmers its proper use (Unggul Jasa or Jaya Perkasa), to replace the manual feed as manual feed preparation is time-consuming. This activity would be mainly on approaching and engaging those private entities to join the project.
- Big Buyer ASC Standard (PT Tilapia Nusantara): The intervention is to introduce eco-standards, provide market information, and to buy eco-labeled grouper directly from farmers. This addresses the gap of farmers not having access to the big buyers due to certification requirements. The associated activity would encompass approaching and getting buy-in from this private enterprise to explore potential market access from production of high quality grouper by farmers in pekalongan.
- Financial Institution: The intervention is to develop tailored credit schemes that will suit the harvest cycle of grouper (BRI/BTPN/BPD Jateng), introduce "green financing" bundled with green farming (Bank Mandiri), and provide weather insurance (Allianz/ACA/Zurich). This will scale up and ensure the availability of financing sources that would need capital investment for pond infrastructure (Floating Net System), working capital needs, and protection against risk that may occurred and would bring financial losses to farmers. This activities would need close approach to those actors in providing potential scalability opportunity to the milkfish farming, need development of MoU or cooperation agreement
- Village Government (Enabler): They can mediate on non-chemical use, support village policies to protect the environment and limit chemical use and create a zoning system based on participatory land/pond use planning and Free, Prior, and Informed Consent (FPIC) activities. This would encompass activities in supporting the formulation and drafting of legal regulation by the project, communities advocacy meetings and getting free and voluntary consent from impacted people (funded by the project)

Annex M Details of Calculation for Milkfish

Actor's Accounting (Revenue Vs Costs)

FARMER's Average Total Cost: (Estimations based on information/data collected),

Milkfish Farmer (per 05 ha or per 0.3 ha pond, per 5-month cycle):

- **Seeds**:
  - For 0.5 ha, 10,000 seeds cost IDR 1,500,000.
  - For 0.3 ha: (0.3/0.5) x 10,000 seeds = 6,000 seeds.
  - Cost of seeds for 0.3 ha: 6,000 seeds x IDR 150/seed = **IDR 900,000**.
- **Feed** (estimated for 1,000 kg yield):
  - **FCR is 2:1**, then 1,000 kg yield needs 2,000 kg of feed.
  - Various feed types and costs for different fish ages.
    - Alfred brand (1-2 months): 2 bags/month x 2 months = 4 bags ➔ 4 bags x IDR 270,000/bag = IDR 1,080,000. ➔ (This is for 10,000 seeds. Then For 6,000 seeds, assume (6000/10000) x 1080000 = **IDR 648,000**
    - Turbo (3-4 months, 1 month): 1 bag/month for 10,000 seeds. Assuming 1 bag for 6,000 seeds. Then 1 bag x IDR 325,000 = **IDR 325,000.**
    - Turbo (5-6 months): 60 bags for 10,000 seeds. For 6,000 seeds, assume (6000/10000) x 60 bags = 36 bags. Then 36 bags x IDR 325,000/bag = **IDR 11,700,000**.
    - Total estimated feed cost for 0.3 ha (6,000 seeds, 1 ton yield): IDR 648,000 (Alfred) + IDR 325,000 (Turbo early) + IDR 11,700,000 (Turbo late) = IDR 12,673,000.
    - Turbo brand is extensively used while The Shark brand is for a smaller initial stage or supplemental feed.
- Netting: IDR 5,000,000. This is a capital cost with a 2-year lifespan. Amortize over 2 years (4 cycles): IDR 5,000,000 / 4 cycles = **IDR 1,250,000 per cycle**.
- Bamboo Poles: 100 pieces x IDR 18,000 = IDR 1,800,000. Amortize over 2 years (4 cycles): IDR 1,800,000 / 4 cycles = **IDR 450,000 per cycle.**
- Labor for Net Cleaning: IDR 150,000/person x 2 people x 3 days = IDR 900,000 per cleaning. Assuming 1 cleaning per cycle: **IDR 900,000.**
- Labor for Net Repair: IDR 110,000/day x 2 people x 5 days = IDR 1,100,000. Assuming once per cycle: **IDR 1,100,000.**
- Labor for Harvest: IDR 170,000 per quintal. 1 ton = 10 quintals. 10 quintals x IDR 170,000/quintal = **IDR 1,700,000.**
- Chemical Pesticides: Assuming a nominal amount, e.g., IDR 100,000 per cycle.

Here is The Summary of Total Estimated Costs for Farmer (0.3 ha, per 1 cycle):

- Seeds: IDR 900,000
- Feed: IDR 12,673,000
- Netting (amortized): IDR 1,250,000
- Bamboo Poles (amortized): IDR 450,000
- Net Cleaning Labor: IDR 900,000

- Net Repair Labor: IDR 1,100,000
- Harvest Labor: IDR 1,700,000
- Pesticides: IDR 100,000
- Total Cost for Farmer = **IDR 19,073,000**

Average Total Revenue : Milkfish Farmer (per 0.3 ha pond, per 5-month cycle):

- Average Harvest: 1,000 kg
- Average Selling Price: Let's use the midpoint of IDR 19,000 - IDR 21,000 = IDR 20,000 per kg.
- Total Revenue: 1,000 kg x IDR 20,000/kg = IDR 20,000,000

Average Profit per cycle : IDR 20,000,000 – 19,073,000 = IDR 927,000

Village-level Collectors/Middlemen:

- Revenue depends on their volume and their selling price to the next actor (wholesalers/retailers). No specific data provided.
- Cost of Goods Sold: Purchase price from farmers (e.g IDR 20,000/kg).
- Operating Costs: Transportation, storage, handling. Not specified. Assume 5-10% of purchase price.
    - For 1 ton: IDR 20,000,000 (purchase) + (5% x IDR 20,000,000) = IDR 21,000,000 (approximately)
- Assume they buy at IDR 20,000/kg and sell at a markup. If they sell at IDR 22,000/kg, their revenue per ton is IDR 22,000,000. Their total revenue would depend on the aggregate volume they handle from multiple farmers.

FARMER'S PRODUCTIVITY

Average Harvest: 1 ton (1,000 kg) per cycle.

