

Supply Chain Analysis of Green Mussel Business in Umbul Asem Village Bandar Lampung

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ABSTRACT

Umbul Asem village is a coastal area has a fairly high potential, especially the farming of green mussels. However, the prospect of green mussel farming which is quite large is still not realized by all fishermen so it is necessary to conduct research to determine the green mussel supply chain and see what opportunities from its business so that it can be developed. This is a descriptive research which is conducted in field and desk research. The results indicate the green mussel supply chain starts from farmers to distributors then to retailers and to end consumers, while supply chain players manage relationships between supply chain from upstream to downstream and vice versa well. Some of the green mussel business opportunities that are visible include selecting the Longline method to minimize costs and increase profits also suitable for high wave waters, farming is simple and does not require special treatment, lots of green mussel seeds are available in the waters, the profit from one longline is around Rp. 691,667, the location is close to PPI Lempassing (3 km in 8 minutes). In addition to developing the green mussel business, it is necessary to conduct a study that is in line with the government's efforts in formulating a strategy for developing the fishing industry in Bandar Lampung.

1. Introduction

Umbul Asem village is located in Keteguhan, East Teluk Betung district, Bandar Lampung city. Most of the population work as fishermen, traders and workers. In this coastal area has a fairly high diversity of organisms, not only fish but also squid, crabs and green mussels (*Perna Viridis*). In particular, the farming of green mussels is very potential in this area, and according to information obtained from fishermen, the farming of green mussels in Umbul Asem village has been started since 2018. At that time, initially the fishermen farmed seaweed using the net and rope method, unexpectedly it turned out that there were many green mussels attached to the rope which indirectly proved that in these waters there were many green mussel seeds that naturally grew and had great potential to be developed. The seaweed farming business was not successful because the fishermen did not know how to market it, so they began to look at the farming of green mussels as a business that needed to be tried. Moreover, they saw that the farming of green mussels at Pasaran island which is not far from the location of Umbul Asem had proven their success in this business which was initiated since 2012. The distance from the coastal area on Pasaran island to the Umbul Asem approximately 2 km, and many researchers had conducted research on green mussels which proved that water quality and location support the farming of green mussels at Pasaran island. Based on research and analysis results of Noor., N.M can be seen if no heavy metal content was detected which indicated the waters were still safe and clean[1].

Currently the farming of green mussels in Umbul Asem is one of the livelihoods with a limited number of fishermen and still not in groups. Based on observations in several traditional markets, it is known that the demand for green mussels is quite high and is always increasing, but it has not been fulfilled and is often difficult to find. The current availability of green mussels has not been able to meet consumer demand optimally. Consumer needs are increasing day by day which consumers want products that have a good distribution flow, these products reach the hands of

consumers at the right place and time when needed. However, from the results of interviews with several fishermen there, it can also be seen that the farming of green mussels is only an alternative livelihood, most of the fishermen still depend on catching fish in the sea and selling at auctions. The prospect of green mussel farming which is quite large is still not realized by all fishermen so it is necessary to conduct research to determine the green mussel supply chain in Umbul Asem village in general, and how the product, financial and information flows and the processes used to deliver the product from the source location/supplier to the end customer, also to see what opportunities from the green mussel business so that it can be developed in Umbul Asem village, Keteguhan district, Bandar Lampung.

