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Logistics Cost Analysis of Catfish in Special Region of Yogyakarta, Indonesia: Internal and External of Logistics Component Costing Systems

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ABSTRACT

Catfish are the most popular cultivated fish in special region of yogyakarta in special region of yogyakarta especially Sleman, Kulon Progo, and Bantul District. These products are categorized as high perishable product so need a special handling to keep the quality from fish farmers to the customers. The aims of this study are to identify and calculate the logistics cost component that needed to keep the quality along the supply chain of catfish. There are three types of data collection methods used, namely observation, in- depth interview, and literature review. The analysis includes descriptive analysis, logistics cost components using ABC, and cost charging systems. Furthermore, it can be known the proportion of each logistics cost component of catfish. This study shows that there are six component of catfish logistics cost, i.e. procurement, material handling, transportation, maintenance, inventory, and customer communication. It also shows that the highest logistics cost component averaged proportion is, 76.421%, material handling.

Keywords: Catfish, Costing System, Logistics Cost, Supply Chain

INTRODUCTION

Indonesia, as a maritime country, has potential fisheries resources, both marine and inland fisheries. The Special Region of Yogyakarta is one of the province-level regions in Indonesia with fishery potential, especially aquaculture, which is inland fisheries. If managed properly, it will improve the welfare of its people (Sylvia and Ismoyowati, 2020). Referring to data from the Central Statistics Agency (2016) sourced from the Maritime Affairs and Fisheries Service, land fisheries contributed 92% of the total fisheries production of D.I. Yogyakarta. It means that inland fisheries play an important role in fulfilling the demand for fishery products. Inland fisheries are the business activity of fishing or cultured fish in inland waters. Furthermore, more than ten types of fish are produced by D.I. Yogyakarta, for example, catfish, tilapia, gourami, and others. Based on the data from the Department of Marine and Fisheries, catfish are the most widely cultured fish in the Special Region of Yogyakarta. Catfish production contributed 45.44% of the total aquaculture production and 35.58% of the value in the Special Region of Yogyakarta in 2015 (DKP, 2016). It shows that catfish is one of the superior fishery commodities in the Special Region of Yogyakarta. Therefore, there is encouragement for fish farmers to continue to increase fisheries production to meet increasing public demand.

According to Widodo and Sylvia (2018), fish must have a high level of quality to meet increasing market demand, but its characteristic is perishable. Failure in activities will impact quality degradation and even cause the value of the fish distributed to consumers to decrease. Therefore, the handling or special treatment that is appropriate in the production process until its distribution is needed. It will undoubtedly lead to logistics costs, which will then be charged to consumers at the end of the supply chain since it affects the selling price of fishery products. These costs are needed so that the actors in each tier can still maintain the quality of the fishery products to the consumers. That's

why the logistics cost plays an essential role in the pricing of products (Kar et al., 2020)

Many things contribute to the issue of costly logistics costs, such as an unbalanced distribution of stock products due to a lack of a logistics commodity, unsupported infrastructures, a weak human resource base, insufficient and unsubstantiated laws, and unsupported infrastructures are the top four problems. Additionally, a prolonged stay is caused by underfunded infrastructure and human resources. However, technological advancements exist to simplify all the issues and complex rules (Schreiben, 2018; Barata, 2020).

There are six components of logistics costs, namely procurement, material handling, transportation, maintenance, inventory, and customer communication (Ongkunaruk and Piyakarn, 2011; Stock and Lambert, 2001). Most logistics actors charge all components of the logistics costs into their internal burdens. Conversely, some actors charge some of these cost components to external parties, the following actors in the supply chain, especially procurement and transportation costs. Logistics costs for each activity have a different structure. Furthermore, each actor along the catfish supply chain also has logistics costs that vary from one another. Therefore, measuring the logistics costs of catfish is very important because logistics activities occur at each tier along the catfish supply chain. The impact, the costs will affect the selling price.

Therefore, this study will focus on logistics costs along the catfish supply chain in the Special Region of Yogyakarta. The method for logistic cost analysis uses activity-based costing (ABC). The use of the ABC method in this study is based on the consideration that the calculation with the ABC is more accurate than the calculation of the cost of using traditional accounting. ABC gives more exact data than traditional accounting (Ongkunaruk and Piyakarn, 2011; Meng and Tian, 2013). In addition, logistics costs are also calculated based on the charging costs system of the supply chain actors. There are two kinds of charging costs: charge on the actor himself and set on the next actor. It depends on the agreement of them.

RESEARCH METHODS

Location and Time of Research

This research was carried out in the special region of Yogyakarta. The sampling technique used in this study was purposive and snowball sampling..

Types and Methods of Data Collection

The data collected in this study are primary and secondary. Primary data collected are general business descriptions, equipment used, logistics activities and logistic costs incurred along the catfish supply chain, including a tier of fish farmers, collectors, and catfish retailers. In addition, information is also collected regarding the distribution channels to consumers. The secondary data collected in this study covers fisheries production data in the Special Region of Yogyakarta to support the primary data obtained. Three types of data collection methods are used: observation, in-depth interview, and literature review.