- The "average land ownership" is 0.3 ha and 0.5 ha.
- Typical Pond Size for this Harvest: for a relatively small pond such as 0.3 hectares farmers use net techniques for harvest.
- Productivity: (1,000 kg / 0.3 ha) = 3,333 kg per hectare per cycle
- Note: If the 1-ton harvest is for the 0.5-hectare pond, then the productivity would be (1,000 kg / 0.5 ha) = 2,000 kg per hectare.

Minimum Optimum Productivity that Should be Produced from the Average Land Ownership of Milkfish Farmers

Considering the average survival rate of 70% from pond for 0.5 ha, we can calculate the potential output or yield if survival rates were improved.

- For 0.5 ha, 10,000 seeds.
- If 60% survive to harvest: 10,000 seeds x 0.60 = 6,000 fish.
- If 1 kg has 5-6 fish, then the average 5.5 fish /kg.
- Total harvest: 6,000 fish / 5.5 fish = 1,090.9 kg (approx 1.1 tons for 0.5 ha).

- This translates to (1090.9 kg / 0.5 ha) = 2,181.8 kg per hectare.

If we aim for higher productivity (e.g., 80% survival rate, which is achievable with better seed quality and management):

- 80% survival: 10,000 seeds * 0.80 = 8,000 fish.
- Total harvest: 8,000 fish / 5.5 fish/kg = 1,454.5 kg (approx 1.45 tons for 0.5 ha).
- This translates to (1454.5 kg / 0.5 ha) = 2,909 kg per hectare.

Given the current average harvest is 1 ton for 0.3 ha (3,333 kg/ha), the "minimum optimum" should at least match or exceed this, while achieving higher survival rates. A target productivity of 2,500 - 3,000 kg per hectare (or higher) with consistent quality and reduced losses would be a reasonable optimum to aim for, ensuring better financial viability and resilience.

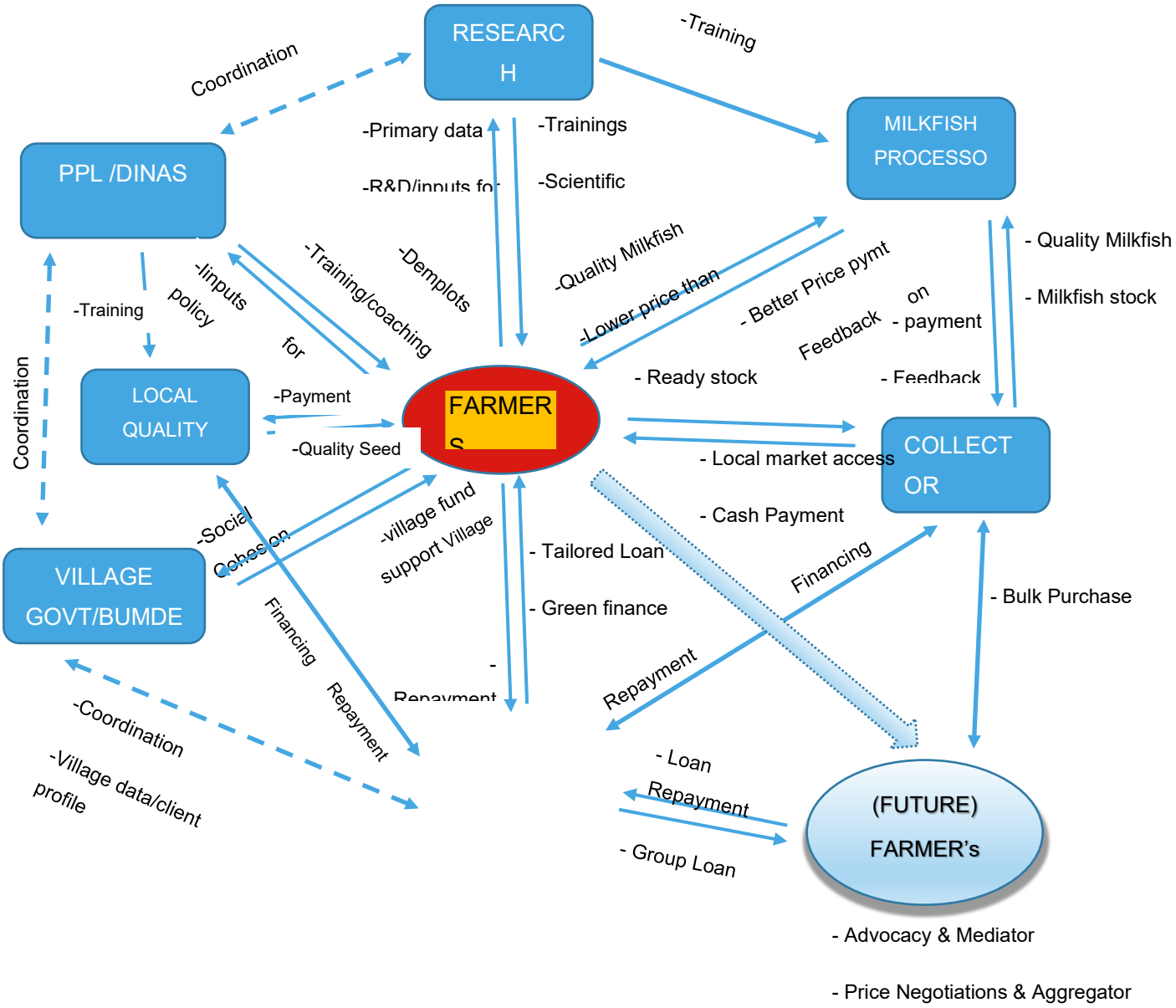
Farmer's Break Even Point

Break-Even Point Analysis

Milkfish Farmer (0.3 ha pond, 1 cycle):