1.1. Supply Chain

The supply chain is a network of interconnected and interdependent organizations to work together to improve the flow of materials and information from suppliers to end consumers [2]. And the supply chain includes all activities related to the flow of goods from the initial to the final stage [3]. In other words, the supply chain consists of all parties involved directly or indirectly in meeting customer demands, not only producers and suppliers, but also transporters, warehouses, and even the customers themselves [4]. Good management in the supply chain is needed which aims to create a fast, efficient, and network of business relationships or supply chains, to get the company's products from concept to market [5]. Several studies related to the supply chain of marine fisheries commodities include: Triyanti, R. et al [6] regarding Lobster Supply Chain Management Analysis (Case Study in Simeulue Regency, Aceh), where the research results show that the lobster supply chain consists of fishermen or cultivators (100%) → suppliers (100%) → exporters (90%) and local consumers (10%) → overseas consumers (100%) and consists of seven mappings in its supply chain management. Furthermore other research on Supply Chain Analysis of Catches in Manado City and Bitung City concluded that the supply chain of most fishing groups in Manado city through fish collectors or distributor and then brought to markets and auctions [7]. However, there are also groups of fishermen who directly sell their catches at the location of the fishing groups, and the role of collectors or distributor is very influential where distribution channels can be determined based on a lot or a small amount of fish caught. Still from the Sulawesi island regarding The Supply Chain Analysis of Floating Chart Capture Fishery Products in TateliWeru (Buloh) Mandolang District Minahasa Regency, it was concluded that from the supply chain actors of fishing products in TateliWeru (Buloh) Mandolang district, Minahasa regency, the first fisherman who owned floating chart, feed factory livestock, small traders or petibo, fishing boats, and the consumers at the end [8]. Next, research of Analysis of Vaname Shrimp Supply Chain and Transportation at the Processing Unit in North Jakarta concluded that the costs of three business actors who provide raw materials for Vanamei shrimp to UPI in North Jakarta are hatchery units, cultivators, and collectors/suppliers, and the percentage of transportation costs to vaname shrimp prices ranged from 0.48-1.39% [9]

1.2. Green Mussel (PernaViridis)

Green mussel is one type of shellfish that has been successfully farmed with the Latin name *PernaViridis*. Green mussel farming is not difficult, because green mussels are able to survive and grow in high environmental pressures and without feed [10]. Green mussel farming needs to pay attention to environmental conditions such as water flow, weather and pollution levels. In other words a cultivation location that strongly supports the growth of green mussels is faster. Several factors that encourage the development of green mussel farming include the relatively fast growth rate of green mussels so that the farming period is shorter to reach the consumption size, in addition, the availability of seeds from nature throughout the year without the need for a hatchery process [11]. Green mussel farming is very prospective to be developed as in the research of Noor, which discusses The Prospects of Green Mussel Cultivation Business Development (*PernaViridis*) on Pasaran Island, Bandar Lampung seen from environmental biology, technical, feasibility study and socio-economics aspects. From the research, it is known that with a raft size of 10 x 10 m², green mussels can be produced up to 3-4 tons of raw green mussels. However, green mussel farming can be done with low production costs but produces high profitability [12]. Actually, there are 4 (four) known green mussel farming methods, namely the stick, the raft, the rack, and the long

line methods (WWF Indonesia). Such as on Pasaran Island which uses the raft method or floating net cages because the depth of the waters supports it and there are already rafts that were previously used for grouper fish farming. There are also those who use other methods as more suitable methods, such as the research of Farming of Green Mussels (*Perna Viridis* L.) with Different Methods and Density In Coastal Waters of Kuala Langsa Aceh, and the results of the study obtained the optimal yield of green mussel farming was produced using the long line method and a density of 20 individuals/bag 5.30 L [13]. The farming of green mussels can actually be done simultaneously with a polyculture system which maintains two or more species of organisms in the same place with the aim of land use efficiency, so that fish can be produced in addition to green mussels [14].

2. Method

This study aims to determine the green mussel supply chain in Umbul Asem village in general, and how the product, financial and information flows and the processes used to deliver the product from the source location/supplier to the end customer, also to see what opportunities from the green mussel business so that it can be developed in Umbul Asem village, Keteguhan district, Bandar Lampung. This research was conducted in two ways, namely by desk research and field research. Where field studies are carried out to find out the overall process and see what is in place, then each bidding process will be carried out to find out the business processes and supply system as a whole. It is carried out by conducting surveys, observations and interviews. The objects observed and surveyed started from the location where green mussels were grown, then how the fishermen processed the green mussels before being sold, then after that how they marketed them. And in the process of interviewing the fishermen of Umbul Asem, business actors, both distributors and retailers, green mussel traders and final consumers who buy green mussels in several traditional markets. All of these generate primary data. While desk research is obtained based on information in the form of studies or data from previous research and literature studies from the latest journals that produce secondary data. This type of research is descriptive research that aims to describe existing phenomena, both now and in the past. In this study, it is directed to obtain detailed information or descriptions of respondents' perceptions as supply chain participants and business actors that occur in certain social units. The time of the research was carried out from August to October 2021.