Analysis Method

The analysis includes descriptive analysis, logistic cost components using ABC, and proposed strategies based on the logistics cost result. Analysing activities and cost components in each supply chain tier do logistics cost structure analysis. The logistics cost components to be analysed include procurement, material handling, transportation, storage, maintenance, and customer communication (Ongkunaruk and Piyakarn, 2011). Complete an analysis of the cost structure to determine the cost components that are most important in each logistics activity and determine which activities need to be controlled and optimised (Guritno and Tanuputri, 2017).

The calculation of logistics costs will use the activity-based costing (ABC) method. The steps taken in the cost analysis using the activity-based costing method include several stages. According to Mulyadi (2007) and Yuniawati (2016), there are several steps in calculating the total cost of products with the ABC method, namely: classification of activities, determination of cost pools, determination of the cost drivers for each activity, determination of homogeneous cost pools, and determination of group rates (pool rate). Then, calculations continue with traces and assign the cost of each cost group to the product. So, costs for each group of logistics costs are traced to different product types. This is done using the group rates consumed by each product. Table 1 shows logistics costs based on activities in the catfish supply chain.

Furthermore, logistics costs are also calculated based on the charging costs system of the supply chain actors. There are two kinds of charging costs: charge on the actor himself and set on the next actor. It depends on the agreement of them. For instance, the charging system is viewed from procurement

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and transportation activities. In this study, there are two systems in procurement activities. For the fish farmer tier, system 1 is where internal parties bear transportation costs for procurement of materials, and external parties bear delivery costs. Whereas system 2 charges transportation costs for materials procurement and delivery costs borne by internal parties, namely the farmers.

Table 1. Logistic Activities Classification

Logistic Activity	Activity	Hierarchy
Procurement	Transportation for seed procurement	Group
	Transportation for feed procurement	Group
	Transportation for additional feed procurement	Group
	Transportation for medicine and vitamin procurement	Group
	Transportation for salt procurement	Group
	Transportation for lime procurement	Group
	Transportation for fertiliser procurement	Group
	Communication to Supplier	Group
Material Handling	Feeding	Group
	Harvesting	Group
	Irrigation	Group
	Equipment Depreciation	Facility
	Losses in handling	Group
	Packaging Purchasing	Group
	Transportation for packaging purchasing	Group
Transportation	Delivery/shipping	Product
	Machine Depreciation	Facility
	Losses in delivery	Product
Maintenance	Equipment maintenance	Facility
	Transportation maintenance	Facility
Inventory	Inventory for fish	Facility
	Inventory for feed and medicine	Facility
	Electricity usage	Facility
Customer communication	Customer communication	Customer

RESULT AND DISCUSSION

Based on the survey results of several locations included in the scope of the research, it is known that there are four tiers in the catfish fisheries supply chain in the Special Region of Yogyakarta, namely fish farmers, collectors, retailers, and consumers (industrial consumers and household consumers). In addition, there are three flow types: product (catfish), financial/fund (money or credit), and information. The catfish supy chain in D.I Yogyakarta can be seen in Figure 1. In this study, product flow in the form of catfish flows from upstream to downstream, as shown in Figure 2. Financial flows in the form of money flow from downstream to upstream.

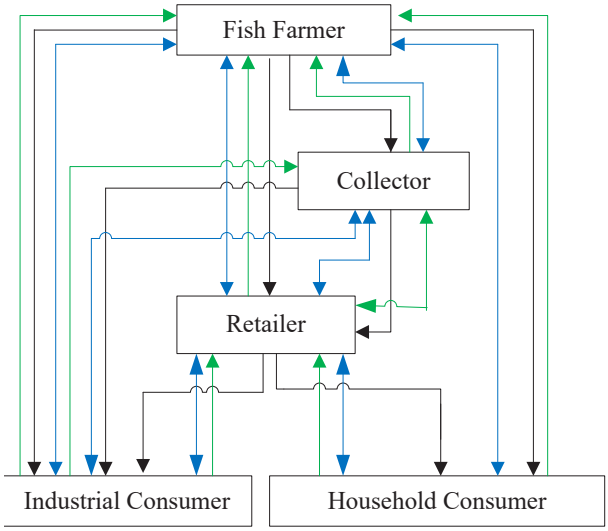

Figure 1. Catfish Supply Chain in D.I. Yogyakarta (Sleman, Kulon Progo and Bantul District) (Sylvia et al., 2018)

In the catfish supply chain in the Special Region of Yogyakarta, information flows in two directions, namely from downstream to upstream, such as the number and specification of orders, and upstream to downstream, such as the amount of supply and product quality. However, it found a deferred payment system with a note (credit) made by the retailer, so there was also a flow from upstream to downstream. Both upstream and downstream endeavours are enthusiastic to overcome the capital limitation. In the interest of an arrangement to the limitation, numerous researchers

