Journal of Community Development in Asia (JCDA)
Vol.5 No.3, pp.40-52, September, 2022
E-ISSN: 2654-7279 P-ISSN: 2685-8819
https://www.ejournal.aibpmjournals.com/index.php/JCDA

Measurement of Supply Chain Management Performance Using SCOR Model

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ARTICLE INFORMATION

Publication information

Research article

HOW TO CITE

Tejaningrum, A., & Putra, A. I. (2022). Measurement of Supply Chain Management Performance Using SCOR Model. *Journal of Community Development in Asia, 5*(3), 40-52.

DOI: https://doi.org/10.32535/jcda.v5i3.1777

Received: 30 June 2022
Accepted: 31 July 2022
Published: 20 September 2022

ABSTRACT

This research took place in the chicken egg distributor industry, which has some troubles in its management of the supply chain, especially in the flow of materials, information, and finance, which is related to the decline in the company's performance (particularly in the aspects of consumer satisfaction and congestion in the financial flow). The objective of this study is to look at the flexibility of the supply chain from upstream to downstream, especially concerning distribution aspects to get to consumers, looking for improved solutions to improve organizational performance. Research Case studies on Industries engaged in the distribution of chicken eggs. The research method is a survey with a case study approach. Supply chain performance obtained value for Perfect Order Fulfillment (POF) of 70.8%, meaning that the company has not perfectly achieved supply chain performance, with Supply Chain Responsiveness of 3 days and Supply Chain Cost of 54%. This condition implies that the average performance of the supply is still in the category of less good. This study only examined the supply chain between internal supply and downstream without involving upstream due to data and information limitations. The research includes cost elements as part of supply chain performance, not only analyzing aspects of the fulfillment of materials and information.

Keywords: Corporate Performance, Logistic, Score Model, Supply Chain.

INTRODUCTION

The success of a business organization depends not only on the company's internal problems but also on the relationship between suppliers and distributors. Therefore, supply chain management science is a necessity studied in business schools, considering the importance of good flexibility between suppliers, manufacturers, and distributors in delivering the best performance to consumers. Oliver and Weber (1982) stated that the supply chain requires management activities, where the material, information, and financial flow process requires collaboration that is integrated with managerial methods and techniques. Globalization makes linkages strong and easy with the help of technology between business entities worldwide, so supply chains can become wider between countries and continents. However, this condition allows risks in supply chain networks, especially in communication errors regarding the quantity, time, and specifications of goods requested and delivered (Kirilmaz & Erol, 2017).

In the context of business applications, we strongly believe that it will not be able to stand alone to deliver goods and services to consumers in achieving high service performance, shown by quality, delivery time, and adequate costs. Achieving this condition requires good management from upstream to downstream or from raw materials to distribution. Many companies are involved in the supply chain; even large companies, usually reach hundreds of suppliers and distributors. Therefore, the Market Share Measure and Supply Chain Management affect performance (Endyanti, Kusmantini, & Wahyuningsih, 2021).

Many problems that arise in supply chain activities occur upstream and downstream due to uncertainty in consumer demand and varying production capacities from each member of the supply chain (Vikulov & Butrin, 2014). Apart from these problems, there are also technological constraints that help distribute information from each member of the supply chain regarding the amount, time, and characteristics of goods distributed, especially this condition occurs in small and medium enterprises (Tejaningrum, 2016). The complexity of the supply chain structure is one of the contributors (Pujawan, 2017). On the other hand, it turns out that one of the weaknesses of the business is that it is unable to adequately compete because it does not have a strong supply chain, where risks will exist at every stage of the supply chain (Ganiyu, Yu, Xu, & Providence, 2020).

Here, we analyzed the effectiveness of the supply chain in one of the industries in Indonesia, West Java, which is engaged in the laying hen farmer sector. This industry is called CV Rizka Jaya, located in Ciamis city, West Java, Indonesia. At this time, the average production reached 24 tons of eggs per month. Some of the obstacles that often occur in the distribution process are material damage, incorrect information on the amount and time of delivery, and invoice payment processing. Based on the interview, the difference between sending and receiving is 3%, most likely due to a lack of flexibility between supply network members. Supply chain performance analysis uses the SCOR model with a process approach. This model is considered more effective than other supply chain performance systems by involving evaluations of internal and external activities, financial and non-financial.