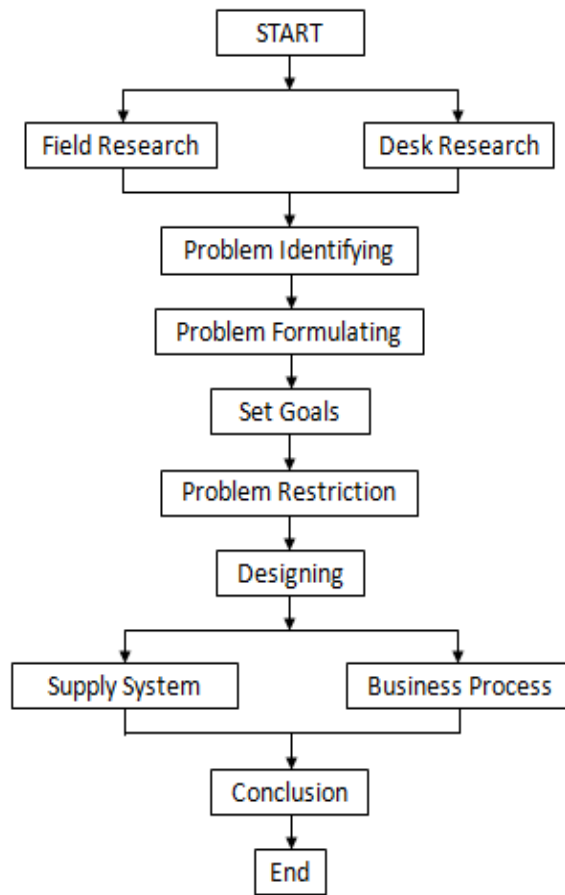


Figure 1. Research Flow Chart

3. Result and Discussion

3.1 Green Mussel Supply Chain in Umbul Asem Village in General



Figure 2. Green Mussel Supply Chain in Umbul Asem Village in General

Source: Own research data

Note:

- : Product Flow
- : Financial Flow
- : Information Flow

The supply chain players start from farmers/producers, they are Umbul Asem fishermen who farm green mussels, their number is still very small, around 10 people and work individually. Then

distributors are people who become collectors at harvesting locations and buy in large quantities to farmers. After that, the distributor will bring the product to PPI Lempasing and sell it to retailers there. The retailers come from various places such as traders in traditional markets, peddlers, or restaurant entrepreneurs. These retailers will later sell these green mussels into final consumers. Sometimes there are distributors who directly bring the product to the GudangLelang market and sell green mussels there at a price at the consumer level, so that the profit is greater. However, distributors generally bring green mussels to PPI Lempasing because the distance is closer, only about 3 km (8 minutes). The Pangkalan Pendaratan Ikan (PPI) is better known to the people as a place to buy marine fishery products that just got off the ship because it is a coastal fishing port. So from Figure 2 it can be seen that there are 3 (three) types of flow in the supply chain, they are product flow, financial flow and information flow.

