Supply Chain Management Performance on Laying Chicken Farm

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Abstract---*Closer competition since more new laying hen farms was entering this business requiring increased company competitiveness. One of the factors that influence a company's competitiveness is effective and efficient supply chain management. Research on the performance of supply chain management of laying hens was conducted at Wiratama Maju Lestari Inc in Bogor Regency, West Java. The purpose of this study is to identify product, financial, information flows and analyze supply chain management performance. The Supply Chain Operations Reference-Analytical Hierarchy Process (SCOR-AHP) method was conducted for analysis. The results showed that the supply chain of laying hens consists of suppliers, breeders and wholesalers. The flow of products, information and finances has been well integrated as indicated by the fulfillment of the number of eggs ordered at the right time according to the contract. Based on the classification of standard supply chain performance values, the achievement of supply chain management performance is classified as good with a performance value of 83.13. The order of importance of the key processes of the SCOR model in the supply chain of laying hens is as follows: deliver, return, make, source, and plan. The prioritized attributes of these key processes are as follows: reliability attribute for the deliver and return key processes; while responsiveness is for plan, source, and make key processes. Improvement of key performance indicators that are prioritized to improve supply chain performance are as follows: level of supply of ready-to-ship eggs, level of customer complaints, production scheduling period and time needed to sort the quality of raw materials, lead time of raw materials, time of supply of chicken eggs , and responsiveness in fulfilling consumer orders.*

Keywords---*laying chicken farm, management, performance, SCOR-AHP, supply chain*

Introduction

The business prospects of laying hen farm are very attractive in Indonesia. In 2020-2024 consumer demand for chicken eggs will increase with an average growth of 2.6% per year as can be seen in Table 1. The increase in national consumption of chicken eggs is a very good business opportunity so that many companies engaged in the field of laying hen farms emerge which in turn encourages intense business competition.

Table 1
National Consumption of Hen Eggs in Indonesia, 2020-2024

Year	Consumption (kg/cap/yr)	Population (000 person)	National Consumption (ton)	Growth (%)
2020	18,35	269.603	4.947.222	
2021	18,47	272.249	5.028.959	1,65
2022	18,84	274.859	5.178.746	2,98
2023*	19,21	277.432	5.329.746	2,92
2024*	19,58	279.965	5.481.855	2,85
Growth Average (%)				2,60

Source: Secretariat General of The Ministry of Agriculture (2020)

Intense competition encourages companies to make management improvements in improving their performance. One of the factors that influence a company's competitiveness is effective and efficient supply chain management. For this reason, it is necessary to measure the performance of supply chain management in order to increase competitiveness, produce high quality goods or services to meet consumer needs, manage them in a timely manner, be economical in supply and cost effective, efficient, and flexible delivery and management (Setiawan & Santosa, 2006). Supply chain management performance is one of the best solutions to increase competitive advantage (Zabidi, 2001). The competitive advantage of supply chain management is how companies can control the flow of goods or products in a supply chain (Watanabe et al., 2001). To maximize competitive advantage, it is necessary to measure supply chain performance. According to Chan (2003), performance measurement is the process of measuring the effectiveness and efficiency of an action. Performance measurement is very important and is an ongoing process (Dornier, 1998).

Supply chain management performance can be measured using the Supply Chain Operations Reference (SCOR) model (Mutakin & Hubeis, 2011). The SCOR model is a model that can represent the conditions that exist in the company. The application of the SCOR method to supply chain management provides for the observation and measurement of the entire supply chain process. SCOR provides supply chain assessment indicators presented on performance metrics. These metrics will later be given weight using the Analytical Hierarchy Process (AHP) to determine their level of importance by comparing the scores contained in each indicator. Thus, it can be evaluated what indicators need improvement. AHP simply can be interpreted as a simple and flexible method that accommodates creativity in its approach to a problem (Thomas, 1993).