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LITERATURE REVIEW

Supply Chain Concept

Every business activity will always aim to deliver goods and services to consumers at a reasonable price, quality, and on time. Of course, achieving this requires a minimum of three parts of cooperation, namely the supplier, the manufacturer, and the distributor. The operational efficiency and effectiveness will be completed well if there is a coordination function, supporting technology, and flexibility among the three (Cao & Zhang, 2011). Conceptually, the supply chain is a company or some part of companies whose interests and operations are related to the raw materials mechanism, products, services, information, and capital from the inventor to the end user (Butilca, Crisan, Salanta, & Ilies, 2011). In contrast, Pujawan (2017) states that the supply chain is a physical network that delivers goods and services from suppliers in the form of materials. Raw manufacturing functions to change the input from the raw material into goods and involves distributors in delivering it to consumers. In the next process, the supply chain concept shifts to supply chain management, including designing, classifying, moving, and determining.

The concept of Supply Chain Management (SCM) was reaffirmed from the Council of Supply Chain Management Professionals (2009), namely activities related to the coordination process among all supply chain members to get a competitive advantage. Supply chain management is needed to solve the differences between its members (Waters, 2011). Chopra and Sodhi (2004) stated that supply chain management would get a competitive advantage if there is long-term synergy and collaboration from suppliers and from manufacturers to distributors so that consumers get the best value in terms of quality, time, and price.

A strategy is needed to satisfy the customer to get a competitive supply chain network. This strategy must be supported by decisions or policies in selecting warehouse locations, transportation, supply, and product development. Achieving this strategy requires the involvement of information technology because it will have a significant relationship with supply chain network flexibility (Christopher & Towill, 2001). In addition to the role of technology, the service model system must be adapted to market and business conditions which is crucial for the effectiveness of the supply chain network (Zhang, 2018). Frequently, the supply chain between one company and another is very different, mainly influenced by the type of product, the number of members involved in the network, and influenced by technology. However, the various basic principles of the supply chain can be applied to all business companies of different sizes (Basu, 2011). Siahaya (2015) mentioned that suppliers, manufacturers, suppliers, wholesalers, and customers are involved in the supply chain. In general, the author can describe the framework of the supply chain, as demonstrated in the picture below:

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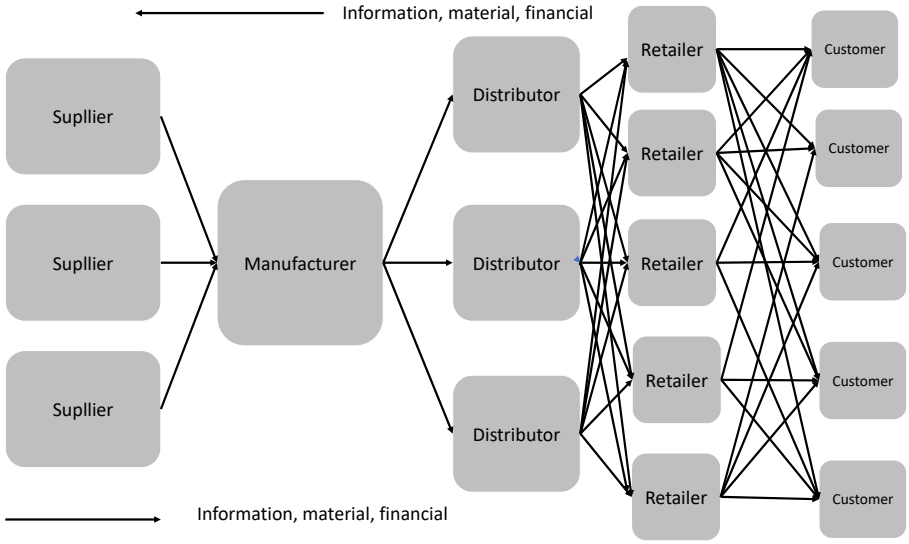
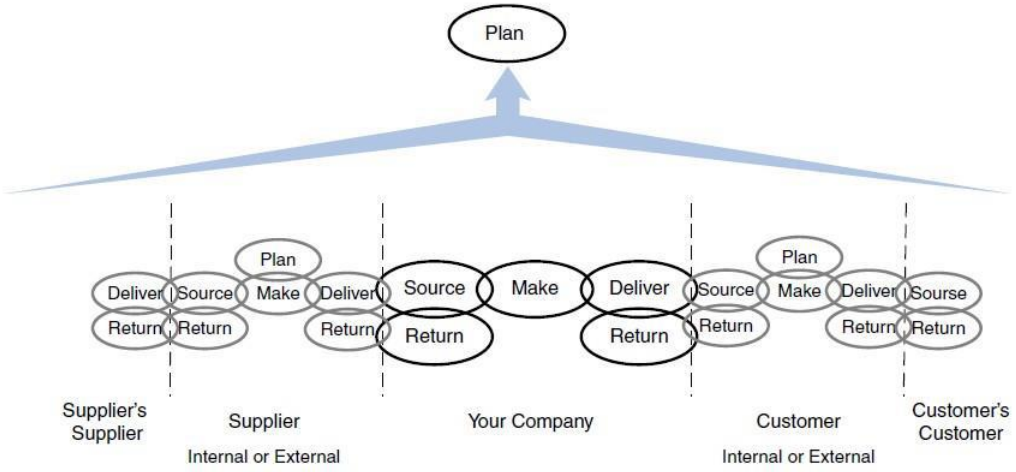
Figure 1. Supply Chain Management Framework