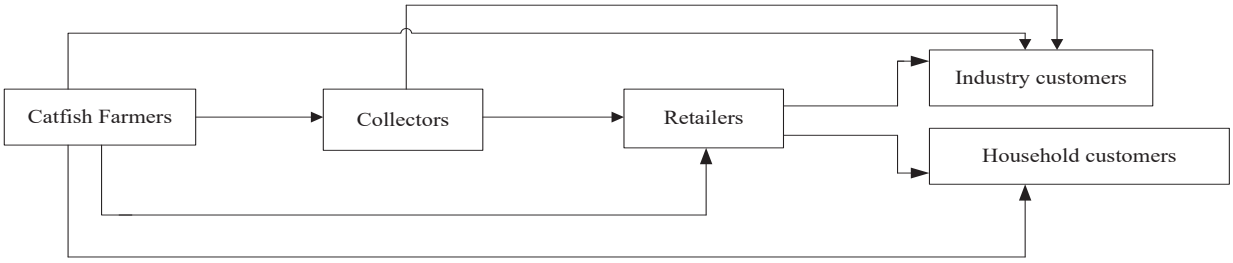

Figure 2. The Product Flow of the Catfish Supply Chain in Special Region of Yogyakarta (Sleman, Kulon Progo and Bantul District)

have endeavoured to resolve the capital limitation of the retailer through endogenous financing. A few of them attempted to assist retailers in getting bank credits for financing. Taking the supply chain as an entire, the foremost agent measure of endogenous financing is commercial credit; the provider gives such strategies as a deferred payment to downstream retailers (Liang and Futou, 2018).

The calculation of logistics costs using the ABC method consists of two stages. The first stage is done by classifying activities, determining cost groups, determining the cost drivers for each activity, determining the homogeneous cost groups (cost pool), and determining the group rate (pool rate). The second stage is done by tracing and charging each group the cost of the product. Based on the results of the calculation of logistics costs using the ABC method, it is known that the catfish fishery supply chain actors in the Special Region of Yogyakarta carry out the costs required for each logistics activity.

Tables 2 to 4 show the data recapitulation of the logistics costs of catfish fisheries in the Sleman, Kulon Progo, and Bantul districts in the Special Region of Yogyakarta. It's the average logistics costs incurred by each tier, including fish farmers, collectors, and retailers in catfish aquaculture supply chains. In the tier of fish farmers, it can be seen that in Sleman and Kulon Progo, there are two systems for charging logistics costs, while in Bantul, there is only one system. The charging system is viewed from procurement and transportation activities. System 1 is a system where internal parties bear the charging of transportation costs for

Table2. Logistics Cost Recapitulation in Fish Farmer tier of Catfish Supply Chain in the Special Region of Yogyakarta (Sleman, Kulon Progo and Bantul District)

		Logistic Activity	Procu-rement	Material Handling	Trans-portation	Main-tenance	Inven-tory	Customer Commu nication	Total
Fish Farmer									
S	1	Cost (IDR/Kg)	43.888	382.284	10.849	29.236	272.397	1.973	740.627
		Proportion	5.926%	51.616%	1.465%	3.947%	36.779%	0.266%	100%
	2	Cost (IDR/Kg)	17.280	86.,682	496.505	140.368	223.170	6.083	1746.089
		Proportion	0.990%	49.407%	28.435%	8.039%	12.781%	0.348%	100%
KP	1	Cost (IDR/Kg)	68.403	1659.687	86.239	75.277	196.438	2.498	2088.543
		Proportion	3.275%	79.466%	4.129%	3.604%	9.406%	0.120%	100%
	2	Cost (IDR/Kg)	77.261	2310.220	240.710	80.723	364.848	1.314	3075.076
		Proportion	2.512%	75.127%	7.828%	2.625%	11.865%	0.043%	100%
B	1	Cost (IDR/Kg)	6.000	1020.893	28.726	30.371	237.531	1.945	1325.467
		Proportion	0.453%	77.021%	2.167%	2.291%	17.921%	0.147%	100%
DIY	**1**	**Cost (IDR/Kg)**	**39.430**	**1021.140**	**41.938**	**44.961**	**235.455**	**2.139**	**1384.879**
		Proportion	**2.847%**	**73,735%**	**3.028%**	**3.247%**	**17.002%**	**0.154%**	**100%**
	2	**Cost (IDR/Kg)**	**33.514**	**1397.932**	**255.314**	**83.821**	**275.183**	**3.114**	**2048.877**
		Proportion	**1.636%**	**68.229%**	**12.461%**	**4.091%**	**13.431%**	**0.152%**	**100%**

Information:
S = Sleman; KP = Kulon Progo; B = Bantul; dan DIY = D.I. Yogyakarta 1 and 2 show the cost charging system.

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the procurement of materials, and external parties bear delivery costs. Whereas system 2 charges transportation costs for procurement of materials and delivery costs borne by internal parties, namely the farmers. The recapitulation results on the farmer tier indicate that system 1 shows a lower total cost than system 2. This is because farmers bear transport costs internally, which adds to the total logistics cost. As time and distance increase and cargo size increases, the compensation for the magnitude of road transport costs becomes more pronounced. If the cargo size does not change, the transportation cost will increase proportionately to the distance travelled (Minken and Johansen, 2019).

