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Supply chain analysis of fish farming enterprises in Saguling reservoir West Bandung regency

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Abstract
Floating net cage is one of the cultivation activities used by farmers in the District of Cililin, West Bandung Regency. This study discusses to analyze the process flow, information flow, business financial flow, fish farming business and marketing channel analysis of aquaculture results in the cage Saguling Reservoir, Cililin District, West Bandung Regency. This research was conducted in July 2019 until August 2019. This research was conducted using the case study method and the sampling method that is snowball sampling. The analytical tool used is a quantitative description through the Asian Productivity Organization (APO), marketing channels and supply chain risk. The results showed that the process of product flow, information flow, financial flow of fish farming in floating cages in the Saguling Reservoir involved farmer, wholesalers, retailers, and consumers were finally able to use well the distribution of farmers who had been supported with the help of fish farmers contractual agreement the chain management is still running informally, making it difficult to predict the number of fish that must be sold to wholesalers. The business process chain is constrained by shortages of supply of product flow occurring in fish. The risk of supply chain of fish farmers has a value of 1.0 means it has a high risk. The marketing channel of fish cultivation in the cage Saguling Reservoir shows a chain structure with the commitment of the farmer → retailer → consumer is more efficient with a marketing margin of Rp3, 000 / Kg for carp and Rp 4, 000 / Kg for tilapia, farmers share 86% for carp and 84% for tilapia and the value to cost ratio of 3.55 for carp and 4.19 for tilapia.

Keywords: carp, tilapia, fish farming, marketing efficiency, risk bussines, supply chain

1. Introduction
West Java is the fourth largest province after South Sulawesi, East Nusa Tenggara and East Java with a production is 7.2% of total aquaculture in Indonesia. The amount of fishery production in West Java is 17.86% comes from floating net activities [1]. One of the biggest areas of fish farming using floating nets in West Java is West Bandung Regency. West Bandung Regency ranks third in the West Java Province after Purwakarta and Cianjur Regencies with the production of floating net fishing activities are 21.8% of total production. Fish farming using floating nets in West Java Province. With that, West Bandung Regency as an area that has a significant contribution to the production and supply of fish commodities, especially freshwater fish for the people in West Java and the surrounding areas [1]. Production of fish in cage West Bandung Regency approximately 42,656.47 tons per year and increases every year. The number of cage in West Bandung Regency are 33,464 plots with the size of each plot measuring 7 x 7 x 3 m^3 [2]. Saguling Reservoir as one of the many areas producing fishery products. Fish production in the Saguling Reservoir ammount 11,981 tons annually. The number of cage in Saguling Reservoir are 7,261 plots. There are five districts inundated by the Saguling Reservoir, namely Cililin District, Cihampelas District, Cipongkor District, Batujajar District and Saguling District. The number of cage in Cililin District are 3,420 plots. 10.2% cage in West Bandung Regency and 50.8% cage in Saguling Reservoir are in Cililin District. With the number of cage farmers in Cililin District are 359 RTP [2].

The supply chain is the downstreaming of fish farming through the stages of the supply of production inputs and the downstreaming of fish farming through the institution of fish cultivation through the stages of output production and distribution [16].

2. Methods
2.1 Research Method
The research method used in this research is the case study method. Data and information were collected from respondents through guidance.

2.2 Data Sources and Types
The data collected consists of primary data and secondary data. The primary data was carried out by direct interviews with the resource persons, namely floating net cage farmers in Cililin District, West Bandung regency. The secondary data is done by collecting data from various instances such as the Statistics Data of the Central Statistics Agency of West Bandung Regency, the Department of Fisheries and Animal Husbandry of West Bandung Regency and the Department of Fisheries and Maritime Affairs of West Java and related agencies.

2.3 Sampling Method
The sampling technique in this research was conducted by the snowball sampling method. Snowball sampling is a sampling technique with the help of key-informants, and from this key informant will develop according to the instructions.

In the sample of data in the study were taken as many as 30 respondents who came from fish farmers in cage Saguling Reservoir, wholesalers, retailers, and consumers

2.4 Analysis Method

The data analysis methods used in this research is descriptive quantitative analysis. Data analysis consists of product flow analysis, information flow and financial flow, supply chain risk analysis and marketing efficiency analysis.

1. Analysis of Product Flow, Information Flow and Financial Flow

The framework for the study of the development of supply chains for floating net cultivation in the District of Cililin in West Bandung Regency uses the development of the Asian Productivity Organization (APO) which has been modified by Van Der Vorst (2006), which includes five aspects of the study, namely (i) supply chain structure, (ii) sources power, (iii) chain management, (iv) chain business processes, (v) supply chain performance [3].

