PERFORMANCE ANALYSIS OF SKIPJACK TUNA SUPPLY CHAINS IN ACEH LAMPULO JAYA BAHARI LTD

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ABSTRACT

Raw material management in the Skipjack Tuna fishing industry is important to be considered due to its abundant stock. The success of a business is not only measured by the level of production and profits, but the cooperative partnership must also be considered in the supply chain system. The purpose of this study was to determine the product flow, financial flow and information flow of Skipjack Tuna supply at Aceh Lampulo Jaya Bahari Ltd. and to determine its performance at Aceh Lampulo Jaya Bahari Ltd. The descriptive analysis method was employed to analyze product flow, financial flow and information flow. This research used the Supply Chain Operation Reference (SCOR) to measure supply chain performance. Performance measurements on the SCOR matrix in this study are supported by the Analytical Hierarchy Process (AHP) and Objective Matrix (OMAX) methods. The results showed that the product flow, information flow and financial flow at Aceh Lampulo Jaya Bahari Ltd. were still not optimal due to the lack of planned raw material supply, inadequate information flow and financial flow with too long waiting periods. The results showed that are 5 KPIs which categorized poor namely P.R.1, S.F.1, M.R.2, M.R.3 and M.C.1. The total performance value of Aceh Lampulo Jaya Bahari Ltd. is in the average category with a total index value reaching 64.2.

KEY WORDS

Supply chain, supply chain performance, SCOR, OMAX, Skipjack Tuna.

The importance of knowing Skipjack Tuna supply chain system is to reduce the risk of uncertainty, both in the form of production and distribution (Sutrisno et al, 2019). The supply chain is an integrated cooperative relationship or an effort to connect to each other that aims to add value to the output that involves several stakeholders to reach the best profit (Husna, 2018). The supply chain system not only measures the success of a business based on the level of production and profits, but also consider the cooperative relationship between stakeholders involved, so that the implementation of the supply chain system can be optimal (Kasimin, 2013). The management of raw materials in the Skipjack Tuna fishing industry is important to be concerned due to its abundant stock (Sulaeman et al, 2018). Skipjack Tuna commodity is a type of fish that has high economic value and plays an important role in the regional and national economy (Toding et al, 2019).

Aceh's ocean has considerable potential for fish resources (Athaillah, 2018). Aceh has a sea area of 295,370 Km² with a coastline of 2,666 Km. With such a vast sea area, Aceh's fishery potential is estimated at 1,600,000 tons per year. All the results of fish products must be able to be distributed and can be used properly, so as to avoid damage that reduces the freshness of the fish.

The company's supply of Skipjack is in the form of fresh fish which is then managed to become last longer which is done by freezing fish in cold storage before being distributed (Tummala and Schoenherr, 2011). Skipjack Tuna is one type of fish that is exported and one of the perishable foodstuffs that requires optimal handling so that the exported goods reach the final consumer (Talib, 2017).

One of the Ocean Fishery Ports in Aceh Province is PPS Kutaraja in Banda Aceh city. The dominant catch in PPS Kutaraja in 2017 came from the type of Skipjack Tuna that has the largest percentage of other fish for 46, 375%. Complete data on the dominant catches in PPS Kutaraja Banda Aceh, 2017 can be seen in Table 1 as follows.

Table 1 – Results of Dominant Arrests at PPS Kutaraja Banda Aceh, 2017

No	Types of Fish	Production (Kg)	Percentage (%)
1	Skipjack Tuna	6.477.680	46,375
2	Scad	3.759.700	26,916
3	Tuna (Yellow Fin)	2.298.743	16,457
4	Bullet Tuna	234.108	1,670
5	Starry Triggerfish	212.716	1,522
6	Spotted Sardinella	126.056	0,902
7	Frigate Mackerel	190.015	1,360
8	Rainbow Runner	103.915	0,743
9	Highfin Amberjack	89.236	0,638
10	Mackerel Tuna	24.556	0,175

Source: Aceh Maritime and Fisheries Office, 2018.

Based on Table 1, it can be seen that in 2017 Skipjack Tuna production ranks first compared to other fish in PPS Kutaraja Banda Aceh, with total 6,477,680 kg. Based on data from the Aceh Marine and Fisheries Service for tuna fish commodity, it shows that the catches of fishermen who experienced a significant increase from 2017 to 2018. Detailed data on the development of Skipjack Tuna can be seen in Table 2 as follows.