The total logistics costs for system 1 are IDR. 740.627 in Sleman, IDR. 2,088.543 in Kulon Progo, and IDR. 1,325.467 in Bantul. The main reason farmers in Kulon Progo pay higher prices is the high cost of materials handling. Material handling includes all activities related to the product's control, movement, and handling. Material handling is needed to ensure that the right product is available in the right place at the right time and at the lowest cost (Ibegbulem and Okorie, 2015; Chioma and Etifit, 2018; Kareem et al., 2022). In system 2, the total logistics costs incurred are IDR. 1,746.089 in Sleman and IDR. 3,075.076 in Kulon Progo.

If the cost of each system in each district is on average, it can be seen that the total cost of System 1 is IDR 1,384.879, and System 2 is IDR 48.877. In system 1, the delivery costs are borne by an external party, so the cost of transportation activities is 3.028% (IDR 41.938), while in system 2, transportation costs have a proportion of 12.461% (IDR 255,314). Logistics costs are 5.459% (IDR. 740.627), while material costs are 94.51% (IDR. 12,757.318) if viewed from the total cost of cultivation. On the other hand, logistics costs have a proportion of 4.770%, material costs of 82.168%, and profits of 13.062% (IDR. 2,027.981) if viewed from the selling price. In system 2, logistics costs have a portion of 10,249% (IDR. 1,414.585), while material costs have a large portion of 89,751% (IDR. 12,378.687) seen from the total cost of cultivation. If it is viewed from the selling price, it is known that the logistics costs have a proportion of 9.154%, material costs of 80.163%, and profits of 10.683% (IDR. 1,659.881).

Referring to Table 1, transportation costs for sending products from farmers to customers

Table 3. Logistics Cost Recapitulation in the collector tier of the Catfish Supply Chain in the Special Region of Yogyakarta (Sleman, Kulon Progo and Bantul District)

		Logistic Activity	Procu-Rement	Material Handling	Trans-portation	Main-tenance	Inven-tory	Customer Commu nication	Total
Collector									
S	1	Cost (IDR/ Kg)	32.716	784.406	226.906	11.293	5.661	2.500	1063.481
		Proportion	3.076%	73.758%	21.336%	1.062%	0.532%	0.235%	100%
	2	Cost (IDR/ Kg)	6.125	703.895	198.521	22.929	64.577	8.125	1004.173
		Proportion	0.610%	70.097%	19.770%	2.283%	6.431%	0.809%	100%
KP	1	Cost (IDR/ Kg)	44.081	784.190	348.403	16.265	10.970	9.813	1213.721
		Proportion	3.632%	64.610%	28.705%	1.340%	0.904%	0.808%	100%
B	1	Cost (IDR/ Kg)	31.453	539.633	364.125	10.769	2.836	6.678	955.494
		Proportion	3.292%	56.477%	38109%	1.127%	0.297%	0.699%	100%
DIY	**1**	**Cost (IDR/ Kg)**	**36.083**	**702.743**	**313.145**	**12.775**	**6.489**	**6.330**	**1077.565**
		Proportion	**3.333%**	**64.949%**	**29.383%**	**1.176%**	**0.578%**	**0.581%**	**100%**
	2	**Cost (IDR/ Kg)**	**6.125**	**703.895**	**198.521**	**22.929**	**64.577**	**8.125**	**1004.173**
		Proportion	**0.610%**	**70.097%**	**19.770%**	**2.283%**	**6.431%**	**0.809%**	**100%**

Information:
S = Sleman; KP = Kulon Progo; B = Bantul; dan DIY = D.I. Yogyakarta 1 and 2 show the cost charging system.

(collectors or retailers) can be minimised using cost charges such as system I. Farmers can reduce transportation costs by allowing customers to pick up the products directly at the farmer's location. The costs that can be minimised are delivery costs, including labour wages and fuel, as well as costs caused by product loss during shipping. The amount of savings that can be made is different for each supply chain actor (fish farmer), depending on the number of delivery points and the distance of the delivery location. For instance, if we refer to Table 2, we can save transportation costs of IDR 485,655/kg (Sleman), IDR 154,471/kg (Kulon Progo), and IDR 20,898/kg (Bantul). The average transportation cost that can be reduced is IDR 220.34/kg.

There are two cost-charging systems in the tier of collectors seen in Table 2. System 1 is a system whereby internal parties bear the cost of transporting material procurement and delivery costs. In system 2, the transportation costs for the procurement of materials are charged by external parties (suppliers), and internal parties, the collectors themselves, bear the delivery costs. The recapitulation results in the tier of collectors show that system 1 shows a higher total cost than system 2. The entire logistics cost for system 1 is IDR. 1,063.481 in Sleman, IDR. 1,213.721 in Kulon Progo, and IDR 955,494 in Bantul. Collectors in Sleman only have two systems; in Kulon Progo and Bantul, only system one is applied. In system 2, the total logistics costs incurred are IDR. 1,063.481 in Sleman.