- **Total Fixed Costs** (Amortized): Netting (IDR 1,250,000) + Bamboo Poles (IDR 450,000) = **IDR 1,700,000**
- **Total Variable Costs**: Seeds (IDR 900,000) + Feed (IDR 12,673,000) + Net Cleaning Labor (IDR 900,000) + Net Repair Labor (IDR 1,100,000) + Harvest Labor (IDR 1,700,000) + Pesticides (IDR 100,000) = **IDR 17,373,000**
- **Total Cost: IDR 19,073,000**
- **Selling Price per kg (P): IDR 20,000**
- **Variable Cost per kg (VC):** IDR 17,373,000 / 1,000 kg = IDR 17,373
- **Contribution Margin** per kg (CM): P - VC = IDR 20,000 - IDR 17,373 **= IDR 2,627**
- **Break-Even Point in Quantity (BEP**): Fixed Costs / Contribution Margin per unit
    - **BEP =** IDR 1,700,000 / IDR 2,627 **= 647.9 kg**
- **Break-Even Point in Revenue (BEP)**: Fixed Costs / (1 - (Total Variable Costs / Total Revenue))
    - BEP = IDR 1,700,000 / (1 - (IDR 17,373,000 / IDR 20,000,000))
    - = IDR 1,700,000 / (1 - 0.86865)
    - = IDR 1,700,000 / 0.13135
    - = **IDR 12,942,596**

Annex N Comprehensive Business Model with Closed Loop System for Milkfish



Annex O GCF Investment Criteria and Intervention Recommendations for Milkfish

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Farmers (core function)	Low Productivity (sub optimal aquaculture farming practice)	Activity : Training /coaching 1. Good Aquaculture Practice Training 2. Climate Literacy Training 3. Financial Literacy Training 4. Gender Training 5. Environmental awareness 6. Field School	Recommended for project funding for: - Comprehensive climate field school for milkfish commodity, which involves a series of trainings on climate literacy (incl. impacts on milkfish), CBIB or Good Aquaculture Practice Certification, climate-adaptive aquaculture methods and the use of CIS, and environmental awareness (incl. pond water management, utilisation of aerators and prohibition of chemical inputs) - Capacity building and technical assistance on farm-management - Financial literacy	Boosting Yield, Reducing mortality rate, Reducing Cost, Increasing technical knowledge, financial knowledge, gender awareness and climate and environmental awareness

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Farmers Cooperative or Association	Activity : Capacity Building 1. Group development 2. Continuous Facilitation on farmers group	Recommended for project funding for - Capacity building of fishfarmer group by involving them in the trainings and demoplots - Community institutional capacity gap and need assessment, strengthening, fish farmers' organizations and encourage local institutions to become centers for innovation and training, especially in organisational management, business management and other relevant technical aspect. This include in building stronger representation of community-led organisation in BUMDES (if necessary) and village planning process - Capacity building and technical assistance on farm-management, with integration of CIS information delivery	Need Institutionalisation at Farmer Level for effectiveness of the Project at recipient level “Seeing is Believing” is idiom for mindset change at farmer level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
			Recommended for project funding for Demoplots for fish fry enlargement and milkfish aquaculture that showcase: - Climate adaptive aquaculture practice based on climate and - weather information that applies CBIB principles, which include local fish fry enlarging facility, floating net system and the use of CIS - Improve networks to input providers (BBPBAP or feed suppliers) and offtakers (incl. milkfish processors, modern retails and e-commerce) - Zoning system for aquaculture pond that is co-designed and followed FPIC principles - Collaboration with the Local Govt (PPL designation and Subsidy/grant program for fisheries)	
		Activity: Demonstration Plot	Recommended for project funding for:	Climate Information System for farmers and

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Adoption	Showcasing Process and output of best practices	- Installation of tidal sensor and water quality monitoring system in the demoplots, which are connected to the CIS, and developing the automatic mechanism that provide alert as well as a recommendation of anticipatory action and/or adaptive practice if certain thresholds are passed - Build/rent cold storage facilities for fresh milkfish	tools for water quality monitoring and tidal sensor to improve practices as well as a means to monitoring and evaluation with environment standard. Cold storage can be used as temporary storage before the milkfish sold or transported to offtakers; preventing spoilt products, particularly when distribution is disrupted during flood event

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack Weather and Climate related Equipment	Activity: 1. Provision of Weather predictor equipment 2. Tools for testing such as PH, salinity, oxygen, contamination level etc		

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Seed Provider/ nursery (core function)	Seed quality is not standard	Activity: Selling quality seed	Recommended activities: - Developing a local enlarging facility for milkfish fry by collaborating with BBPBAP (Centre for Brackish Water Aquaculture) as the provider for certified milkfish fry - Identify fishfarmers-group that can manage the facility	Quality of Seed is the main issue of input factor that affect the harvest result for milkfish farming
Feed Provider (core function)	Quality seed not used	Activity: • Promoting quality feed • Teaching Farmers on the proper use of feed	Recommended activities: - Strengthen networks or access to high quality and probiotic feed suppliers,	Incentive for involvement: • Product Promotion • Market expansion • Revenue
Financial Institution (Supporting Function)	Low/No Access to Finance	Activity: 1. Developing a Tailored credit Scheme for farmers 2. Introducing Green Financing (bundled service with green farming) 3. Financial Literacy Training (CSR activity) 4. Weather Insurance	Recommended activities: - Introduce access to green financing - Collaborate with private sectors or financial institutios for financial literacy - Incentive scheme for fishfarmers/fishfarmer groups who adopt climate-adaptive method - Improve milkfish farmers' access to tailored bundled service of (inter alia) savings, parametric insurance products, credits, and digital marketing in collaboration with the	Incentive for involvement: • Expanding Portfolio • New Client Base

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
			Financial Services Providers (FSPs) and Marketplace companies -	
Village Government / Local Government (Enabler)	Low Involvement	Activity: 1. Mediation related to non-chemical use 2. Support in Village Level policy & Safeguarding project 3. Mediation in potential social conflict 4. Potential utilization of BUMDES (Village-owned Enterprise) as a supporting function, such as providing services / Agri Shop selling inputs/providing equipment	Recommended activities: - Advocacy to include climate resilience and climate-adaptive livelihood into village development plan. This would include series of meetings or discussions. - Advocacy for the formulation of Village Regulation regarding climate-adaptive and sustainable aquaculture, which includes the prohibition of chemicals for aquaculture and zoning system for the pond - Collaborative scheme with BUMDES to provide supporting function - Advocacy to include adaptive aquaculture activity as part of the Marine and Fisheries Agency Annual Work Plan	Village Officials and Apparatus are key stakeholders when doing a livelihood project at the village level, especially related to enforcement of regulation/policy and to maintain conducive environment and social cohesion
University/ Research/ consultant			Develop a market information app that integrated to CIS and offer training for farmers and fish farmers on its use.	