2. Supply Chain Risk Analysis

The value of this risk is referred to as the risk consequences (α) which can be calculated using the following formula [4]:

$$\alpha = \frac{\delta \text{ replace (day)}}{\delta \text{ collapse (day)}} \quad (1)$$

Information:
α: The consequences of the risk of a product in the supply chain
δ replace: The time needed for a supply chain to replace a sub-product or the time needed to handle disruption of a product flow, and return to normal scheduling conditions with the same quality level δ collapse: The time of the sub-product fails to be completed before the supply chain loses at a critical point in its market service

3. Analysis Marketing Efficiency

In marketing activities, the results needed by chain members from fish supply chain activities are to obtain maximum benefit. Therefore, marketing efficiency must be measured. by measuring marketing margins, farmer share and benefit cost ratio

a. Farmer Share

Farmer Share is to compare prices at the level of farmers with prices at the consumer level[7] using the formula Farmer Share's:

$$FS = \frac{Pf}{Pr} x\ 100\% \quad (2)$$

Information
FS: Farmer share's or part of the price received by farmers (%)
Pf: The purchase price at the level of the farmer (IDR/kg)
Pr: Retail prices at the consumer level (IDR/kg)

Criteria
A marketing is said to be efficient if the farmer's share is greater than the marketing margin [7]

b. Marketing Margin

To calculate the margins of each marketing agency a formula is used [5]

$$MP = Pr - Pf \quad (3)$$

Information
MP: Marketing Margin (IDR/kg)
Pr: Consumer Prices (IDR/ kg)
Pf: Producer price (IDR/kg)

Criteria
A distribution system is said to be efficient if the level of marketing margins is less than 50% of the price level paid by consumers [5]

c. Benefit Cost Ratio

Benefit cost ratio is the amount of benefit received from marketing costs incurred. Thus the more even distribution of benefit and cost ratios, the marketing system operational will be more efficient [6]

$$BCR = \frac{B}{C} \quad (4)$$

Information
B: Benefits of marketing institutions
(IDR)
C: Marketing cost (IDR)

Criteria
If the ratio of benefit to costs ≥ 1, the business can be said to be efficient, and if the ratio of benefit to costs <1, the business can be said to be inefficient [8]

3. Results and Discussion

3.1 Geographical Location and Regional Condition of District Cililin West Bandung Regency

Geographically, West Bandung Regency is a division of Bandung Regency which was born with the encouragement and aspirations of the people of West Bandung who want West Bandung Regency to be independent. The total area of West Bandung Regency is 1,305.77 km^2.
West Bandung Regency has two large reservoirs in West Java that have potential as a place for fish farming in the cage, namely Cirata Reservoir and Saguling Reservoir. Commodities of fish in the form of tilapia, catfish, carp, catfish and carp. Cililin District is one of 15 districts in West Bandung Regency. In Cililin District there is fish cultivation in cage which has the potential to continue to be developed precisely in the Saguling Reservoir.

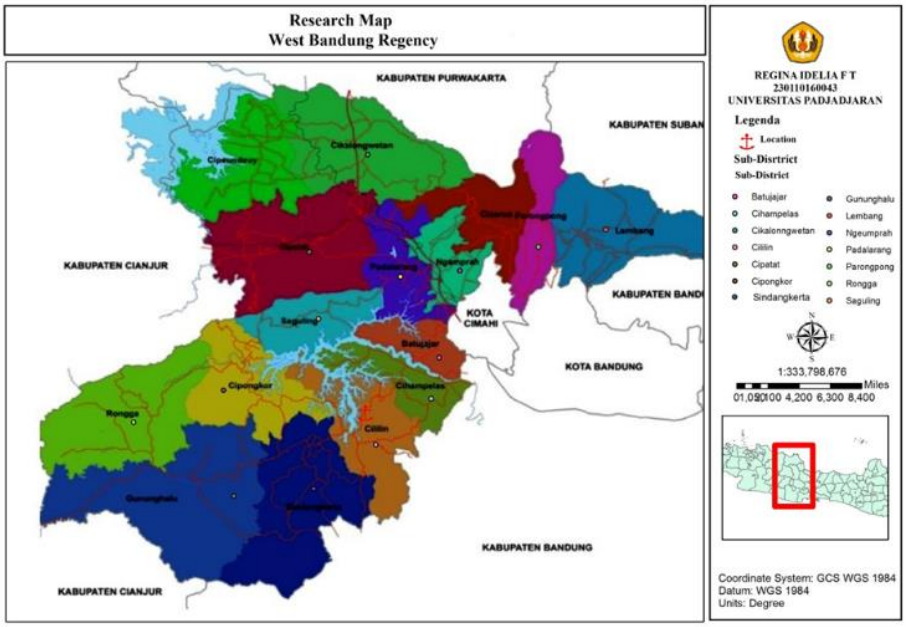

Fig 1: West Bandung Regency

3.2 Overview of Respondents

Characteristics of respondents is a description and condition of respondents involved in the fish supply chain in cage Saguling Reservoir, Cililin District, West Bandung Regency