If the cost of each system in each district is on average, it can be seen that the total cost of system 1 is IDR. 1,077.565, and system 2 is IDR. 1,004.173. In system 1, the transportation costs for material procurement are borne by internal parties. So, the procurement costs have a proportion of 3.333% (IDR. 36.083), while in system 2, the procurement costs have a proportion of 0.610% (IDR. 6.125).

Referring to Table 3, transportation costs for catfish procurement from fish farmers to collectors can be minimised using cost charges such as system II. Collectors can reduce transportation costs when farmers send catfish to collectors directly. The costs that can be minimised are delivery costs, including labour wages and fuel, as well as costs caused by product loss during shipping. However, system II for collectors means that farmers bear procurement transportation costs. Therefore, another solution is for collectors to look for catfish suppliers who are located nearby so that transportation costs for procurement can be minimised by shortening the distance to the supplier's location.

At the retailer tier, as seen in Table 4, there are two systems for cost charging in Sleman, Kulon Progo, and Bantul. System 1 is a system where external parties bear the charge of transportation costs for the procurement of materials, and internal parties bear the delivery costs. Meanwhile, in system 2, loading transportation costs for procurement of materials and delivery costs are handled by internal parties, namely the retailer. The recapitulation results at the retailer tier indicate that system 1 shows a lower total cost than system 2.

Logistics costs are 6.430% (IDR. 1,077.565), while material costs are a substantial portion of 93.570% (IDR. 15.680), as seen from the total production costs in system collection 1. However, if it is viewed from the selling price, the logistics costs have a proportion of 5.942%, material costs of 86.447%, and profit of 7.586% (IDR. 1,375.595). In system 2, logistics costs are 5.362% (IDR. 1,004.172), while material costs are a substantial portion of 94,674% (IDR. 17,849.999), as seen from production costs. If it is viewed from the selling price, it is known that the logistics costs have a proportion of 5.338%, material costs of 94.884%, and losses of 0.222% (IDR. 41.672).

The total logistics costs in the retailer tier in system 1 are IDR. 2,100.997 in Sleman, IDR. 2,306.045 in Kulon Progo, and IDR. 2,769.969 in Bantul. In system 2, the total logistics costs incurred were IDR. 2,674.411 in Sleman and IDR. 1,713.404 in Kulon Progo, and IDR. 4,208.191. Furthermore, If the cost of each retailer system in each district is on average, it can be seen that the total cost of system 1 is IDR. 2,392.337, and system 2 is IDR 2,865.335.

In system 1, logistics costs are 11.544% (Rp 2,392,337) against production costs, while material costs have a portion of 88,456 (Rp. 18,331,226). If it is viewed from the selling price, it is known that the logistics costs have a proportion of 11.054%, material costs of 84.703% and profits of 4.242% (IDR. 918.104). In the system 2 retailing business, logistics costs have 14,172% (IDR. 2,865.353) of production costs, while material costs have a portion of 85,828% (IDR. 17,352.666). If it is viewed from the selling price, it is known that the logistics costs have a proportion of 14.092%, the material cost is 85.828%, and the profit is 0.567% (IDR. 115.331).

Referring to Table 4, transportation costs for catfish procurement from collectors to retailers can be minimised using cost charges such as system I. Retailers can reduce transportation costs when collectors send catfish to retailers directly. The costs

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Table 4. Logistics Cost Recapitulation in Retailer Tier of Catfish Supply Chain in the Special Region of Yogyakarta (Sleman, Kulon Progo and Bantul District)

		Logistic Activity	Procu-Rement	Material Handling	Trans-portation	Main-tenance	Inven-tory	Customer Commu nication	Total
Retailer									
S	1	Cost (IDR/Kg)	6.022	1879.799	124.413	35.430	46.624	8.708	2100.997
		Proportion	0.287%	89.472%	5.922%	1.686%	2.219%	0.414%	100%
	2	Cost (IDR/Kg)	4.262	2432.654	124.786	1.598	111.111	0.000	2674.411
		Proportion	0.159%	90.960%	4.666%	0.060%	4.155%	0.000%	100%
KP	1	Cost (IDR/Kg)	2.750	1986.448	225.839	45.176	36.957	8.875	2306.045
		Proportion	0.119%	86.141%	9.793%	1.959%	1.603%	0.385%	100%
	2	Cost (IDR/Kg)	3.400	1585.340	29.194	35.470	60.000	0.000	1713.404
		Proportion	0.198%	92.526%	1.704%	2.070%	3.502%	0.000%	100%
B	1	Cost (IDR/Kg)	5.833	2579.115	53.182	21.626	63.546	46.667	2769.969
		Proportion	0.211%	93.110%	1.920%	0.781%	2.294%	1.685%	100%
	2	Cost (IDR/Kg)	10.101	3886.075	134.835	20.946	156.233	0.000	4208.191
		Proportion	0.240%	92.346%	3.204%	0.498%	3,.713%	0.000%	100%
DIY	**1**	**Cost (IDR/Kg)**	**4.868**	**2148.454**	**134.478**	**34.078**	**49.042**	**21.417**	**2392.337**
		Proportion	**0.205%**	**89.574%**	**5.878%**	**1.475%**	**2.039%**	**0.828%**	**100%**
	2	**Cost (IDR/Kg)**	**5.921**	**2634.690**	**96.272**	**19.338**	**109.115**	**0.000**	**2865.335**
		Proportion	**0.199%**	**91.944%**	**3.191%**	**0.876%**	**3.790%**	**0%**	**100%**