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
			Link fish farmers to domestic and national distribution networks, including modern retail and e-commerce.	

Potential Candidate for Training/Capacity building Provider:

1. PPL /Extension Services from Regency Office (Badan Pelaksana Penyuluhan Pertanian, Perikanan & Kehutanan / BP4K Kota Pekalongan)
2. Pekalongan University
3. Diponegoro University
4. Private Consultant
5. Lead Farmer/Champion
6. NGO ➔Training and also Group/Cooperative Formation

Potential Candidate Actors for Seed Provider:

1. BBPBAP Jepara
2. PT Moya Bahari Perdana (MBP)
3. SLBB

Potential Candidate Actors for Feed Provider:

1. Unggul Jasa PS Pekalongan
2. Jaya Perkasa

Potential Candidate Actors for Financial Institution:

1. BRI & BTPN - medium size loan up to IDR 100 million and micro Loan up to IDR 25 million
2. BTPN Syariah
3. PT PNM – micro loan up to IDR 10 million
4. Bank Mandiri – Green Financing
5. BPD Jateng – productive and consumption loan
6. Bank Jateng
7. Allianz – Crop and Weather Insurance
10. ACA – Crop Insurance
11. Zurich Sharia – Crop and Weather Insurance
12. Microfinance Institution
13. Potential Candidate Actors for Offtaker and Market (including e-commerece)

GCF Investment Criteria for MILKFISH

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
Critical climate resilient livelihood. **Many farmers transitioned from rice**	Potential for scalable in terms of tonnage produced and reaching further market channel, milkfish farming	The use of chemical pesticides could pose health risks to farmers and consumers, therefore changing practice to non	Milkfish is the main aquaculture commodity of Pekalongan for several decades, it is the main source of income for majority	National government vision for food security	If Best Practices applied, productivity could be boost up to twice or triple (current yield max 1 ton/ha, with best practices milkfish could

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
farming due to seawater intrusion.	could be leveraged with financial support	chemical substance will save people	fishfarmers. Climate-induced flooding has disrupted their livelihood, and a more adaptive technique is neede. This adaptive model could increased income for household, shifting farmers from the current subsistence livelihood, reduce poverty and economic vulnerability for farmers		yield average 2 – 3 ton/ha

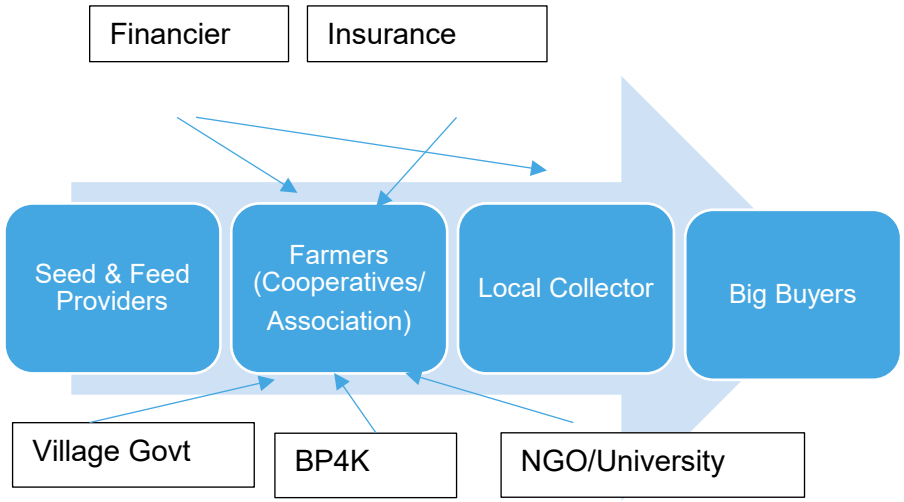
Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
When farms are managed to avoid mangrove clearing—or better yet, integrate mangrove replanting—they help protect these critical carbon sinks		Milkfish farming requires many additional labor therefor it creates employment	Milkfish needs financing, especially for inputs and infrastructure of ponds. Access to finance is critical.	Milkfish is one of the main commodities for Pekalongan City and Regency	
Milkfish is Pekalongan's primary aquaculture commodity and a cornerstone of local livelihoods, yet it is increasingly threatened by land subsidence, sea-level rise, and extreme		Reliance on externally sourced fry as seed for milkfish farming further increases production costs and exposes farmers to supply chain risks, especially when floods disrupt transport. Without adaptive interventions, Pekalongan risks losing			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
weather. Permanent inundation and tidal flooding have reduced productive pond areas from nearly 200 hectares to just 12 hectares, while salinity fluctuations, pond erosion, and infrastructure damage are driving frequent harvest failures and mass fish mortality. Smallholder farmers, lacking resources to continually raise dikes or nets, are the most vulnerable—many		even its remaining productive ponds, making climate-resilient milkfish systems essential to safeguard livelihoods, stabilize local food supply, and sustain the aquaculture economy			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
have already abandoned aquaculture and shifted to low-paying informal work. .					

SCORING FOR MILKFISH: HIGHLY RECOMMENDED COMMODITY

MARKET MAP FOR MILKFISH



The intervention for systemic change for milkfish should focus on addressing low productivity due to sub-optimal aquaculture practices, high capital needs and environmental & climate change risks. Key entry points for this paradigm shift should include activities as follows:

- Farmers Level: Training in Good Aquaculture Practices by BP4K, accompanied by training on climate, financial, gender, and environmental awareness as well as Farmers group/cooperative formation by selected local NGO. The Project also should conduct activities Field School and Demonstration plots showing best practices, quality seeds used, and chemical-free inputs that can help farmers adopt new methods. The provision of weather predictor equipment and water quality testing tools will also improve practices (handed over to ownership by farmer group).
- Seed Provider/Nursery & Feed Provider: The intervention for seed providers (BBPBAP or PT MBP) is to ensure they are selling quality seeds, which is a main input factor affecting harvest results. Feed providers (Unggul Jasa or Jaya Perkasa) should promote quality feed and teach farmers its proper use. These activities would mainly on advocating and getting engagement from those private entities.
- Financial Institution: The intervention is to develop tailored credit schemes by BRI or BPD Jateng, and to some extend exploring to introduce "green financing" (bundled with green farming practices requirement) by Bank Mandiri, and offer weather insurance (Allianz/ACA/Zurich). These activities would need close approach to those actors in providing potential scalability opportunity to the milkfish farming, need development of MoU or cooperation agreement
- Village Government (Enabler): They can support the project by mediating on the issue of non-chemical use, creating village-level policies to protect the environment and limit chemical use, and establishing zoning systems. This would involve activities in supporting the formulation and drafting of legal regulation by the project, community's advocacy meetings and getting free and voluntary consent from impacted people (funded by the project)

