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Risk mitigation and structure analysis of logistics cost for marketing *pindang* fish supply chain in bawean island, Gresik, East Java

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ABSTRACT

An integrated operational system is needed including fishermen, collectors, processors, traders and consumers to distribute *pindang* fish. The purpose of this study was to identify supply chain models and the risks that exist in the supply chain in Bawean Island, Indonesia, determine risk mitigation and risk treatment, analyze marketing *pindang* fish logistics cost based on logistics activities, and provide recommendations to each tier of *pindang* fish supply chain. The research was collected by convenience sampling through in-depth interview using interview guidance. Identification, analysis, evaluation, and risk management were analyzed by using Rapid Agricultural Supply Chain Risk Assessment (RapAgRisk). The logistic cost was calculated by using the Activity-Based Costing (ABC) Method. The results indicated the existence of risks in each tier. Logistics cost structure analysis showed the highest proportion of activity cost in the supply chain which were procurement activities. The research concluded that there was a linkage between the logistic cost structure and the risk mitigation actions in marketing *pindang* fish supply chain.

Keywords: *Pindang fish, Logistic cost structure, Supply chain, Risk management*

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INTRODUCTION

Pindang is a processed product derived from conventional cooked fish. Based on the interview, *pindang* is preserved by boiling and giving salt. Salt not only acts as a preservative but also a flavoring. The purpose of this cooking method is to reduce the number of microbes and reduce enzyme activity so that pindang fish are not easily damaged (Darmadi et al., 2018). Pindang has a shelf life that is not too long because it only uses salt as a natural preservative.

Pindang fish are one of strategic sea commodities in Bawean Island which is located north of Gresik City, East Java. According to BPS-Statistics of Gresik Regency (Sampieri, 2020), Bawean Island has a fish production of 24,82% of the total production of Gresik City. Due to their perishable nature, *pindang* fish need special handling throughout the supply chain because they are seasonal and easily damaged. The main problems in the *pindang* fish supply chain are planning, distribution, and delivery. Each tier in the *pindang* fish supply chain may handle different kinds of risks in which risk prevention might vary as well (Yasin & Griffith, 2015). Risk in the supply chain capture *pindang* fish have risks that can affect the logistics cost of each tier.

MATERIAL AND METHOD

This research was conducted in Bawean Island, Gresik, East Java. This research used the snowball sampling method. The data were collected by questionnaires filled out by respondents throughout the supply chain. In addition, interviews were conducted to identify risks and find related information from risk owner. The risk analysis method moreover used the Rapid Agricultural Supply Chain Risk Assessment (RapAgRisk) based on ISO 31000: 2018 as a risk management standard (Anonymous, 2018).

Risk management is also applied to prevent risks that may cause losses in the quality and the quantity, which can be properly resolved. The aims of this study were to identify existing risks in the supply chain, to mitigate those risks, and to suggest strategies for an appropriate supply chain. Rapid Agricultural Supply Chain Risk Assessment (RapAgRisk) was used to adjust both internal and external risks to perishable products (Jaffee et al., 2008).

RESULT DAN DISCUSSION

Based on field surveys conducted in Bawean Island, the supply chain consists of four tiers, fishermen, collectors, processors, and traders. The total of respondents are 30 people. According to risks examined via the RapAgRisk method as shown in the Table 1 and 2. The red color explains high expected loss. The blue color explains medium expected loss. The yellow color explains low expected loss.

This study used several codes, as illustrated in Table 1 and 2. First letter refers to different tiers, such as F for fishermen, C for collectors, P for processors, and T for traders. The second code letter explains the risk parameters, namely A for natural disaster risk, B for biological risk, C for weather risk, L for logistical risk, M for operational risk, and P for market-related risk. The last code explains the sum for each risk parameter. Then the table 3 shows proportions of costs in each logistic activity and the table 4 shows proportions of costs in each tiers.

It considers the nature of product demand (functional products or innovative products). After knowing the nature of the product, the actor can formulate an ideal strategy. Functional products require a supply chain with efficient strategy, while innovative products require a supply chain with a responsive strategy. Based on observations, *pindang* fish have product characteristics functional products, namely a long product life cycle and not much change. *Pindang* fish is also a product that is easily available, included in basic necessities, and is sold in large quantities. In addition, *pindang* fish is included in the maturity phase because it has a stable supply.