Currently, laying hen farm companies have full control over supply chain management, but more needs to be done to survive in the competitive industry. The supply chain at this company consists of three streams which include product flow, financial flow and information flow. The problem faced by this company is intense sales competition that encourages price competition and it was not yet known what indicators need to be improved to increase the performance of its supply chain management. Thus, the purpose of this research was to find out how product flow, financial flow, information flow and supply chain management performance of laying hen farms. The results of this study was expected to be used as a basis for corrective action by company management (Moleong, 2021; Singarimbun & Effendi, 1995).

Research Methods

The research was conducted at PT Wiratama Maju Lestari, Cigudeg District, Bogor Regency, West Java. The company is one of the largest laying hen farms raising around 115,000 chickens which represents the company having full control over supply chain management. The time of the research was August–October 2022. The primary data source was key informants who were selected using a purposive method. The criteria for the selected key informants are having knowledge and experience on the object of research and being willing to provide opinions and assessments on the aspects in question. Based on these criteria, there were five key informants, namely the Head of the Company, Head of Marketing, Head of Public Relations, Head of Production, and Head of Warehouse (Buller & Roe, 2014; Lee et al., 2020).

The two variables in this study are: (1) supply chain management mechanism with indicators namely product flow, financial flow, and information flow, and (2) supply chain performance. To find out the description of product flow, financial flow, and information flow in the supply chain, a qualitative analysis was carried out. Quantitative analysis is used to measure supply chain performance by identifying metrics for each level, verifying Key

Performance Indicators (KPI), calculating the normalized value (score) for each metric using the Snorm De Boer normalization process, analyzing AHP to obtain the weight of each criterion. Assessed through a paired matrix using a scale of 1-9 as detailed in Table 2. The final performance value is obtained after calculating the weight with AHP and evaluating performance using SCOR. The resulting value shows supply chain performance with a range of values that can be seen in Table 3.

Table 2
Scale of Analytical Hierarchy Process (AHP)

Scale	Annotation
1	Equally Importance.
3	Moderate Importance
5	Strong Importance.
7	Very Strong Importance.
9	Extreme Importance.
2, 4, 6, 8	Moderate value.

Source: Thomas (1993)

Table 3
Supply chain performance standard value classification

Score Performance	Criteria Performance
< 40	*Poor*
> 40-50	*Marginal*
> 50-70	*Average*
> 70-90	*Good*
> 90	*Excellent*

Source: Sumiati (2012)

Analysis of Supply Chain Management Performance Value with the SCOR Approach

According to Pujawan et al. (2002), a performance measurement must be able to show individual values for each metric as well as aggregate values at each level of the measurement hierarchy. To be carried out the aggregation process, the weights and values of the metrics or a collection of metrics below are required. The SCOR method helps determine the variables to be studied along with the attributes of each variable to produce Key Performance Indicators that will be used to assess Supply Chain Management performance. Furthermore, according to Amrullah (2011), the aggregation process requires a mechanism to equalize the measurement scale of each metric. This is necessary because each metric has the same units but with different value scales. Therefore, it is necessary to equalize the value scale, by the normalization process of Snorm De Boer. According to Trienekens & Hvolby (2000), normalization can be done with the formula:

$$\frac{(si - si\min)}{s\max - s\min} \; x \; 100$$

Where, si is the actual value, s min is the worst value, and s max is the best value. Supply Chain Management performance research indicators at levels 1,2, and 3 refer to Paul (2014). Table 4 describes the performance attributes and metrics used in this study (Kittisut & Pornsuwancharoen, 2012; Saeed et al., 2019).