Supply Chain Performance Measurement

In the collaborative relationship between supply chain members, it must be analyzed how high the collaboration performance is. Collaboration that must be emphasized in the supply chain is more on how the flow of materials, information, and money flows from upstream to downstream and vice versa. Melnyk, Stewart, and Swink (2004) state that performance measurement must contain individual metrics, metric sets, and the overall performance measurement system. Furthermore, it is explained that metrics focus on financial and operational performance, where operational performance in the supply chain is more in non-money units, such as lead time, inventory, and process quality. Another model that is process oriented is the Supply Chain Operations References Model (SCOR). This model describes the mapping carried out to describe the material, information, and financial flows from a company's supply chain (Pujawan, 2017). In supply chain mapping in SCOR, processes in the supply chain in the management process are categorized into five core processes. For example, look at the following figure.

Figure 2. Integration of five core processes in SCOR



Source: Supply Chain Operation References (Paul, 2014).

From Figure 2, it can be seen that there are five activities in the supply chain. The first is the designing stage which describes activities related to information on the number of requests and the adjustment process to capacity owned, both at suppliers and distributors. The second activity is ordering expenditures, scheduling delivery, and receiving validation of delivery and storage. Next, concerning transforming input into output followed by delivery to consumers, there is another activity in the form of returns if the goods do not match the order. Lin and Lin's (2018) research shows that startups must increase their communication rate as well as their partnership to increase supply chain integration and cope better. Five elements were applied to measure supply chain performance using the SCOR APICS 2017 model. Those elements are demonstrated below (see table 1).

Table 1. Performance Attributes of the SCOR Model

Performance Attribute	Defense	Formulation Calculation
Reliability	Ability to carry out tasks as expected: timeliness, quality accuracy, and quantity according to consumer demand.	• Perfect order fulfillment
Responsiveness	The speed of completing an order is usually measured by the average cycle time of the order period.	• Order Fulfillment Cycle Time (OFCT)
Agility	The capability to respond to external changes so that the company can compete. Performance measures related to adaptability and flexibility.	• Upside Supply Chain Flexibility (USCF) • Upside Supply Chain Adaptability (USCA) • Downside Supply Chain Adaptability (SCA) • Overall supply Chain Value at Risk
Cost	In relation to the costs incurred in maintaining the supply chain process usually includes labor costs, distribution costs, storage costs, and also material costs. Therefore, the calculation component uses the Cost of Goods Sold (CGS).	• Supply Chain Management Cost (SCMC) • Cost of Goods Sold (CGS)
Asset Management	A low inventory level and high utility capacity indicate the ability to use assets productively.	• Cash-to-Cash Cycle Time (CCCT) • Return on Supply Chain Fixed Assets (SCFA) • Return Working Capital RWC)

Source: Supply Chain Council (2010)

Implementation of the measurement of the activity matrix in table 1, the operational calculations are as follows: Perfect order fulfillment is a presentation of orders that

are perfectly fulfilled according to orders, there are no errors in quantity, quality or errors in documents and information. Order fulfillment cycle time is the amount of time starting from the order made until the goods arrive at the consumer. Upside supply chain flexibility is the time needed to address requests when there is an increase of at least 20% beyond what is planned without having to pay upside supply chain adaptability is an increase in the maximum amount from the amount that is usually served in a sustainable manner which can be done within 30 days. Cash-to-cash cycle time is the very first payment until the sender of materials receives the money. Finally, return on supply chain fixed assets is the speed of income in returning investment in fixed assets.