a. Age Level of Respondent

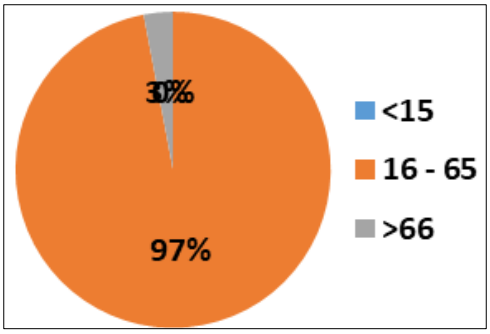

Fig 2: Age level of respondent

Characteristics of respondents based on age levels in the range of 16 - 65 years as much as 97% and only 3% who are aged more than 65 years. This shows that the majority of respondents are of productive age. Productive age is in the vulnerable 15 to 65 years and the nonproductive age is under 15 years and above 65 years.[9]

b. Education Level of Respondent

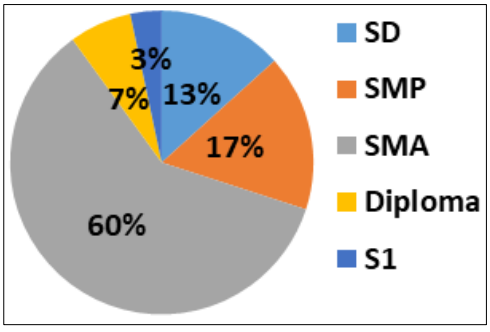

Fig 3: Education Level of Respondent

The education level of respondents generally ranged from elementary to high school. Elementary school education is 13% with and all are farmers. Junior high school education is 17%. High school education level is 60%. The level of diploma education is 7%.

This illustration shows that business actors and end consumers involved in the fish supply chain in cage Saguling Reservoir with higher levels of education have better levels of knowledge in running a business and good nutritional knowledge. The higher the level of education the more benefit will increase. Education has contributed to increasing benefits as one of the benchmarks of business success [10].

c. Work Experience of Respondent

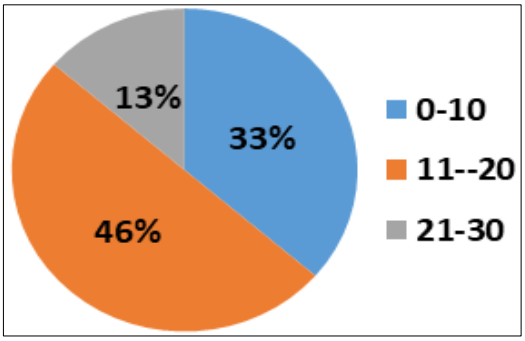

Fig 4: Work Experience of Respondent

Business experience of respondents in general has business experience ranging from 0-10 years at 33%, 11-20 years at 46% and only a few respondents with 21-30 years business experience at 13%. The longest business experience carried out by farmers is 11-20 years at 21%.

This illustration shows that business actors involved in the fish supply chain in cage Saguling Reservoir, Cililin District have a long time business experience so that they have the potential to develop their businesses based on knowledge and experience. The longer the work period of a workforce, the skills and ability to do work should increase [11].

3.3 Product Flow Analysis, Information Flow and Financial Flow

a. Chain Structure

The flow of the fish supply chain in cage Saguling Reservoir is greatly influenced by those involved in the supply chain, the rules of the game that apply in the supply chain, and marketing objectives. The most dominant factor influencing the supply chain of carp and tilapia is the quality and marketing objectives.

In general, the flow of fish commodities in saguling reservoirs involves farmers as the main producers and most important members. There are key members and supporting members in the supply chain [12]. Primary member in the supply chain is a farmers, wholesalers, retailers, and end consumers. While the secondary members is a feed provider, seed provider and production facility provider.

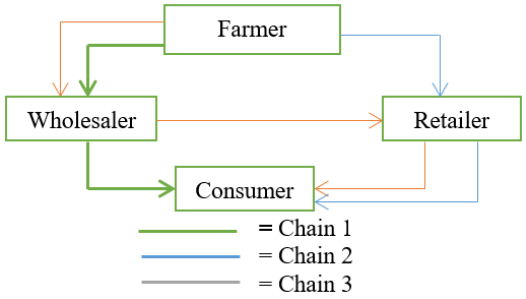

Fig 5: Marketing Chain

b. Supply Chain Goals

The chain target is considered by looking at buying behavior, distribution type and supply chain structure[13].The target chain is aimed at the domestic market with the target market being intermediary traders, namely wholesalers and retail around West Bandung Regency, Bandung City, Bandung Regency and surrounding areas

c. Supply Chain Management

Farmer are members of the supply chain who have a large share. The partnership formed is the general operational and trade partnership. The criteria determined by Farmer as their sales partners is a better selling price. While the selection criteria for partners at the merchant level are still based on the principles of trust and dependence due to the certainty of subscription ties. Contractual agreements are carried out informally and the transaction system used is cash. There is no support from the government in running a business.