Annex P Details of Calculations for Processed Milkfish

Actor's Accounting (Revenue Vs Costs)

Processed Milkfish Entrepreneurs:

- Revenue per Box (2 fish): IDR 55,000
- Revenue per individual fish (not boxed): IDR 20,000 – IDR 25,000
- Revenue per small fish (for traditional market/catering): IDR 15,000

Cost Components for Processed Milkfish Entrepreneurs (per 10-20 kg of raw milkfish, processed twice a week):

Using the means value, 15 kg of milkfish processed per production cycle, twice a week (average of 10-20 kg per week, assuming two cycles).

- Raw Material Cost:
  - Market: 15 kg x IDR 33,000/kg = IDR 495,000
  - Collector: 15 kg x IDR 28,000/kg = IDR 420,000
- Energy (LPG Gas): 1 unit per production cycle (assuming 1-2 units per week or average 1.5 units per week). For 2 cycles, 2 units. Then 2 units x IDR 25,000/unit = IDR 50,000
- Manpower: 2-3 people per production. Assuming 2 people x IDR 100,000/day = IDR 200,000 per production cycle. For 2 cycles: IDR 400,000.
- Electricity: IDR 300,000 per month. Per production cycle (assuming 8 cycles a month): IDR 300,000 / 8 = IDR 37,500.
- Packaging: Assuming 1 kg contains 3-4 fish (average 3.5). 15 kg x 3.5 fishs/kg = 52.5 fish.
  - Cost per piece of fish = IDR 2,000.
  - Total packaging cost = 52.5 fish x IDR 2,000/fish = IDR 105,000.

Estimated Revenue per Production Cycle for 15 kg milkfish, assuming all 52.5 fish are sold as boxed products (2 fish/box), resulting in approximately 26 boxes.

- 26 boxes x IDR 55,000/box = **IDR 1,430,000.**

Estimated Profit Margin per Production Cycle:

- **Market Source:** IDR 1,430,000 (Revenue) - IDR 862,500 (Cost) = **IDR 567,500**
- **Collector Source**: IDR 1,430,000 (Revenue) - IDR 787,500 (Cost) = **IDR 642,500**

Therefore, sourcing from collectors, despite potential quality issues, offers a higher profit margin due to lower raw material costs. The cost of packaging and labor are significant components.

As calculated above, the estimated profit per production cycle (15 kg milkfish):

- Market Source: IDR 567,500
- Collector Source: IDR 642,500

This suggests that processed milkfish entrepreneurs capture significant value, and sourcing raw materials from collectors can yield a higher profit margin for them due to lower input costs.

Estimated Profit Margin (as a percentage of revenue):

- Market Source: (567,500 / 1,430,000) x 100% approx 39.7%
- Collector Source: (642,500 / 1,430,000) x 100% approx 44.9%

This indicates a healthy profit margin for the processing stage.

PRODUCTIVITY

Productivity of Processed Milkfish Entrepreneurs (Pressured Cooked Milkfish and Milkfish Processor)

- Input Requirement: 10-20 kilograms of fresh milkfish per week.
- Fish per Kilogram: 3-4 fish (average 3.5 fish) for current size. For special orders, 1-2 fish (average 1.5 fish).
- Production Cycles: Cooked twice a week.

Let's assume an average input of 15 kg of standard-sized milkfish per production cycle.

- Raw Fish Input per Cycle: 15 kg
- Number of Fish per Cycle: 15 kg x 3.5 fish/kg = 52.5 fish (approx. 52-53 fish)
- Output (Finished Product):
    - Each finished product is packed individually (cost IDR 2,000 per head).
    - A packing box usually contains 2 fish.
    - So, from 52.5 fish, approximately 26 boxes (52.5 / 2 = 26.25).

Productivity of Milkfish Processor (in terms of finished units per kg of raw material):

- From 1 kg of raw milkfish, the output is approximately 3.5 finished individual fish.
- From 1 kg of raw milkfish, the output is approximately 1.75 boxes (if sold in boxes).

Weekly Productivity (assuming 2 production cycles per week with 15 kg input each):

- Raw Fish Input per Week: 30 kg
- Number of Fish Processed per Week: 30 kg x 3.5 fish/kg = 105 fish
- Number of Boxes Produced per Week: 105 fish / 2 fish/box = 52.5 boxes (approx. 52-53 boxes)

Labor Productivity:

- Manpower per production cycle: 2-3 people. Let's assume 2.5 people on average.
- Finished fish per person per cycle: 52.5 fish / 2.5 people = 21 fish/person.
- Finished boxes per person per cycle: 26 boxes / 2.5 people = 10.4 boxes/person.

The minimum optimum productivity for the processed milkfish entrepreneur

- Current Production: 10-20 kg/week, processed twice a week. This is their current operating range, which implies it's viable for them.
- Constraint: "Limitations production mass , capacity limited when face order in amount big or minimum quota fulfillment production". This suggests their current productivity is below their optimal capacity for growth and larger orders.

To determine minimum optimum productivity, an milkfish entrepreneur needs to cover:

1. Fixed Costs:
    - A portion of monthly electricity (IDR 300,000 / 4 weeks = IDR 75,000/week).
    - Pressure cooker repair (IDR 500,000) is an infrequent but significant fixed cost if it occurs.
    - Other overheads not specified (e.g., rent if applicable, administrative costs).
2. Variable Costs per production cycle: Raw material, LPG gas, manpower wages, packaging.

We could assume the weekly costs and revenues.