Table 2 – Development of Skipjack Tuna Fish Production in Kutaraja PPS 2014-2018

No.	Year	Total Production (Kg)	Total Average/Month (Kg)
1	2014	2.933.775	244.481
2	2015	3.786.382	315.532
3	2016	4.451.764	370.980
4	2017	6.477.680	548.140
5	2018	7.799.448	649.954

Source: Aceh Maritime and Fisheries Office, 2019.

Based on Table 2, it shows those fishermen's catches are dominant compared to Skipjack Tuna due to the large demand such as in fulfilling supply to the company, so integrated supply chain performance is needed to utilize the production of Skipjack Tuna.

One company that manages Skipjack Tuna is Aceh Lampulo Jaya Bahari Ltd. This company manages fresh Skipjack Tuna from fishermen which is then frozen for immediate distribution. Therefore, the purpose of this study is to determine the product flow, financial flow and information flow of Skipjack Tuna supply at Aceh Lampulo Jaya Bahari Ltd. and to determine the performance of Skipjack Tuna supply at Aceh Lampulo Jaya Bahari Ltd.

METHODS OF RESEARCH

The location of the research was at PPS Kutaraja Banda Aceh which was devoted to Aceh Lampulo Jaya Bahari Ltd. with commodity types namely Skipjack Tuna. The objects of this study are all parties involved in the Skipjack Tuna supply chain including fishermen, *toke bangku* (Patron), and Aceh Lampulo Jaya Bahari Ltd. The scope of the study is limited to the problem of Skipjack Tuna supply chain flow and its performance at Aceh Lampulo Jaya Bahari Ltd. This research was conducted from August to December in 2019.

The sampling technique was carried out by interview and direct observation to several stakeholders related to the Skipjack Tuna supply chain activities. More complete types and sources of data can be seen in Table 3.

The SCOR analysis model has advantages as a Process Reference Model which is the ability to integrate Business Process Reengineering and Overview (Abbaspour, 2019). The output generated from the SCOR method is the performance value matrix of Aceh Lampulo Jaya Bahari Ltd. SCOR is based on five different business processes namely planning, source of supply, production, distribution and return. The definition of attributes and performance can be seen in Table 4.

Table 3 – Types and Analysis Tools

No	Research Purpose	Funding Needs		Analysis Tools
		Primary Data	Secondary Data	
1	Describe the supply chain of skipjack fish, financial flow and information flow	Interview data on Skipjack Tuna commodity at Aceh Lampulo Jaya Bahari Ltd. 2018, fish distribution and sales price	Statistics data on Skipjack Tuna production at PPS Kutaraja and at Aceh Lampulo Jaya Bahari Ltd. in 2018	Descriptive
2	Measuring the performance of Skipjack Tuna supply chain in the company including plan, source, make, deliver and return	Stakeholder assessment of Aceh Lampulo Jaya Bahari Ltd.	Statistics on the purchase and sale of fish at Aceh Lampulo Jaya Bahari Ltd. in 2018	SCOR (Supply Chain Operation Reference)

Source: Prayoga, 2017.

Table 4 – Matrix of Supply Chain Performance Attributes

Core Process (Level 1)	Dimension (Level 2)	KPI	Key Performance Indicators (Level 3)
Plan	Reability	P.R.1	Time to identify employee performance (Days)
	Asset	P.A.1	Cash to cash cycle time (Days)
Source	Reability	S.R.1 S.R.2	Raw materials that are not good (Kg) Fulfillment of raw materials (Kg)
	Responsiveness	S.Re.1	Receive product cycle time (Days/Tons)
	Flexibility	S.F.1	Supply chain flexibility and adaptability (%)
	Cost	S.C.1	Cost to source (IDR/Kg)
Make	Reability	M.R.1 M.R.2 M.R.3	Errors in packaging (Kg) Total amount of production (Kg/Days) Total production of employees (Kg/Hour)
	Responsiveness	M.Re.1	Production time (Days)
	Cost	M.C.1	Cost to make (IDR/Kg)
	Reability	D.R.1 D.R.2 D.R.3	Perfect condition (%) Documentation accuracy (%) Deliver cycle time (Days)
Deliver	Responsiveness	D.Re.1	Average document processing time (Days)
	Cost	D.C.1	Cost to deliver (IDR/Kg)
Return	Reability	R.R.1	Return (Kg)

Source: Supply Chain Council, 2006.