Table 4
Performance Attributes and Metrics

Core Process (Level 1)	Attribute (Level 2)	KPI Code	Key Performance Indicator (KPI) (Level 3)
Plan	Reliability	PR-1	The accuracy of the implementation of planning the use of raw materials
		PR-2	The accuracy of product delivery planning implementation
	Responsiveness	PRe-1	Production scheduling timeframe
		PRe-2	The time needed in sorting the quality of raw materials
	Asset	PA	The rate of return on production capital
Source	Reliability	SR-1	Raw material defects
		SR-2	Fulfillment of raw materials
		SR-3	Reliability in delivery
	Responsiveness	SRe	Raw material lead times
	Flexibility	SF	Availability of suppliers
	Cost	SC	Order costs to suppliers
	Asset	SA	Daily supplies
Make	Reliability	MR-1	Error in packing
		MR-2	The number of eggs that are less than perfect
	Responsiveness	MRe-1	Egg preparation time
		MRe-2	Responsiveness in fulfilling consumer orders of eggs
	Flexibility	MF	Flexibility in fulfilling consumer orders for eggs
	Cost	MC	Production cost
	Asset	MA	The average length of service life of production equipment
Deliver	Reliability	DR-1	The level of supply of ready-to-send for eggs
		DR-2	Product exhaustion rate
	Responsiveness	DRe	Finished product lead times
Return	Reliability	RR	The level of complaints from customers
	Responsiveness	RRe	Time to replace the product

Weighting with AHP

Analytical Hierarchy Process or AHP can simply be interpreted as a simple and flexible method that accommodates creativity in its approach to a problem (Thomas, 1993). The AHP method is used to give a weight and value score to each criterion, attributes to criteria, and sub criteria. The AHP method itself is used with the aim of mapping the priority scale in each company's activities so that it can determine the priority of improvements that need to be made. The initial stage carried out in this weighting is to make a pairwise comparison questionnaire filled out by each respondent. Completion of the pairwise comparison questionnaire is done by comparing each criterion, the attributes of the criteria, and the sub-criteria on the criteria attributes. The data obtained from the results of the questionnaire, then calculated with Microsoft Excel. Starting from processing the data for each questionnaire that has been filled in by each respondent on each criterion, attributes on the criteria, and sub criteria. Then proceed with combining the results of each questionnaire on each criterion, attributes on the criteria, and sub criteria (de Jong et al., 2020; Vanderhasselt et al., 2014).

Results and Discussion

The supply chain of laying hens at PT Wiratama Maju Lestari illustrates that there are three flows, namely product flow, information flow, and financial flow. Supply chain business processes run well because product flows,

financial flows, and information flows run smoothly and are well integrated. a picture of the supply chain of PT Witama Maju Lestari's egg supply chain is presented in Figure 1.

Product Flow

PT Wiratama Maju Lestari's supply chain product flow starts from ordering raw materials. PT Wiratama Maju Lestari orders DOC with an average purchase of 20,000 birds per 2 months, feed with an average of 300,000 kg per month, vaccines and medicines ordered for 1-2 months with detailed quantity details as follows: 50 vials of vaccine, 10 kg of medicine, and 10 kg of vitamins. Ordering cage equipment as needed with an average order of 100 pcs of feeder chicks, 200 pcs of feeding plates, and 150 bottles of vet strep. Distribution of raw materials using vehicles from each supplier company. The agreement between the supplier and PT Wiratama Maju Lestari is a written contract agreement. The agreement that occurs contains agreements regarding product prices, payment terms, quality, quantity, and delivery periods (Ka et al., 2019; Abdullah et al., 2013).

The next flow of supply chain products is from PT Wiratama Maju Lestari as a producer of purebred chicken eggs where PT Wiratama Maju Lestari conducts livestock business for 1 to 21 months. Egg products can be flowed from the start of production at the age of chickens 4 months to 21 months. Eggs are the final product that is accepted by wholesalers. This product flow started with PT Wiratama Maju Lestari by harvesting eggs every day from the cage. The eggs are then sold to wholesalers. Wholesalers have the capacity to purchase 86,000 to 108,000 kg of egg products a month. purchasing chicken eggs from wholesalers to PT Wiratama Maju Lestari using units per crate or 15 kg to adjust to the level of needs of wholesalers. distribution uses a fleet of 4-wheeled and 6-wheeled trucks. The agreement between PT Wiratama Maju Lestari and wholesalers is done orally without any formal contract agreement with evidence of an agreement (Golden et al., 2021; Durmaz & Bilgen, 2020).