The activities of the actors are based on the catching of sea fish by fishermen as the initial supplier. This condition is included in the push based supply chain category because all of its activities are determined by the main supplier. Efficient strategy is obtained based on the analysis of the cost structure. The largest percentage of costs in the fishermen tier is procurement activities with a percentage of 67.17%. An efficient strategy that can be carried out by tier fishermen is the use of fishermen who are skilled in maintenance and repair of ship engines. The provision of technical capability for maintenance and repair of these machines is carried out by the Gresik Marine and Fisheries Service. The use of

Table 1. Expected loss ranking matrix

		Potential Severity of Impact				
		Negligible	Moderate	Considerable	Critical	Catashtropic
Probability of Event	Highly probable			P.P.2		
	Probable			F.L.2; P.P.4		
	Occasional	C.M.1	F.P.1	C.B.2; C.P.2 F.C.I; F.B.1;		
	Remote	P.P.3		F.M.2; F.L.1; P.P.1	R.B.1	
	Improbable	C.P.1	C.L.1; R.P.1; R.L.1	F.M.3; C.B.1; R.M.1		F.M.1; F.L.3

Table 2. Vulnerability assessment

	Capacity to Manage Risks				
Expected Loss	**1**	**2**	**3**	**4**	**5**
High	F.L.3	P.P.2			F.L.2; C.P.2
Moderate			F.L.1; P.P.4	F.C.1; P.P.1; R.B.1	F.B.1; F.M.1; F.M.2; C.B.2; P.P.3
Low				R.P.1	F.M.3; F.P.1; C.B.1; C.L.1; C.M.1; C.P.1; R.L.1; R.M.1

Vulnerability Scale	Code	Key Characteristics
Extremely vulnerable		Losses are estimated to be high, capacity is low.
Highly vulnerable		Losses are estimated to be medium-high and capacity is low-medium.
Moderately vulnerable		Losses are estimated to be medium and capacity is medium.
Slightly vulnerable		Losses are estimated to be low-medium and capacity is medium-high.
Limited vulnerability		Estimated losses are low and capacity is high.

Table 3. Proportions of costs in each logistic activity

No.	Variables	Procurement (%)	Material Handling (%)	Inventory (%)	Transportation (%)	Customer Communication (%)
1	Fishermen	78,2	54,37	2,32	36,21	24,94
2	Collectors	6,06	0	0	25,61	0
3	Processors	8,43	45,63	0	0	11,59
4	Traders	7,28	0	97,68	38,19	63,47
	Total	100	100	100	100	100

Table 4. Proportions of costs in each tiers

No.	Variables	Procurement (%)	Material Handling (%)	Inventory (%)	Transportation (%)	Customer Communication (%)	Total (%)
1	Fishermen	67.17	13	6.73	12.97	0.13	100
2	Collectors	24.83	38.74	0.51	35.73	0.2	100
3	Processors	6	37.91	52.14	0	3.95	100
4	Traders	30.86	0	0	67.48	1.66	100

fishermen who are skilled in the maintenance and repair of ship engines was chosen because fishermen can also act as engine repairmen so that they can reduce procurement costs. An efficient strategy for actors (collectors, processors and traders) is collaboration in the flow of information and data, flow of funds and material flow. If each actor can be open to each other about their problems, they will communicate with each other and understand each other's problems. The hope is that there will be a strong and sustainable supply chain.

The *pindang* fish supply chain on Bawean Island consists of fishermen; collectors; processors; traders and consumers. The supply chain is divided into 4 tiers, including fishermen, collectors, processors, traders, and consumers. Expanding and strengthening coordination between

fishermen and other actors may assist to coordinate price of *pindang* fish and their flexibility demand. The risks faced by each actor are varied and potentially detrimental. So they need several strategies to build a strong supply chain, namely "push based supply chain" and "collaboration". The risks faced by each actor are varied and potentially detrimental. So they need several strategies to build a strong supply chain, namely "push based supply chain" and "collaboration".

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