The mathematical formula from the description above can be seen below :

a. Reliability (Perfect Order Fulfillment (POF))

$$POF = \frac{\text{Total orders} - \text{Total problem orders}}{\text{Total Order}} \; x\ 100\%$$

b. Responsiveness (Order Fulfillments Cycle Time (OCFT))

OCFT = Supply chain process cycle time *(source + make + deliver)*

c. Flexibility (Upside Supply Chain Flexibility (USCF))

$$USCF = \frac{\text{Upstream supply chain flexibility } (source + make\ deliver + return)}{3}$$

d. Costs (Costs of Goods Sold (COGS))

COGS = raw material cost + labor cost + factory overhead

e. Assets Management (Cash-to-Cash Cycle Time (CCCT))

CCCT = Inventory days of supply + days sales outstanding – days payable outstanding

Gap Analysis

The researchers use gap analysis to perform level 1 analysis. In this process, the amount of revenue increase is calculated if the metric at level 1 is reached. Direct calculations can be used for internal supplies, while customers can use either of: the lost opportunity, the canceled order, and the market share measure (Bolstorff & Rosenbaum, 2012).

RESEARCH METHOD

This study begins with an analysis of problems that occur in a supply chain network, with a sample of small and medium enterprises engaged in animal husbandry, with the main product being chicken eggs. As everyone knows that chicken eggs are a product with a high risk of damage to goods; therefore, strong coordination between supply chain networks is needed. The research method is a case study by analyzing a series of supply chains, collecting data and information regarding the flow of material, information, and money between supply chain networks. Analyzing the level of responsiveness, agility, cost, and asset management, and then making comparisons with similar companies. Finally, a performance evaluation was carried out by looking at weaknesses and proposed

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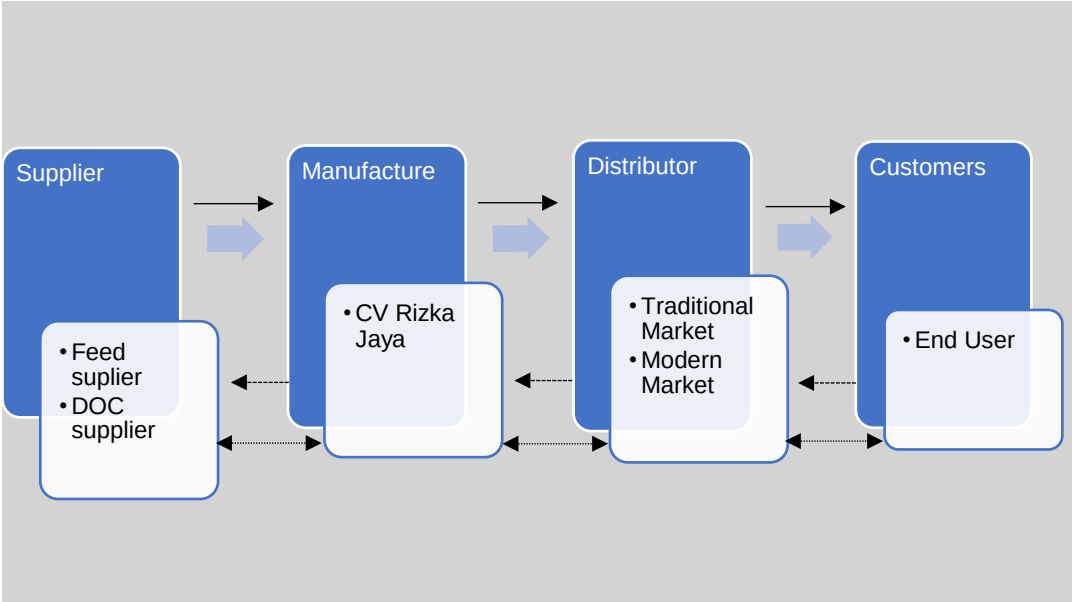
improvements to improve supply chain performance. The performance analysis uses the SCOR method. Data were collected directly in the field by interview and observation.

RESULTS

Company Profile Sample

The following is an overview of the supply chain network of CV Rizka Jaya. The supplier is in the form of raw materials and chicken feed, while the internal process is the process of raising chickens and providing feed so that the chickens grow and produce eggs. To reach consumers, CV Rizka Jaya involves many distributors in traditional and modern markets to reach the final customers.