3.2 Product Flow of Green Mussel Supply Chain in Umbul Asem Village

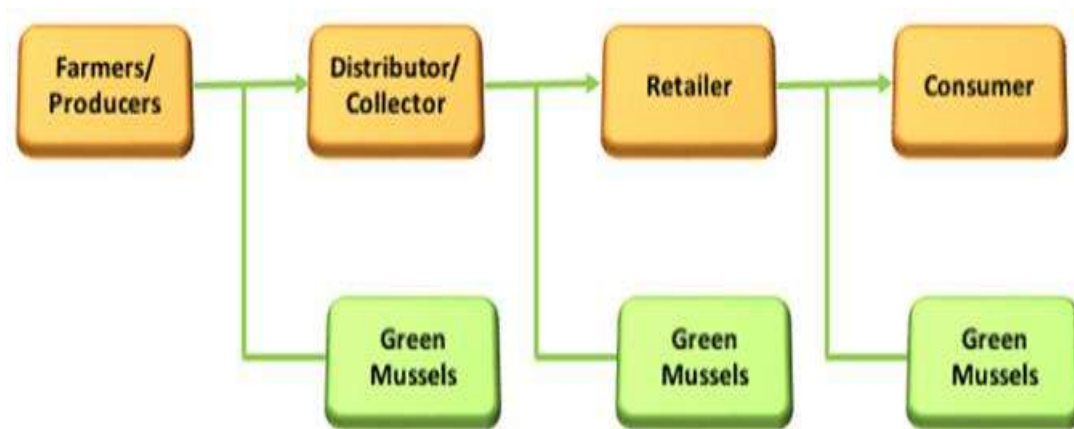


Figure 3. Product Flow of Green Mussel Supply Chain in Umbul Asem Village
Source: Own research data

From Figure 3, we can see that the product flow in the green mussel supply chain in Umbul Asem village is a flow that flows from upstream to downstream. While Farmers harvest green mussels and wait for collectors to pick them up. Usually the yield can reach 10 tons of raw green mussels. As for 1 kg of green mussels can contain approximately 50 pieces with the size of an adult's thumb. Generally, these green mussels are sold still with the shells, but they have been removed of hardobjects attached (in Figure 4). The job of removing dirty shells is usually done by women in addition livelihood to help the family's economy and they are paid Rp.1000/kg.



Figure 4. Removing Dirty Shells of Hard Objects attached on Green Mussels
 Source: Own research data

3.3 Financial Flow of Green Mussel Supply Chain in Umbul Asem Village

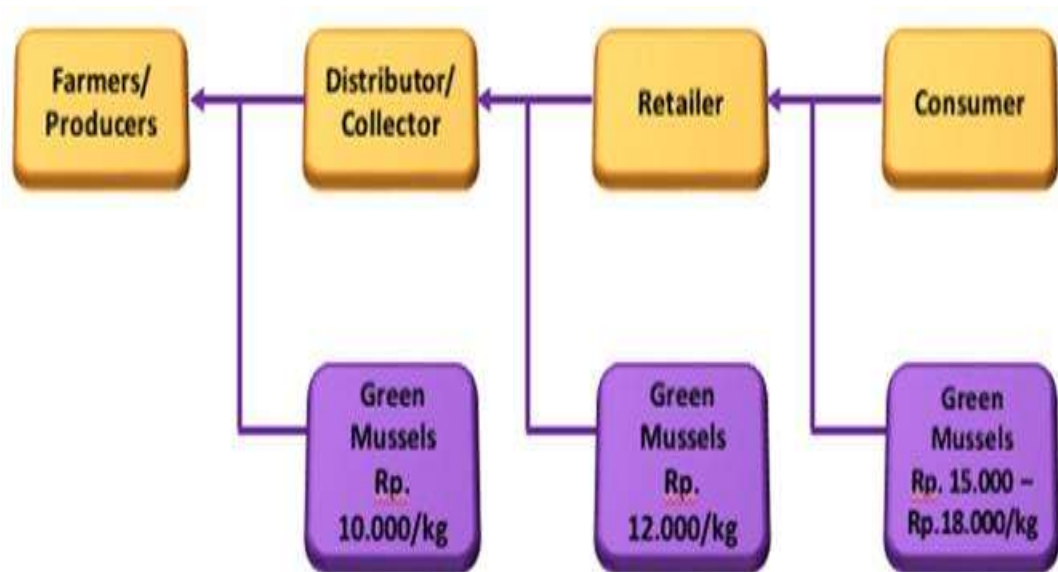


Figure 5. Financial Flow of Green Mussel Supply Chain in Umbul Asem Village
 Source: Own research data

In Figure 5 can be seen that the financial flow in the Green mussel supply chain in Umbul Asem village that flows from downstream to upstream. The final consumer buys green mussels at a price of Rp. 15,000 – Rp. 18,000 per Kg from retailers, then retailers buy from distributors at a price of Rp.12,000/Kg, while distributors buy from farmers for Rp.10,000/Kg. The entire financial flow in the supply chain uses cash transactions.