If the results of an analysis have been obtained, the results will be scored based on a performance indicator monitoring system that can be seen in the following Table 5.

Table 5 – Supply Chain Performance Indicator Monitoring System

Monitoring	Performance Indicators
<40	Poor
40-50	Marginal
50-70	Average
70-90	Good
>90	Excellent

Source: Trienekens and Hvolby, 2000.

Analytical Hierarchy Process (AHP) is a decision support model developed by Thomas L. Saaty. AHP has the advantage of being able to combine objective elements with subjective elements of a problem (Anjomshoae et al, 2019). The purpose of weighting the AHP is as a model that supports decision making by comparing between elements (Gunduz and Khaled, 2020). An example of weighting can be seen in Table 6.

Table 6 – Pairwise Comparison Matrix

C	A1	A2	A3	An
A1	A11	A12	A13	A1n
A2	A21	A22	A23	A2n
A3	A31	A32	A33	A3n
An	An1	An2	An3	Ann

Source: Saaty and Vargas, 2000.

Alternative choices are obtained after weighting and the final value can be seen from the calculation results on priority vector as priority of the weighting results (Kuzu and Beysehir, 2020). After obtaining AHP weights, it is necessary to test the consistency of the type of accurate measurement. The Consistency Index (CI) formula is:

$$CI = \frac{\lambda_{maks} - n}{(n-1)} = \quad (1) \text{ (Wibisono, 2006)}$$

Where: λ is eigenvalue and n is the size of the matrix. The maximum eigenvalue of a matrix will not be smaller than the value of n so that the CI value is not negative.

The formula of the Random Index is as follows.

$$RI = \frac{1.98 (n-2)}{(n)} = \quad (2) \text{ (Wibisono, 2006)}$$

The formula for the Consistency Ratio is as follows.

$$CR = \frac{(CI)}{(RI)} \quad (3) \text{ (Wibisono, 2006)}$$

Where: CI - Consistency Ratio; RI - Consistency Index; CR - Random Index.

If the CR is greater than 0.10 or equal to 10%, it means that each element that has been determined is not compared to the proper and the decision maker must review the comparison process carried out (Wibisono, 2006).

OMAX (Objective Matrix) can combine several productivity criteria into an integrated form and related to each other. The OMAX assessment scheme consists of three parts: very low (red), mid (yellow) and very good (green) shown in Table 7 as follows.

Table 7 – Examples of OMAX (Objective Matrix) Schemes

KPI No.									
Performance									
Level	10	10							
	9	9							
	8	8							
	7	7							
	6	6							
	5	5							
	4	4							
	3	3							
	2	2							
	1	1							
	0	0							

Source: Riggs, 1987.

A standard performance value can be obtained from the calculation of the average that will be placed at level 3. After level 3 is filled, then determine the smallest scale of the calculation of the ratio that will be placed at level 0. For level 10 is the value of the target to be achieved by the company (Avianda et al, 2014). The formula used to calculate the scale between level 0 to level 3 with the following formulation:

$$\text{Level 0-Level 3} = \frac{(\text{Level 3}-\text{Level 0})}{(3-0)} \quad (1) \text{ (Avianda et al, 2014)}$$

The formula used to calculate the scale between level 3 and level 10 is as follows:

$$\text{Level 3-Level 10} = \frac{(\text{Level 10}-\text{Level 3})}{(10-3)} \quad (2) \text{ (Avianda et al, 2014)}$$

RESULTS AND DISCUSSION

The potential of Skipjack Tuna production is influenced by the type of fishing gear used. There are 3 types of fishing gear used in the Ocean Fisheries Port (PPS) of Kutaraja, namely Purse Seine, *Ulur* Fishing Line and *Rawai* Fishing Line. Purse Seine fishing gear is a fishing gear that has the biggest catch landed at PPS Kutaraja. One of the companies established in the area of PPS Kutaraja is Aceh Lampulo Jaya Bahari Ltd. as a company that manages fish by freezing it in cold storage with a capacity of 400 tons. Aceh Lampulo Jaya Bahari Ltd. has a concept of performance that is very concerned with the quality of the product.