Figure 3. Supply Chain Network CV Rizka Jaya



Notes:
: Material flow
: Financial flow
: Information flow

Figure 3 shows that the upstream activities (suppliers) are related to the purchase and procurement of raw materials in the form of DOC (day-old chicken) and feed for the chicken healing process. CV Rizka obtains several suppliers in West Java. The suppliers involved are generally large companies engaged in the animal feed and DOC industries. The process which arises in the internal supply chain is the process of growing chicks to adulthood and producing eggs, with activities that occur generally related to the process of receiving orders, delivering, and returning. Thus, reaching consumers will involve distributors, which is done through modern and traditional markets. The supply chain network will be divided into three streams, namely financial, material, and information, from upstream to downstream and vice versa.

Table 2. Sales and Error Distribution

Month	Sales (kg)	Sales (frequency)	Material error	Mis information	Financial error
January	28272	316	63	15	-
February	28613	303	74	8	-
March	26815	310	72	6	-
April	32880	350	91	24	5
May	34780	376	97	19	3
June	27540	303	83	11	-
July	25761	277	68	13	-
August	25700	279	65	7	-
September	23850	263	54	5	-
October	23374	260	83	9	-
November	22147	268	85	8	-
December	25406	299	89	16	5
Total	324019	3604	924	141	13

Source: CV Rizka Jaya 2021

Data were collected for one year in 2020. The distribution of eggs was more than 324 tons, with a shipping frequency of 3604 times for 12 months or an average of 300 shipments a month. From the table above, it can be seen that there are problems related to distribution in the supply chain. As many as 924 times the occurrence of material flow errors, information flow errors 141 times, and financial flow errors 13 times.

Supply Chain Reliability

Based on table 1 above, the number of problem orders in one year as a whole reaches 1078 times, with a total distribution of 3604, then the POF value is:

$$POF = \frac{3604 - 1078}{3604} \; x\ 100\% = 70.08\%$$

Thus, it can be said that the company is only able to provide 70.08% of perfectly fulfilling consumer demands. As many as 29.92% provide problems in distribution related to quantity, information, and financial problems. Most errors are in material errors related to wrong specifications, wrong quantities, wrong delivery times, etc.

Supply Chain Responsiveness

The performance indicator used in measuring Supply Chain Responsiveness is Order Fulfilments Cycle Time (OCFT).

Table 3. Order Fulfillment Cycle Time (OCFT)

Year	Distributor	OCFT
2020	Bandung city	4 day
	Bogor city	4 day
	Tasikmalaya city	2 day

$$OCFT = \frac{4\ day + 4\ day + 2\ day}{3} = 3\ day$$

Thus, the average ordering period is three days. This order time shows the company's readiness to provide a grace period from ordering until the distributor receives the product. The company's target hopes to reach one day, but so far, it has not been achieved due to various obstacles.

Table 4. Upside Supply Chain Flexibility (USCF)

	Sum	
Production Capacity/month	25000 Kg	
Sales increase 20%	5000 Kg	
Number of days needed to fulfill	2	procurement
5000 kg	1	controlling
	1	packing and distribution
	4	USCF

From table 3, it can be seen that the company takes five days for the delivery process when there is a surge in demand as much as 20% of capacity. This condition shows the company's low level of flexibility in dealing with changes in demand because many similar companies only need 2 to 3 days.

Supply Chain Cost

Supply Chain Cost relates to the amount of money or investment that the company spends to invest because there is a supply chain activity. These components are labor costs, material costs, and overhead costs.

Table 5. Cost of Goods Sold

Component	Calculating	Total COGS
Raw Material	72 %	
direct labor costs	5%	81. %
Overhead cost	4%	

The costs incurred related to the purchase of DOC (day-old chicken), feed, vitamins, and equipment are estimated at Rp4.320.000.000 per production. Direct labor costs Rp380.000.000, and factory overhead costs Rp310.000.000. The average value of egg sales reaches Rp6.000.000.000 in one year.

DISCUSSION

Supply Chain Asset Management

Cash-to-cash Cycle Time (CTCCT) is used to analyze supply chain performance from an asset management aspect. Assets play a significant role in supporting the success of the supply chain, usually in the form of warehouses, IT systems, vehicles, etc. In addition, CTCCT is the time required to return investment to the company after capital is used for purchasing raw materials and financing production (APICS, 2017). Cash-to-cash cycle time on egg production CV Rizka Jaya is divided into three calculation components. These components consist of accounts payable, accounts receivable, and inventory days of supply (inventory turnover rate). The following table calculates the cash-to-cash cycle time of egg production in CV Rizka Jaya.