3.4 Information Flow of Green Mussel Supply Chain in Umbul Asem Village



Figure 6. Information Flow of Green Mussel Supply Chain in Umbul Asem Village
Source: Own research data

We can see on Figure 6, the flow of information in the green mussel supply chain in the village of Umbul Asem flows from two directions, from upstream to downstream and vice versa from downstream to upstream. The information that flows between supply chain players is information about the price of green mussels, the quality of the product produced or sold, the inventory of the product or the quantity available. Meanwhile, supply chain actors from downstream will respond in price negotiations, purchase quantities, complaints or appreciations about product quality.

3.5 Visible Potential in Supporting Green Mussel Farming in Umbul Asem Village

3.5.1 Applied Farming Method

From surveys, observations and interviews in Umbul Asem village, we can notice that the farming of green mussels was pioneered by Kamsi, who focuses on green mussels farming because of his age he no longer to be a fisherman. Based on his experience in this field, it is known that the most suitable method for him to apply is the Longline method. In addition to the investment for this method, it is relatively cheap, only Rp. 200,000 for one longline for 50 m.

This longline can be made using second hand goods he obtained from Labuan Maringgai, East Lampung. The components of the longline maker consist of used waring which is a series of woven such as nets that are widely used for fences for palm plantations, fish ponds and livestock. Beside used waring or net, Kamsi also utilized used ship ropes, and buoys containing waste such as styrofoam, plastic bottles, etc. This buoy is tied to a rope every 3 m from the longline. An example of the Longline created by Kamsi can be seen in Figure 7.



Figure 7. The Longline Made from Waste
Source: Own research data

The advantage of using the Longline method from waste materials is that the price is very cheap compared to the raft or cage method which is widely used both in the Pasaran island and elsewhere, and this longline method is very suitable for farming locations with high waves [15]. However, the raft method had been done by fishermen in Skip village, Bumi Waras district which is assisted. Unfortunately the high waves that occurred in October 2021 have destroyed their raft on the beach. If fishermen in Skip village used the Longline method as a medium for green mussels farming, it can be ascertained that this farming is still in its proper place. According to Kamsi and several fishermen in Umbul Asem village, when the Sunda Strait tsunami wave in 2018 occurred, this longline proved to be able to survive undamaged and lost in the water even though it was twisted one to another longlines and difficult to separate.

3.5.2 Availability of Lots of Green Mussel Seeds from Nature

In the waters of Umbul Asem village there are many green mussel seeds that naturally grow and float so that it is very supportive for green mussel farming. Green mussels are generally found in abundance in coastal waters [16] as well as in the village of Umbul Asem. Umbul Asem fishermen realized this potential when in 2018 they received the government assistance in farming seaweed. At that time many green mussels were attached to the rope used for seaweed cultivation. The existing potential has not been fully realized by all fishermen where in fact there are only about 10 fishermen who farmed it and they work individually, not in groups that should be better.

However only one person is really farming green mussels, namely Kamsi, while the others only use this as a side business. And another factor that strongly supports the farming of green mussels in Umbul Asem village is its location close to the PPI Lempassing which is only approximately 3 km with a travel time of 8 minutes, where retailers who want to buy green mussels are already waiting there even sometimes many distributors come directly to the location when harvesting green mussels is ready.