Financial Flow

The supply chain financial flow began with PT Wiratama Maju Lestari buying production facilities from raw material suppliers, namely DOC Rp. 7,875 per head, feed Rp. 6,700 per kg. The maintenance of laying hens is carried out intensively so that they are not susceptible to disease so that PT Wiratama Maju Lestari costs IDR 89,910 per vial for vaccines, IDR 1,665,000 for drugs per kg, and IDR 255,300 for vitamins per kg. PT Wiratama Maju Lestari also purchases cage equipment to simplify the production process where the purchase costs are calculated in a month. Cage equipment costs IDR 5,070,000 in a month. Payment for purchases of raw materials uses the cash payment system method, non-cash payments via interbank transfers, and credit payments when the product has arrived at PT Wiratama Maju Lestari. Subsequent financial flows occurred in purchasing activities of purebred chicken eggs carried out by wholesalers to PT Wiratama Maju Lestari at a price received by wholesalers of IDR 22,200 per kg. Payments are made in cash, non-cash through bank transfers and credit payments when the goods or egg products reach the wholesalers. The money received by the breeder from the overall sale is used as capital to continue the production process (Widyantara & Sukaatmadja, 2019; Widarma & Setiawina, 2019).

Information Flow

The flow of information that PT Wiratama Maju Lestari distributes to wholesalers or vice versa in the supply chain is through telecommunication media (telephone) and face to face when wholesalers visit PT Wiratama Maju Lestari. The information flowed is related to the condition of the broiler livestock business, such as cultivation techniques, disease conditions in animals, and estimated yields. PT Wiratama Maju Lestari also receives information from prospective buyers in the form of information on the number of product requests, the prevailing egg price in the market, the desired quality and quantity of eggs. PT Wiratama Maju Lestari exchanges information when wholesalers visit PT Wiratama Maju Lestari and via cell phones. The flow of information created between PT Wiratama Maju Lestari and suppliers or vice versa is through telecommunication media (telephone). price information agreed between supply chain actors, namely by looking at market prices and the number of requests and supplies from suppliers, then information on the time to make purchases of raw materials is determined. and submitted by PT Wiratama Maju Lestari so that the raw materials obtained are as desired.

Supply chain management performance

The purpose of this analysis is to find the final value of the performance of supply chain management. The performance value is obtained from the calculation of the normalized score which has been obtained from the normalization formula for the snorm de boer and the weight is obtained from the AHP calculation. Calculation of the final SCM performance score is done by multiplying each normalized score that has been obtained from the Snorm De Boer normalization formula with the weight of each Key Performance Indicator (sub criteria), dimension (atribut), and core process (criteria). This calculation can be seen in Table 5.

   Calculation of the performance of each level is done by multiplying the normalized score by the weight of each using AHP. The results of supply chain management performance recapitulation of PT Wiratama Maju Lestari can be seen in Table 4. In this table it can be seen that the final value of supply chain management performance is 83.13. Based on the classification of standard value of supply chain performance, the achievement of supply chain management performance is classified as good. From the results of the calculations performed, it can be seen that the highest order of weight for the core process (level 1) is the deliver process (the process of fulfilling egg requests to customers) is in first place with a weight of 0.53. The second order is in the core return process (the process of returning or receiving damaged product returns) with a weight of 0.26. The third order is the core process of make (product manufacturing) with a weight of 0.16. Fourth place is the core process of sourcing (procurement of raw materials to meet customer demand) with a weight of 0.05. And the last sequence is in the core process plan (production process planning) with a weight of 0.03.