- Weekly Variable Costs (assuming 30kg input/week from collector source):
    - Raw Material: IDR 420,000 x 2 cycles = IDR 840,000
    - LPG Gas: IDR 25,000 x 2 units = IDR 50,000
    - Manpower: IDR 200,000 x 2 cycles = IDR 400,000
    - Packaging: IDR 105,000 x 2 cycles = IDR 210,000
    - Total Weekly Variable Costs: IDR 1,500,000
- Weekly Fixed Cost (Electricity): IDR 75,000
- Total Weekly Cost: IDR 1,575,000
- Weekly Revenue (assuming 52 boxes at IDR 55,000/box): IDR 2,860,000

The current operating volume (10-20 kg/week) appears to be above their break-even point. Minimum Optimum Productivity would be the point where they achieve economies of scale, maximize their equipment utilization, and minimize the impact of fixed costs per unit. Given their complaints about limited mass production capacity, their current 10-20 kg/week is likely not their optimal. An optimum would probably be higher, allowing them to fulfill larger orders more efficiently without significant disruptions or added per-unit costs. This would require an analysis of their cooker capacity and labor capacity.

Average Total Revenue and Cost for Processed Milkfish Entrepreneurs:

- Average Weekly Raw Material Input: Let's take the midpoint of 10-20 kg, so 15 kg per production cycle, twice a week, totaling 30 kg/week.
- Average Weekly Revenue (from boxed products): Assuming 3.5 fish/kg, 30 kg x 3.5 fish/kg = 105 fish. 105 fish / 2 fish/box = 52.5 boxes.
    - Average Total Revenue (weekly): 52.5 boxes x IDR 55,000/box = IDR 2,887,500
- Average Weekly Total Cost (using Collector Source as more profitable):
    - Raw Material (30kg): IDR 28,000/kg x 30 kg = IDR 840,000
    - LPG Gas (2 units/week): IDR 25,000/unit x 2 units = IDR 50,000
    - Manpower (2.5 people/cycle, 2 cycles): 2.5 people x IDR 100,000/day x 2 days = IDR 500,000 (assuming 1 day per production, 2 days for 2 cycles, and 2.5 people average)
    - Electricity (weekly share of monthly): IDR 300,000/month / 4 weeks = IDR 75,000
    - Packaging (105 fish): IDR 2,000 x 105 fish = IDR 210,000
    - Average Total Cost (weekly): IDR 840,000 + 50,000 + 500,000 + 75,000 + 210,000 = IDR 1,675,000

    (Note: This calculation averages manpower and assumes 1 day of work per production cycle.)

Average Profit of Processed Milkfish Entrepreneurs:

Average Weekly Profit = Average Weekly Revenue - Average Weekly Total Cost

IDR 2,887,500 - IDR 1,675,000 **= IDR 1,212,500 (weekly profit)**

Break-Even Point Analysis

Break-even point (BEP) is where total costs equal total revenue. For Processed Milkfish Entrepreneurs (Weekly Basis):

Assumptions:

- Average weekly electricity cost (fixed): IDR 75,000 (IDR 300,000/month / 4 weeks)
- Selling Price per box: IDR 55,000
- Variable Costs per box:
    - Cost per kg of raw milkfish: IDR 28,000
    - Fish per kg: 3.5 fish (average)
    - Cost per fish raw material: IDR 28,000 / 3.5 = IDR 8,000
    - Cost per box raw material (2 fish): IDR 8,000 x 2 = IDR 16,000
    - Packaging cost per box (2 fish): IDR 2,000 x 2 fish = IDR 4,000
    - LPG Gas per production cycle (approx. 52.5 fish/cycle or 26 boxes): IDR 25,000 / 26 boxes approx IDR 961.5 per box
    - Manpower per production cycle (approx. 26 boxes): IDR 200,000 / 26 boxes approx IDR 7,692.3 per box
    - Total Variable Cost per box: IDR 16,000 (raw material) + 4,000 (packaging) + 961.5 (LPG) + 7,692.3 (manpower) = IDR 28,653.8

Break-Even Point in Units (Boxes):

- BEP (units) = Fixed Costs / (Selling Price per Unit - Variable Cost per Unit)
- BEP (boxes) = IDR 75,000 / (IDR 55,000 - IDR 28,653.8)
- BEP (boxes) = IDR 75,000 / IDR 26,346.2 approx **2.85 boxes**

Break-Even Point in Revenue:

- BEP (revenue) = BEP (units) * Selling Price per Unit
- BEP (revenue) = 2.85 boxes * IDR 55,000/box approx **IDR 156,750**

Analysis: The break-even point for processed milkfish entrepreneurs is very low (around 3 boxes or IDR 156,750 in weekly revenue). This indicates that the business can cover its fixed costs with a small volume of sales, making it relatively robust from a financial stability perspective. Their current production volume (around 52-53 boxes/week) is significantly above their break-even point, indicating profitability.

Analysis of Return Cost Ratio (RC Ratio) and Benefit Cost Ratio (BC Ratio)

RC Ratio (Return on Cost) = Total Revenue / Total Cost BC Ratio (Benefit Cost Ratio) = Total Benefits / Total Costs

For financial analysis, these are often used interchangeably, especially when benefits are primarily represented by revenue.