The concept of supply chain is a system that is complexly used (Ganesan et al, 2020). The supply chain system must also be managed properly to become a unified and sustainable whole (Krishnan et al, 2020). There are 3 integrated supply chain systems, which include physical flow, financial flow and information flow (Pellegrino et al, 2018). The three flows in PPS Kutaraja can be seen in Figure 1 as follows.

Maritime and Fisheries Service, Fishermen/Producers, *toke bangku* (Patron), Aceh Lampulo Jaya Bahari Ltd, Local Retailers, Regional, Medan Tropical Canning Ltd. Export, Final Consumer.

Figure 1 – Physical Flow Scheme, Information Flow and Financial Flow

Figure 2 – Scheme of Skipjack Tuna supply chain

Figure 1 shows that the physical flow (product) of Skipjack Tuna is starting from fishermen selling fish through *toke bangku* (Patron); *toke bangku* (Patron) sell it to Aceh Lampulo Jaya Bahari Ltd., local and regional retailers, and then export to final consumers. The information flow was obtained from PPS Kutaraja area which was under the supervision of the Aceh Marine and Fisheries Service. The Skipjack Tuna supply chain flow can be seen in Figure 2.

Based on Figure 2, it can be seen that the production of fresh Skipjack Tuna in PPS Kutaraja which is sold through *toke bangku* (Patron) reaching 100%, but *toke bangku* (Patron) do not sell all Skipjack Tuna to the company. The company gets the supply of Skipjack Tuna only 78.25%. *Toke bangku* (Patron) also sell Skipjack Tuna fish to regional retailers and export reaching 21.75% and the last distribution is directly sent to final consumers. *Toke bangku* (Patron) benefits from the sale of Skipjack Tuna by selling it to Aceh Lampulo Jaya Bahari Ltd., then Aceh Lampulo Jaya Bahari Ltd. sends the frozen tuna to Medan Tropical Canning Ltd. without additional value due to the co-partnership of both companies.

There are 18 dominant and most important indicators that will be measured at Aceh Lampulo Jaya Bahari Ltd. which is the main focus in the company's performance and the indicators have been confirmed to avoid repetition. The selected indicator is an indicator that matches the needs of the company. These KPIs can be seen in Table 8 as follows.

Table 8 – Matrix of Supply Chain Performance Attributes and Weighting Results

Core Process (Level 1)	Weight	Dimension (Level 2)	Weight	KPI	Key Performance Indicators (Level 3)	Weight
Plan	0,04	Reability	0,67	P.R.1	Time to identify employee performance	1,00
		Asset	0,33	P.A.1	Cash to cash cycle time	1,00
Source	0,51	Reability	0,30	S.R.1 S.R.2	Raw materials that are not good Fulfillment of raw materials	0,75 0,25
		Responsiveness	0,10	S.Re.1	Receive product cycle time	1,00
		Flexibility	0,09	S.F.1	Supply chain flexibility and adaptability	1,00
		Cost	0,50	S.C.1	Cost to source	1,00
Make	0,26	Reability	0,27	M.R.1 M.R.2 M.R.3	Errors in packaging Total amount of production Total production of employees	0,71 0,14 0,14
		Responsiveness	0,09	M.Re.1	Production time	1,00
		Cost	0,64	M.C.1	Cost to make	1,00
Deliver	0,12	Reability	0,27	D.R.1 D.R.2 D.R.3	Perfect condition Documentation accuracy Delivery cycle time	0,75 0,12 0,13
		Responsiveness	0,09	D.Re.1	Average document processing time	1,00
		Cost	0,64	D.C.1	Cost to deliver	1,00
Return	0,07	Reability	1	R.R.1	Return	1,00

Source: Primary Data (processed), 2019.

Table 8 above shows that in the core process the source weight value is the greatest weight with a score of 0.51 or 51% compared to the plan that is 0.04 or 4%, make as much as 0.26 or 26%, deliver as much as 0,12 or 12% and return of 0.07 or 7%. Based on the results of the calculation, the source has the greatest weight, meaning that among several other core processes the core source process is the main priority that is most needed by the company Aceh Lampulo Jaya Bahari Ltd. The smallest weight is in the core plan process, which means that Aceh Lampulo Jaya Bahari Ltd. is not planning for the skipjack tuna supply chain.