Information:
S = Sleman; KP = Kulon Progo; B = Bantul; dan DIY = D.I. Yogyakarta 1 and 2 show the cost charging system.

that can be minimised are delivery costs, including labour wages and fuel, as well as costs caused by product loss during shipping. However, the system I for retailers means collectors bear procurement transportation costs. Therefore, another solution is for retailers to look for catfish suppliers who are located nearby so that transportation costs for procurement can be minimised by shortening the distance to the supplier's location.

Figure 3 shows the cost difference in each catfish fishery's supply chain tier. It can be seen that the highest cost of procurement activities is issued in the farmer's tier, which is IDR. 36,472. This is because the farmer tier is the highest tier for carrying out procurement activities, including the transportation to procure the materials, including seeds, feed, medicine, vitamins and others. The highest material handling costs are in the retailer's

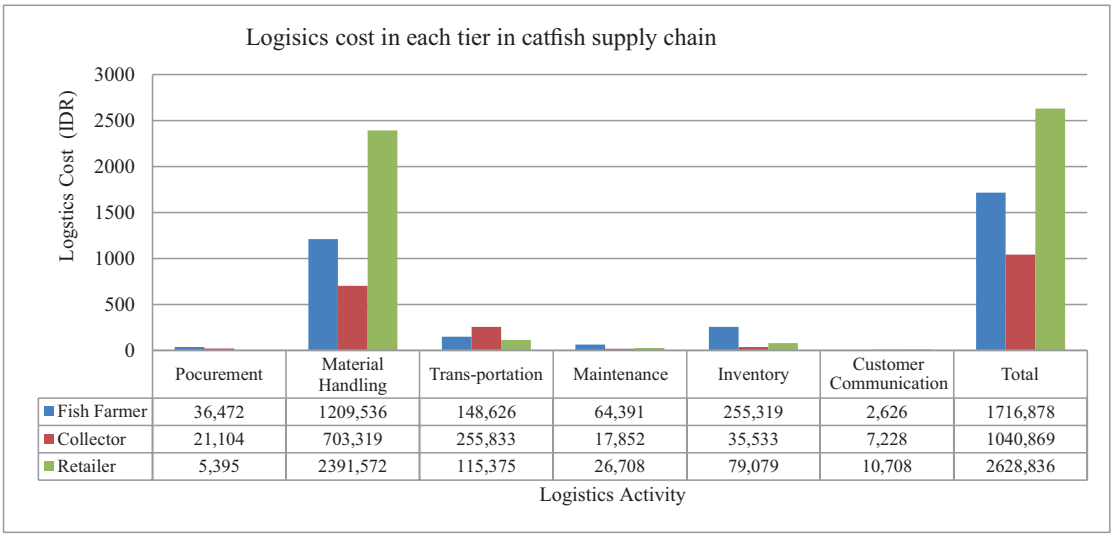

Figure 3. Logistics cost in each tier in catfish supply chain (IDR/Kg)

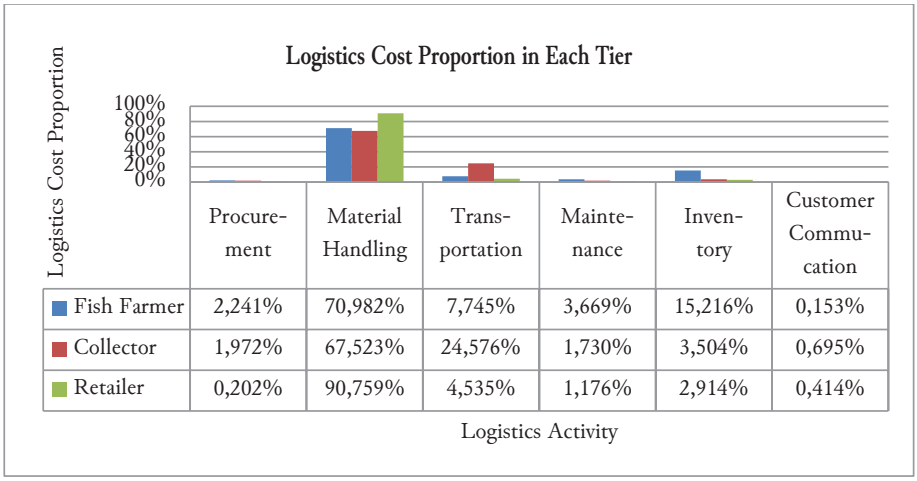

Figure 4. Logistics Cost Proportion in Each Tier (IDR/Kg)

tier, which is IDR. 2,391.570. This is because of the costs charged to the material handling activities, even though the quantity of fish is not as much as in the tier of farmers and collectors. The next cost is the highest transportation cost incurred in the collection tier, IDR. 255,833. This is because collectors have more customers, causing a higher intensity of product delivery to customers.