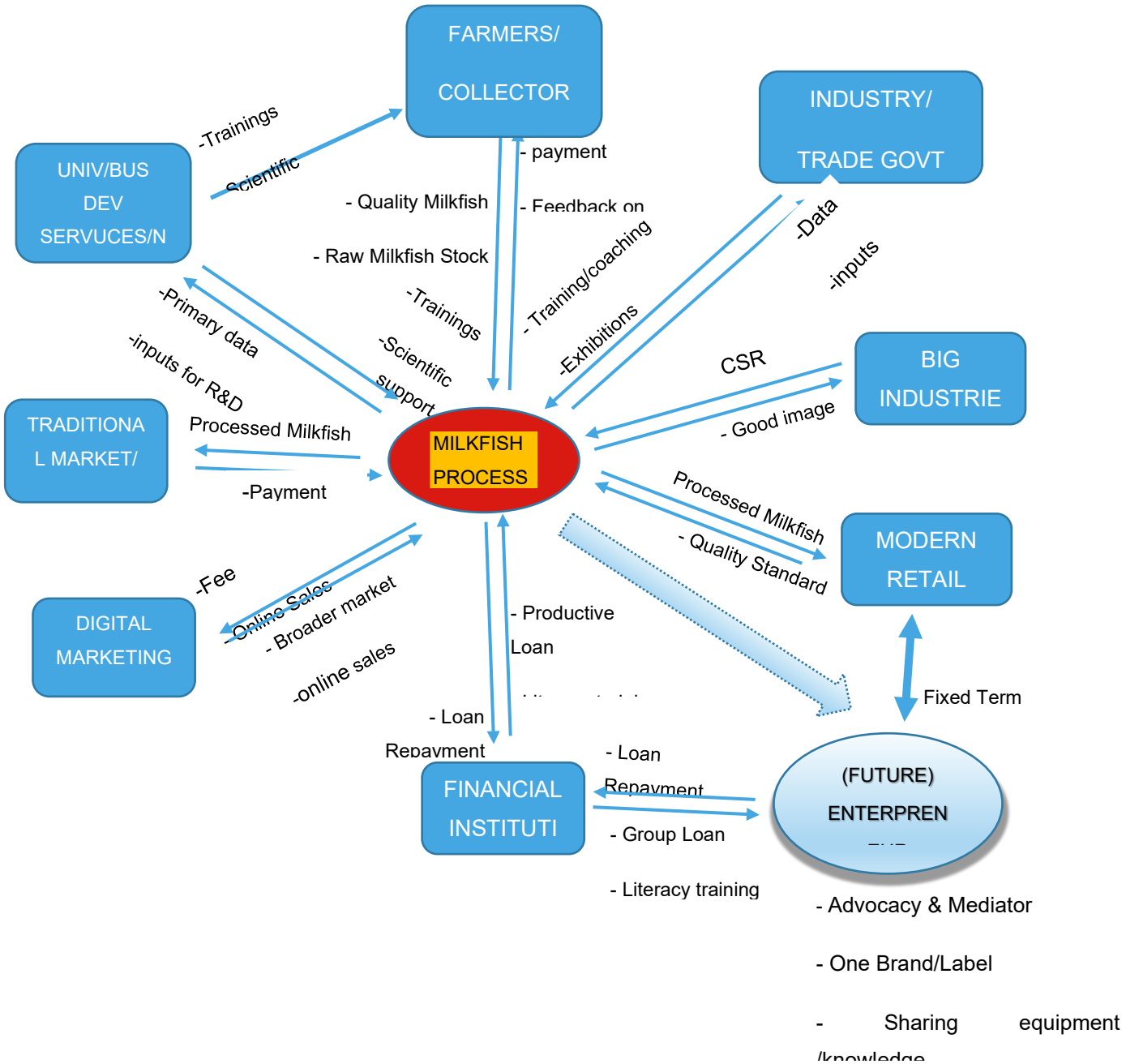
For Processed Milkfish Entrepreneurs (Weekly Basis, using Collector Source):

- Total Weekly Revenue: IDR 2,887,500

- Total Weekly Cost: IDR 1,675,000
- RC Ratio / BC Ratio = IDR 2,887,500 / IDR 1,675,000 approx 1.72

Analysis: An RC/BC ratio of 1.72 means that for every IDR 1.00 of cost incurred, the entrepreneur generates IDR 1.72 in revenue. This is a strong ratio, indicating that the processed milkfish business is highly profitable and provides a good return on the investment in costs.

Annex Q Comprehensive Business Model with Closed Loop System for Processed Milkfish



Annex R GCF Investment Criteria and Intervention Recommendations for Processed Milkfish

Actors Level & Associated Activities/Investment

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
Entrepreneurs (core function)	Sub Standard Product (sub optimal processing practice)	Activity : Training /coaching 1. Training on Efficient and Cost Effective Processing 2. Financial Literacy Training 3. Digital Marketing 4. Environmental awareness on waste or by product Activity : Capacity Building	Recommended for project funding for trainings on: - Environmentally-friendly milkfish processing (presto, otak-otak etc.) and financial literacy - Digital marketing	Boosting Quality of End Product, Reducing Cost, Increasing technical knowledge, constant production, healthy and quality end product, good packaging and unique Branding, using renewable energy source, waste management, financial knowledge,

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Entrepreneurs Cooperative or Association	1. Group development 2. Continuous Facilitation on Entrepreneurs Association	Recommended for project funding for Group formation, Community institutional capacity gap and need assessment, strengthening the existing producers organizations and encourage local institutions to become centres for innovation and training, especially in organisational management, business management, entrepreneurship and other relevant technical aspect. This include in building stronger representation of community-led organisation in BUMDES (if necessary) and village planning process	Need Institutionalisation at Entrepreneur Level

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
	Lack of Adequate and Durable Processing Unit	Activity: Provision of durable and eco friendly as well as energy efficient equipment	Recommended for project funding for Procurement of Processing Equipment	Damaged or dysfunction of equipment resulting in disruption in operation
Modern Retail Market (core function)	No Access	Activity: Approaching for marketing access	Recommended activities: Packaging, Branding and Licensing/Industrial Product Permit/certification Develop a market information app that integrated to CIS and offer training for farmers and fish farmers on its use.	Quality end product is the requirement, along with the constant production and with large quantity

Actor	Gaps	Intervention for Systemic Change	Funded by GCF	Rationale
			Link producers to domestic and national distribution networks, including modern retail and e-commerce.	
Financial Institution (Supporting Function)	No Access to Finance	Activity: 1. Microfinance Loan 2. Financial Literacy Training (CSR activity)	Recommended activity: - Collaborate for financial literacy training or CSR for operational development - Improve producers access to tailored bundled service of (inter alia) savings, credits, and digital marketing in collaboration with the Financial Services Providers (FSPs)	Incentive for involvement: • Expanding Portfolio • New Client Base
Local Government (Dinas)/Village or Kelurahan Government	Limited to Providing Stall in Exhibition, simple permit	Activity: 1. Hardskill and Soft skill training support 2. Support in Market Access	Recommended activity: - Explore for potential location that can be used for production area - Support in licensing - Advocacy to include adaptive aquaculture activity as part of the Marine and Fisheries Agency Annual Work Plan	Since MSME sector is large in Pekalongan then the Government support is necessary

Potential Candidate for Training/Capacity building Provider:

1. Balai Latihan Kerja / BLK Kajen Pekalongan
2. Pekalongan University
3. Dinas Koperasi & UMKM Pekalongan
4. NGO ➔Training and also Group/Cooperative Formation

Potential Candidate Actors for Fresh Milkfish Provider:

- Farmers & Farmers Group under The Project

Potential Candidate Actors for Modern Retail Market:

1. Hypermart Pekalongan
2. Transmart Mall Pekalongan
3. Yogya Mall Pekalongan

Potential Candidate Actors for Financial Institution:

1. BRI Link & BTPN– Microfinance Unit
2. PT PNM Mekar – micro loan up to IDR 10 million
3. BPD Jateng – productive and consumption loan
4. Microfinance Institution

GCF Investment Criteria for PROCESSED MILKFISH

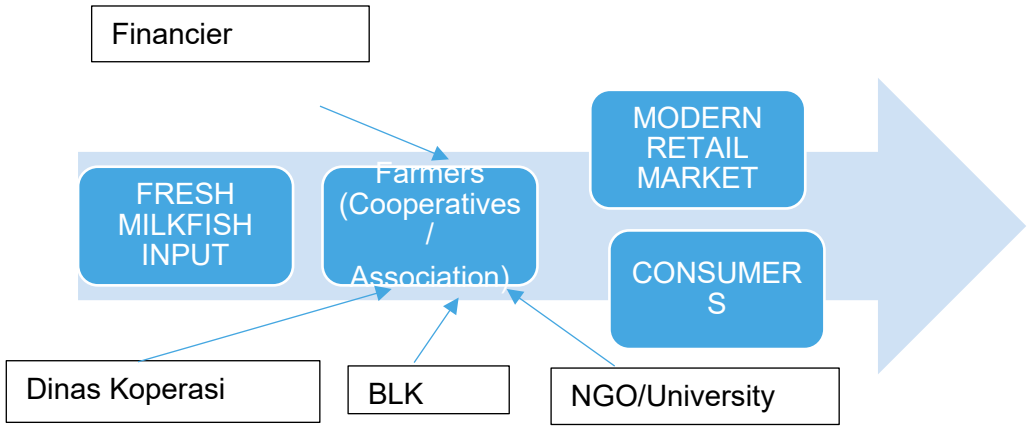
Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
No direct Impact to Climate Change, indirectly through requirement on healthy and free of chemical milkfish as raw material	Although currently Limited Value Proposition, but with innovative packaging and branding, Altogether with diversification of product by enterpreneurs; value proposition has potential to be increased. Limited Potential for scalable since mostly are home based	In some part of processing requires extra labor so it will create income generating activities for others Aside from providing market assurance during flood events and periods of low fish prices, this value-added scheme is designed to empower women and women groups, particularly those whose husbands work in climate-vulnerable sectors such as fishing or fish farming, or	Milkfish Processing fall into the category of MSME then it will help the informal sector, and job creation to some extent	National government vision for food security	If efficient process as well as appropriate equipment used, production of pressure cooked could be improved, constant producing, healthy and quality, with good packaging and branding

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
	industry, however together with value proposition increase; positioning in the market especially within the region. Has also the potential to be strengthened	those who have been forced to be a manual labor due to the loss of productive land. These households are faced with decreasing and unpredictable incomes as a result of climate impacts, while at the same time, they are also faced with the increasing financial burden of adaptation measures, such as increasing floor levels or protecting their homes against flooding.			

Impact Potential	Paradigm Shift Potential	Sustainable Development Potential	Needs of the Recipient	Country Ownership	Efficiency & Effectiveness
	Loan requirement mostly micro financing	Mostly processed milkfish entrepreneurs are women By involving women in this activity, the scheme creates alternative income opportunities that could help them support their families and build economic resilience	Milkfish entrepeneurs are facing difficulties in assessing bank loan since they don't have collateral	Supporting the informal sector and Job Creation that will reduce regional unemployment rate The idea of value added scheme is to extending the milkfish supply chain in Pekalongan so the bigger gain could be generated for the local communities. This is economic diversification activities is important for economic risk mitigation for the small-scale farmer	Since the production of Pressure Cooked Milkfish do not require large capital investment then the return on investment is relatively quick to achieve

SCORING FOR PROCESSED MILKFISH: HIGHLY RECOMMENDED COMMODITY

MARKET MAP FOR PROCESSED MILKFISH



The intervention for systemic change for processed milkfish should address the issue of sub-standard products, acquisition of durable and energy efficient processing unit, low market penetration, working capital needs and a lack of entrepreneurs' associations/shared resources. Key entry points for this paradigm shift should include activities as follows:

- Entrepreneurs Level: Activities in Training and coaching on efficient and cost-effective processing by BLK Kajen or Dinas Koperasi UMKM; Training on financial literacy, Digital Marketing, gender and environmental awareness on waste management as well as forming entrepreneur group/association by Pekalongan University or Dinas Koperasi UMKM. The Project should also consider the provision of durable, eco-friendly, and energy-efficient equipment that will help boost product quality and consistency, such equipment will be handed over, owned and co-shared by entrepreneurs' association.
- Modern Retail Market (Hypermart, Transmart, Yogya Mall): The intervention is to approach these markets for access and potential co-financing for packaging, labeling, branding, and support licensing. The activities involved would encompass, identification of product requirement, support in developing seller-buyer contract, negotiation on terms and conditions, FGD and seminars with topics meeting the milkfish processor and the modern retail market actors (funded by the project).
- Financial Institution (BRI Link/BTPN/PT PNM): The intervention is to provide microfinance loans and financial literacy training to entrepreneurs who often lack collateral for bank loans. The activities would be around approaching those financiers, providing profile of potential clients from women entrepreneurs in milkfish processing and collaborate development of curriculum for financial product and literacy trainings.
- Local Government agency (BLK Pekalongan and Dinas Koperasi UMKM Pekalongan): The local government can provide hard and soft skills training support and assist with market access. A close coordination and collaboration will be needed, activities would involve regular meetings, FGDs, Seminar, collaboration in exhibition event (these activities potentially co financing or fully funded by the Project).
- Overall, it could be examined as part of the milkfish value chain, supporting particular processors.

Annex S FGD Documentations