3.5.3 The Potential of Green Mussels as a Source of Food and People Income

More restaurants are serving green mussels as a culinary option which can generally be found in many places. They are known to have a delicious and distinctive taste, so many seafood fans like them. In addition to its delicious taste, people are starting to realize that green mussels are a food source that has a high protein content, compared to other animal protein sources such as beef, lamb, chicken, sardinela fish and trout [17]:

Table 1. Composition of Nutritional Content of Some Food Source Animals

No	Item	Protein	Fat (gr)	Water (gr)	Ca (gr)	P (gr)	Fe (gr)	Vitamin (A)
1	Green Mussels	47.6	7.0	19.9	0.45	0.73	-	-
2	Beef	18.8	14.5	66.0	11	170	2.8	30
3	Lamb	17.1	14.8	66.3	10	191	2.6	-
4	Chicken	18.2	25.0	55.9	14	200	1.5	810
5	Sardinela fish	16.0	15.0	56.0	20	200	2.0	100
6	Trout	38.0	14.0	30.0	40	100	0.7	-

Source : (Suwignyo et al, 1984)

The high demand for green mussels is a great opportunity for fishermen to farm and develop it as a promising form of business.

From the results of an interview with Kamsi, the owner of the largest green mussel farming in Umbul Asem village, it is known the investment capital spent to make one longline measuring 50 m is not much, with this cost (Rp. 200,000) will obtain 100 Kg of green mussels. The price of green mussels sold by farmers to distributors is Rp. 10,000/kg. Then it can be illustrated the benefits that farmers can gain for 1 (one) longline as follows:

Investment Cost:

Longline (50 m)	: Rp. 200,000
Useful life	: 2 years
Depreciation per year	: Rp.100,000
Depreciation per month	: 8.333

Capital Cost:

Harvest labor	: $2 \times \text{Rp. } 100,000 = \text{Rp. } 200,000$
Finishing Labor	: $1 \times \text{Rp. } 100,000 = \text{Rp. } 100,000$
Total Cost of Capital	: Rp. 300,000

The selling price of 1 kg of green mussels = Rp. 10,000
So for 100 kg = Rp. 1,000,000
Total Cost = Rp. 308,333
PROFIT: Rp. 1,000,000 – Rp. 308, 333 = Rp. 691,667
The Payback Period occurs within 3.5 months.

This calculation is a simple way only to illustrate the value of profit that can be obtained from just 1 (one) longline, if farmer spread over 30 longlines, the total profit obtained is approximately Rp. 20,750,010. The harvesting process requires 2 (two) harvest labors and 1 (one) finishing labor who cleans the hard shells before green mussels are sold. The harvesting process does not require a motorized boat so there are no fuel costs. And the distance of harvesting with the shoreline is approximately 1.5 km with a depth of 4-5 m so that it is enough to ride a small boat or canoe to the location. Normally, the job of cleaning the shells is generally done by women in the village of Umbul Asem, so this business actually opens up opportunities for many people to get involved and earn additional income. In conclusion, this business can run and be sustainable, considering that this has been running since 2018 and the scale of the business can be increased or enlarged by increasing the number of longlines that are deployed to the sea.

4. Conclusion

The green mussel supply chain in Umbul Asem village, Keteguhan district, Bandar Lampung starts from farmers to distributors then to retailers and end consumers, while supply chain players manage relationships between supply chain from upstream to downstream and downstream to upstream well.

A lot of potential was found as a green mussel business opportunity in the Umbul Asem village, in terms of the Longline method chosen which is resistant to high waves, the use of waste in making longlines with the aim of minimizing costs and increasing profits, there are many green mussel seeds that naturally grow and float in Umbul Asem coastal area, this farming is simple and does not require special treatment, the farming location is close to PPI Lempasing (3 km in 8 minutes) as a gathering place for retailers, this business actually opens up opportunities for many people to get involved and earn additional income beside farmers.

From the findings in the field, it is known that there are still many fishermen who are not interested in farming green mussels, this requires further research to get a clearer picture. In addition, in an effort to develop the green mussel business, it is necessary to conduct a study that is in line with the government's efforts in formulating a strategy for developing the fishery industry, particularly related to the fishery processing industry to anticipate increased production, support the improvement of product quality and added value, and support regional economic development [18]. Furthermore, it is also necessary to examine whether efforts to provide digital marketing training to develop a wider business will be needed or not related to existing resources.

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