Table 5
Results of the Final Assessment of Supply Chain Management

Core Process	Weight	Attribute	Weight	KPI	Weight	Global Weight	Performance Value	Final Value
Plan	0,03	Reliability	0,06	PR-1	0,50	0,0008	62,14	0,049
				PR-2	0,50	0,0008	65,15	0,052
		Responsiveness	0,77	Pre-1	0,50	0,0099	100	0,99
				Pre-2	0,50	0,0099	100	0,99
		Asset	0,17	PA	1,00	0,0043	100	0,43
Source	0,05	Reliability	0,20	SR-1	0,32	0,0030	100	0,30
				SR-2	0,46	0,0043	100	0,43
				SR-3	0,22	0,0021	100	0,21
		Responsiveness	0,30	SRE	1,00	0,0140	100	1,40
		Flexibility	0,24	SF	1,00	0,0115	100	1,15
		Cost	0,22	SC	1,00	0,0102	100	1,02
		Asset	0,04	SA	1,00	0,0018	50	0,09
Make	0,16	Reliability	0,18	MR-1	0,50	0,0144	100	1,44
				MR-2	0,50	0,0144	50	0,72
		Responsiveness	0,35	Mre-1	0,25	0,0142	100	1,42
				Mre-2	0,75	0,0427	100	4,27
		Flexibility	0,21	MF	1,00	0,0337	100	3,37
		Cost	0,17	MC	1,00	0,0282	100	2,82
		Asset	0,09	MA	1,00	0,0146	100	1,46
Deliver	0,53	Reliability	0,75	DR-1	0,70	0,2776	100	27,76
		Responsiveness	0,25	DR-2	0,30	0,1190	50	5,95
				Dre	1,00	0,1322	100	13,22
Return	0,26	Reliability	0,96	RR	1,00	0,2531	50	12,65
		Responsiveness	0,04	Rre	1,00	0,0094	100	0,94
						Total Performance Rating		83,13

Source: Processed from primary data (2022)

The attribute (level 2) weights of the core process are as follows. The highest attribute weight in the plan process (production process planning) is responsiveness (the company's responsiveness in carrying out production planning and the period of time for sorting raw materials) with a weight of 0.77. The highest attribute weight in the source process (procurement of products or services to meet customer demand) is the responsiveness attribute (responsiveness of the company in fulfilling raw materials) which is equal to 0.30. In the make process (product manufacturing), the responsiveness attribute (company responsiveness in carrying out production activities) is the most important attribute with a weight of 0.35. Furthermore, in the deliver process (fulfilling the demand for chicken eggs to customers) the reliability attribute (the company's reliability in carrying out production activities) is the most important attribute with a weight of 0.75. Finally, in the return process (the process of returning or receiving returns for damaged products), the reliability attribute (the company's reliability in the process of returning products and complaints by customers) is the most important attribute with a weight of 0.96. Based on the final value, the KPIs prioritized at PT Wiratama Maju Lestari are DR-1 (fulfillment rate of ready-to-ship chicken eggs), DRe (finished product lead time), RR (customer complaint rate), DR-2 (out of stock rate) product), MRe-2 (responsiveness in fulfilling chicken egg consumer orders), and MF (flexibility in fulfilling chicken egg consumer orders)

Conclusion

The results of the study revealed that product, financial and information flows in the supply chain of laying chicken farm at PT Wiratama Maju Lestari had been well integrated as indicated by the fulfillment of the number of eggs ordered at the right time according to the contract. Based on the classification of standard supply chain performance values, the achievement of supply chain management performance is classified as good with a performance value of 83.13. The order of importance of the core process of the SCOR model in the supply chain of laying hens is as follows: deliver, return, make, source, and plan. The prioritized attributes of the core process are as follows: Reliability attribute for the deliver and return core process; while the responsiveness attribute for the core processes of plan, source, and make.

Recommendation

In order to improve supply chain performance in laying chicken farm it is recommended to prioritize the improvement of key performance indicators as follows: the level of fulfillment of ready-to-ship egg supply, the level of customer complaints, the production scheduling period and the time needed to sort the quality of raw materials, and Lead Raw material time, chicken egg preparation time, and responsiveness in fulfilling consumer orders.

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