Objective Matrix Analysis (OMAX) is an analytical method used to assess all company activities (James L. Riggs, 1986). Scoring System calculations are performed using the Objective Matrix (OMAX) method. The results of the Scoring System calculation conducted at Aceh Lampulo Jaya Bahari Ltd. can be seen in Table 9.

Table 9 – Matrix Scoring System Perspective Plan

KPI No		P.R.1	P.A.1
Level	10	2,00	11,47
	9	2,12	12,40
	8	2,25	13,32
	7	2,37	14,25
	6	2,49	15,17
	5	2,61	16,10
	4	2,74	17,02
	3	2,86	17,95
	2	3,14	21,07
	1	3,43	24,20
	0	3,71	27,32
Level		3,92	4,00
Weight		1,00	1,00
Value		3,92	4,00

Source: Primary Data (processed), 2019.

Based on Table 9 it can be seen that the value of the perspective plan scoring system on KPI P.R.1 has a value of 3.92 that is in the red zone or in the poor category, which means that Aceh Lampulo Jaya Ltd. must re-evaluate its performance system in order to achieve the company's target. Meanwhile, for KPI P.A.1, the company gets a score of 4.00 in the yellow zone, which means the company must also be careful so that its performance will not decrease.

Table 10 – Matrix of Perspective Source Scoring System

KPI No		S.R.1	S.R.2	S.Re.1	S.F.1	S.C.1
Level	10	0	789.600	0,033	100	14.000
	9	10	508.612	0,036	93,79	14.417
	8	20	508.612	0,040	87,57	14.833
	7	30	508.612	0,043	81,36	15.250
	6	40	508.612	0,046	75,15	15.666
	5	50	508.612	0,049	68,94	16.083
	4	60	508.612	0,053	62,72	16.499
	3	70	508.612	0,056	56,51	16.916
	2	80	314.030	0,065	49,30	19.277
	1	90	314.030	0,074	42,10	21.639
	0	100	314.030	0,083	34,89	24.000
Level		10	4,00	4,17	3,83	4,75
Weight		0,75	0,25	1	1	1
Value		7,5	1	4,17	3,83	4,75

Source: Primary Data (processed), 2019.

Based on Table 10 it can be seen as a whole that for S.F.1, the company has not been able to perform its performance optimally because it is still in the red zone and there needs to be an evaluation or a review of its performance.

Table 11 – Matrix Scoring System Perspective Make

KPI No		M.R.1	M.R.2	M.R.3	M.Re.1	M.C.1
Level	10	0	27.000	9.000	3	304,51
	9	10	16.718	5.573	4	338,16
	8	20	16.718	5.573	5	371,81
	7	30	16.718	5.573	6	405,46
	6	40	16.718	5.573	7	439,11
	5	50	16.718	5.573	8	472,76
	4	60	16.718	5.573	9	506,41
	3	70	16.718	5.573	10	540,06
	2	80	9.677	3.226	11	643,24
	1	90	9.677	3.226	12	746,42
	0	100	9.677	3.226	13	849,60
Level		10	3,83	3,83	10	3,92
Weight		0,71	0,14	0,14	1	1
Value		7,1	0,53	0,53	10	3,92

Source: Primary Data (processed), 2019.

Based on Table 11 above, it can be seen that the company's performance for M.R.1 and M.Re.1 is good, that is in the green zone, that is, the company has never made mistakes in packing frozen tuna products and the company also has efficient production time. For the performance of M.R.2, M.R.3 and M.C.1 performance evaluations and improvements are still needed.

Table 12 – Deliver Perspective Scoring Matrix System

KPI No	D.R.1	D.R.2	D.R.3	D.Re.1	D.C.1
10	100	100	1	1	300
9	99	99	2	2	400
8	98	98	3	3	500
7	97	97	4	4	600
6	96	96	5	5	700
5	95	95	6	6	800
4	94	94	7	7	900
3	93	93	8	8	1000
2	92	92	9	9	1100
1	91	91	10	10	1200
0	90	90	11	11	1300
Level	10	10	10	10	10
Weight	0,75	0,12	0,13	1	1
Value	7,5	1,2	1,3	10	10

Source: Primary Data (processed), 2019.