The next cost is the highest maintenance cost found in the fish farmers tier, IDR. 64.391, while the highest inventory cost is in the farmer's tier, IDR. 255.319. Tier farmers spend the most inventory costs because the land is used more widely, causing higher rental prices. The last logistic cost is customer communication. This cost is highest in the retailer tier, which is IDR. 10.708. If it is viewed from the total logistic costs incurred, it can be seen that the retailer tier is the tier that issues the highest logistic cost of IDR. 2,628.836. Furthermore, the fish farmer tier is IDR. 1,716.878, and the smallest total logistic cost is issued by the collector tier, which is IDR. 1,040.869. The proportion of logistic costs in each tier can be seen in Figure 4.

If every cost is averaged, it will know the average logistics cost of supply chain actors in the catfish fisheries supply chain system in the Special Region of Yogyakarta. The average cost per kg of catfish is IDR. 20.990 for procurement, IDR. 1,434.809 for material handling, IDR. 173.278 for transportation, IDR. 36.317 for maintenance, IDR. 123.310 for inventory and IDR. 6.854 for customer communication. The proportion of each of these costs can be seen in Figure 5.

The recommended strategy for improving logistics activities to minimise logistics costs is optimising the use of resources, especially human resources, for materials handling in the fish farmer tier and, in addition, making orders to suppliers according to customer orders (pull-based strategy) and optimising the use of resources both human resources and transportation equipment for collectors. Then, apply a few responsive and flexible suppliers and optimise the use of human resources in material handling activities for retailers (Sylvia et al., 2018). Furthermore, they can apply CPFR (Collaborative Planning Forecasting and

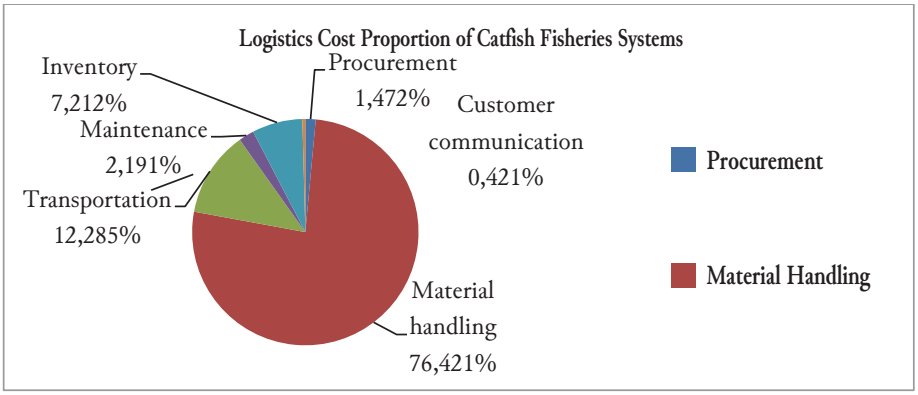

Figure 5. Logistics Cost Proportion of Catfish Fisheries System in Special Region of Yogyakarta (Sleman, Kulon Progo and Bantul District)

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Replenishment) model. CPFR is a model which combines supply chains so that there is cooperation along the supply chain between sellers and buyers in forecasting activities production and delivery planning. Seller and buyer activities in the CPFR model makes it possible to collaborate by correcting adjustments and proposing prices and quantities products are bought and sold to reach an agreement that is beneficial to both parties (Rosihan et al., 2021). In addition, it is essential to realise that technology allows supply chain actors to perform better, especially in supply chain management. For instance, blockchain technology to share real-time data transparently plays a vital role in the pricing of goods (Loureiro et al., 2020).

CONCLUSIONS AND POLICY RECOMMENDATION

Conclusions

Four tiers in the catfish fisheries supply chain in the Special Region of Yogyakarta are fish farmers, collectors, retailers, and consumers (industrial consumers and household consumers). Every tier in the catfish supply chain has different logistics activities. Furthermore, logistics costs in catfish fisheries systems have an average proportion of 76.421% for material handling activities, 12,285% for transportation activities, 7,212% for storage activities, 1,472% for procurement activities, 2,191% for maintenance activities, and 0.421% for communication activities with customers. The logistics cost component with the highest proportion is procurement. The recommended strategy for improving logistics activities to minimise logistics costs is optimising the use of resources, applying pull-based strategy and CPFR (Collaborative Planning Forecasting and Replenishment) along the supply chain of catfish in D.I. Yogyakarta.