d. Chain Resources

Chain resources generally include physical resources, technological resources, human resources, and capital resources. Chain resources consist of physical resources which include production resources such as ships and cage. Human resources in fish culture are only 1 to 2 farmers in each cage ownership, 1 distributor, and 1 worker in wholesaler and retailer. Technology resources include communication aids in the form of cellular telephones and scales both digital and analog. Business capital comes from private capital.

e. Chain Business Process

Business processes between members of the fish supply chain illustrate how business mechanisms occur within it. It is important to know about the interrelationships that occur, and their influence on the continuity of business processes. The business relationship that occurs in the fish supply chain is a business process [14].

There are differences in the procurement cycle in the first and second chains, but for the first and third chains have the same procurement cycle.

3.4 Supply Chain Risk Analysis

The supply chain flow of carp and tilapia from seed providers and feed providers as input, fish that are cultivated by farmers are kept in floating net cages, after the fish are ready for consumption, the fish are marketed from the farmer to the final consumer. The price of fish offered ranges IDR 20.000 – IDR 28.000.

Table 1

No	Supply Chain Risk Types	Value	
1	Seed Availability	$\frac{7}{7}$	1,0
2	Feed Availability	$\frac{7}{7}$	1,0
3	Late Payment	$\frac{120}{241}$	0,6

Information[4] :
0,1: easy replaced
0,3: easy replaced
0,6: not easy replaced
1,0: not replaced
So, the value of the consequence of the risk is not replaced and not easily replaced.

3.5 Marketing Efficiency Analysis

a. Marketing Margin

Marketing margins are calculated to determine the price difference at the level of farmers with prices at the level of wholesalers, retailers or consumers [15].

In general, farmers sell 250 grams of carp at a price of IDR 21,000 / kg and 300 grams of tilapia at a price of IDR 20,000. In carp marketing, the first chain has a marketing margin of IDR 7,000. In the second chain IDR 3,500. In the third chain IDR 3,500. In marketing tilapia, the first chain has a marketing margin of IDR 4,000. In the second chain IDR 4,000 In the third chain IDR 4,000. All three chains are efficient because they are less than 50% of the price level paid by consumers [5].

b. Farmer Share

Farmer share is inversely related to sales margins, meaning that the higher the marketing margin, the lower the farmer share will be [7].

In carp marketing, the first chain has a 75% farmer share value. In the second chain 86%. In the third chain 86%. In marketing tilapia, the first chain has a 71% farmer share value. In the second chain 83%. In the third chain 84%.

The three marketing chains are efficient because the farmer share value is more than 50% [7]. Based on primary data analysis, the marketing channel which has the highest farmer share is channel 3, which is 86% for carp and 84% for tilapia.

c. Benefit Cost Ratio

Benefit cost ratio is the amount of benefit received from marketing costs incurred [6].

In carp marketing, the first chain has a benefit value of 3.25. In the second chain 3.17. In chain three 3.55. In tilapia marketing, the first chain has a benefit value of 3.79. In the second chain 3.76. In chain three 4.19. All three chains are efficient because they have a value of more than 1[8].

The value of total benefit cost ratio, marketing channel 3 is the highest value compared to marketing channel 1 and marketing channel 2 for one time fish distribution.

4. Conclusion

The conclusions that can be obtained from the results of the research are as follows:

1. The process of product flow, information flow, financial flow of fish farming in floating cages in the Saguling Reservoir involving farmers, porters, wholesalers, retailer, and end consumers is quite good in relation to channeling from farmers that have not been supported by the knowledge of farmers related to fish quality. Contractual agreements in chain management are still running informally, making it difficult to predict the quantity of fish that must be sold to wholesalers. The business process chain is constrained by a lack of supply of product flow in the event of a disease in fish.
2. Risks that must be faced by farmers are feed availability (1.0), seed availability (1.0) and late payment (0.6). The value of the consequences of the risk is irreplaceable and not easily replaced.
3. The marketing channel of fish culture results in the cage shows that the third chain structure is more efficient with business actors namely farmers → retailers → consumers with a marketing margin of IDR 3,500 for carp and IDR 4,000 for tilapia, farmer share of 86% for carp and 84% for tilapia and the value of the benefit-to-cost ratio of 3.55 for carp and 4.19 for tilapia

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