Table 13 – The Return Perspective Scoring System Matrix

KPI No	R.R.1
10	0
9	10
8	20
7	30
6	40
5	50
4	60
3	70
2	80
1	90
0	100
Level	10
Weight	1
Value	10

Source: Primary Data (processed), 2019.

Table 14 – Performance Measurement Matrix at Aceh Lampulo Jaya Bahari Ltd. in 2018

No	Perspective	Dimension	KPI
1	Plan (3,95)	Reability (3,92)	P.R.1 3,92
		Asset (4)	P.A.1 4
2	Source (5,69)	Reability (8,50)	S.R.1 10
		Responsivenees (4,17)	S.R.2 4
		flexibility (3,83)	S.Re.1 4,17
		Cost (4,75)	S.F.1 3,83
			S.C.1 4,75
3	Make (5,61)	Reability (8,16)	M.R.1 10
		Responsivenees (10)	M.R.2 3,83
		Cost (3,92)	M.R.3 3,83
			M.Re.1 10
			M.C.1 3,92
4	Deliver (10)	Reability (10)	D.R.1 10
			D.R.2 10
		Responsivenees (10)	D.R.3 10
		Cost (10)	D.Re.1 10
			D.C.1 10
5	Return (10)	Reability (10)	R.R.1 10
Index Total			
6,42			

Source: Primary Data (processed), 2019.

Based on Table 12, it can be seen that the performance of Aceh Lampulo Jaya Bahari Ltd. in the perspective of deliver is already meeting the target and is in the green zone.

Based on Table 13, it can be seen that for the performance of the performance perspective scoring system, the company is in the green zone because there is no return.

Based on Table 14 above, it can be seen that the overall performance calculation of Aceh Lampulo Jaya Bahari Ltd. obtained a total index score of 6.42 and the value is in the yellow zone. PT Aceh Lampulo Jaya Bahari must improve or evaluate some of the performance in the red and yellow zones to improve company performance. The performance indicator monitoring system at Aceh Lampulo Jaya Bahari Ltd. can be seen in Table 15 as follows.

Table 15 – Monitoring System Performance Indicators of Aceh Lampulo Jaya Bahari Ltd. in 2018

Monitoring	Performance Indicators
< 40	Poor
40 – 50	Marginal
50 – 70	Average
70 – 90	Good
> 90	Excellent

Source: Primary Data (processed), 2019.

Measurement of supply chain performance in researched companies refers to Trienekens and Hvolby (2000) standards. Based on Table 15 above, the results of the performance of Aceh Lampulo Jaya Bahari Ltd. are on the performance indicator is the average and the index value of the total performance of the Skipjack Tuna supply chain at Aceh Lampulo Jaya Bahari Ltd. is 6,42 on a scale of 10 or 64,2 on a scale of 100.

CONCLUSION

Product flow and information flow at Aceh Lampulo Jaya Bahari Ltd. is still not optimal due to the lack of supply raw materials planning, seen from the amount of raw material for fresh Skipjack Tuna still not meeting the target. The company's raw material target is 30,000 kg per day, but the amount of Skipjack Tuna is always below the company's target. Fresh Skipjack Tuna is not fully sold to Aceh Lampulo Jaya Bahari Ltd. by *toke bangku* (Patron) because of limited information on the amount of raw material needed by the company per day that causes some fresh Skipjack Tuna sold outside the region. The flow of finance at Aceh Lampulo Jaya Bahari Ltd. is also still not optimal due to the long waiting period between payments made by Medan Tropical Canning Ltd. to Aceh Lampulo Jaya Bahari Ltd.

The results of supply chain performance measurements at Aceh Lampulo Jaya Bahari Ltd. Showed that there are 5 KPIs which categorized poor, namely PR1, SF1, MR2, MR3 and MC1. The company pays little attention to these indicators so that these indicators must immediately take action in making improvements to improve company performance to meet so the company targets. The total performance value of Aceh Lampulo Jaya Bahari Ltd. is in the average category with a total index value reaching 64,2. The company is not in a safe position because a few mistakes can reduce the company's performance.

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