Policy Recommendation

The government can provide assistance or training to supply chain actors in carrying out good supply chain or logistics management to help minimize costs incurred. This can be done by seeking improved knowledge and abilities of supply chain and logitics management through training, coaching, piloting and innovation, and fisheries cultivation group quality improvement.

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AUTHORS CONTRIBUTION STATEMENT

We hereby declare that the contributions of each author to the writing of this paper are: Teny Sylvia is main contributor, Kuncoro Harto Widodo and Dyah Ismoyowati are member of contributor. The authors declare that the Author Contribution Letter has been attached.

REFERENCES

Blocher, E.J., Chen, K.H., Cokins, G., dan Lin, T. (2007). *Cost Management: A Strategic Emphasis.* McGraw-Hill.USA.

Barata, F. A. (2020). High Cost of Logistics and Solution. *Advances in Economics, Business and Management Research,* 115: 407-410.

Chioma, A., & Etifit, J. O. (2018). Material management and the effectiveness of selected manufacturing small and medium size firms in Enugu State. *Asia Pacific Journal of Research in Business Management,* 9(1).

DKP DIY. (2016). *Buku Monografi Dinas Kelautan dan Perikanan Daerah Istimewa Yogyakarta Tahun 2015*. Dinas Kelautan dan Perikanan DIY. Yogyakarta.

Guritno, A.D. and Tanuputri, M. R. (2017). Comparison of Fish Supply Chain from Aquaculture and Sea Catchment Areas. *Journal of Service Science and Management*, 10 (4):353-359.

Ibegbulem, A. B., & Okorie, C. (2015). Assessment of materials management and profitability of an organization. *Journal of Policy and Development Studies*, 289(1851), 1–13.

Kar, A. and Datta, P. R. (2020). Logistics Cost Dynamics in International Business: A Causal Approach. *Foreign Trade Review*, 55(4).

Kareem, J.A.H., Mohammed, B. I., and Abdulwahab, S. A. (2022). Optimal Materials Handling Equipment and Defective Product Reduction Skills in Enhance Overall Production Efficiency. *Sage Open*, 1-16.

Liang, L. and Futou. (2018). Optimal Decision of Deferred Payment Supply Chain Considering Bilateral Risk-Aversion Degree. *Mathematical Problems in Engineering*, 3 (4): 1-11.

Loureiro, R., Silva, S., Pacheco, A., and Simoes, J. (2020). Logistics 4.0: The Cooperative Strategy and Reducing Cost. *The International Journal of Business & Management*, 8(7): 80-87.

Meng, X. and Tian, S. (2013). *Application Analysis of Activity-Based Costing in Logistics Cost*

Management: In Comparison with Tradisional Costing. Springer. Verlag Berlin Heidelberg.

Minken, H. and Johansen, B.G. (2019). A Logistics Cost Function with Explicit Transport Costs. *Economics of Transportation*, 19:1-13.

Mulyadi. (2007). *Activity Based Cost System*. Unit Penerbit dan Percetakan Sekolah Tinggi Ilmu Manajemen YKPN. Yogyakarta.

Ongkunaruk, P. dan Piyakarn, C. (2011). Logistics Cost Structure for Mangosteen Farmers in Thailand. *System Engineering Procedia,* 2, 40-48.

Rosihan R.I., Paduloh, Sulaeman, Dedy. 2021. Penerapan Collaborative Planning, Forecasting and Replenishment (Cpfr) Guna Mengurangi Bullwhip Effect Di Pt.XYX. Prosiding Seminar Nasional Aplikasi Sains & Teknologi (SNAST),1-8.

Schreiben, R. (2018). Tingginya Biaya Logistik dan Solusi Untuk Menekan Biaya Logistik di Indonesia. Accessed on 17 March 2023. https://www.ali.web.id/web2/publication_detail.php?id=498.

Sylvia, T., dan Ismoyowati, D. (2020). Conduct and Perfomance of Catfish marketing Channel in the Special Region of Yogyakarta, Indonesia. *Agritech*, 40(3): 232-241.

Sylvia, T., Widodo. K.H., dan Ismoyowati, D. (2019). Strategi Pengurangan Biaya Logistik Perikanan Lele (*Clarias sp*). *Jurnal Sosek Kelautan dan Perikanan,* 13 (2), 205-218.

Widodo, K.H., Perdana, Y.R., dan Sumardjito, J. (2011). Konsep Product-Relationship-Matrix untuk Pengembangan Model Supply Chain Kelautan dan Perikanan. *Jurnal Teknologi Pertanian,* 12 (2), 122-129.

Widodo, K.H. and Sylvia, T. (2018). Basic Analysis of Logistics Cost for indonesian Fishery Commodities. Presentedat 4th International Conference on Science and Technology (ICST), *IEEE Xplore*, 1-5.

Yuniawati, R. A. (2018). Analisis Penerapan Activity Based Costing (ABC) System dalam Menentukan Harga Pokok Produksi Cokelat (Studi Pada Pusat Penelitian Kopi Dan Kakao Indonesia). *Accounting and Business Information System Journal,* 6(3): 1-13.