Table 6. Cash-To-Cash Cycle Time

Component calculating	Day	Total CTCCT
Account Payable	1 day	
Account Receivables	2 day	4 day
Inventory Day of Supply	1 day	

Matrix Performance

Based on the results of supply chain performance measurement, it can be obtained the performance matrix SCOR®12.0 on the CV Rizka Jaya, which will be shown in the table below, along with the target of the company. This target is the benchmark for measuring supply chain performance. The following is a table of supply chain performance matrix.

Table 7. Matrix Supply Chain Management Performance

No.	Performance Attributes	Indicator	Performance
1	Supply Chain Reliability	Perfect order fulfillment	70.08%
2	Supply Chain Responsiveness	Order fulfillment cycle time	3 day
3	Supply Chain Flexibility	Upside supply chain flexibility	4 day
4	Supply Chain Cost	Cost of goods sold	81%
5	Supply Chain Asset Management	Cash-to-cash cycle time	4 day

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Benchmarking, Requirement Gap, and Opportunity

To examine the performance of the supply chain is necessary to benchmark companies that are relatively the same in the same area with the same capacity to make comparisons. Derived from the results above from several research sources, the table below describes the actual data, benchmark data, requirement gap, and opportunity of each performance attribute. Thus the company can analyze how well our performance is and how big the gap is as well as opportunities that can be done to improve performance. well our performance is and how big the gap is as well as opportunities that can be done to improve performance.

Figure 4. Benchmarking, Requirement Gap and Opportunity

Performance Atribute	Metrik	Data Actual	Benchmark Data			Gap	Opportunity
			S	A	P		
Supply Chain Reability	POF	70,08%	92,4%	78,5%	65,7%	27,53%	Profit Increase
Supply Chain Responsivnes	OFCT	3 day	1 day	3 day	5 day	2 day	Improve Lead Time
Supply Chain Flexibility	USCF	4 day	3 day	5 day	7 day	1 day	Increase cooperation with suppliers
Supply Chain Cost	COGS	81 %	27%	51,5%	64,8%	54%	reduce material, labor and overhead costs
Supply Chain Asset Management	CTCCT	4 day	4 day	6 day	9 day	-	Optimatization Asset

S= Superior, A= Advantage, P= Parity

From the figure above, there are indicators that fall into the superior category, namely the ability to manage assets to provide good service to consumers and indicators that fall into the Superior category are in the supply chain Asset Management (CTCCT). This condition indicates that the company is able to manage assets in the form of warehouses, vehicles, IT systems, and factories in providing services to distributors as members of the supply chain network. Meanwhile, three indicators included in the Advantage category are Supply Chain Reliability, Supply Chain Responsiveness, and Supply Chain Flexibility. Therefore, the three performances must be improved to achieve superior performance. Meanwhile, the indicator included in the parity category is the Supply Chain Cost which is calculated from the cost of goods sold. Handayani, Affandi, and Irawati (2019) said one of the supply chains for agricultural businesses in Indonesia that is still weak is in its elements.

There are five indicators used for supply chain performance analysis using the SCOR method: Supply Chain Reliability, Supply Chain Responsiveness, Supply Chain Flexibility, Supply Chain Cost, and Supply Chain Asset Management. The results of field data analysis using interviews, data analysis, and direct field observations show that there is still a gap between the five indicators. Only one indicator is included in the superior category, namely Supply chain asset management. The gap for SCR is 27.53%, the gap in Supply Chain Responsiveness is two days, and the gap in Supply Chain Cost is 54%. CV Rizka Jaya can do many opportunities to improve supply chain performance, one of them is to improve the coordination function between supply chain members both

upstream and downstream. It is in line with Chan, Ho, & Gunareksa (2019), who state that infrastructure declines to encourage the achievement of supply chain performance.

CONCLUSION

Small businesses have a major weakness in using technology to coordinate with supply chain networks, especially to ensure information regarding quantity, delivery time, and product specifications. This condition results in a high Cost of Goods Sold (CGS) and low SCR. Another problem in small and medium enterprises is their management, which focuses more on people and not on the system. Owners in SMEs are decision-makers, and managerial dominance is in the owners. This condition is sometimes a function of cooperation between supply chain members, not organizational cooperation but personal cooperation. Future suggestions for improving the supply chain network performance are utilizing technology for cooperation networks, simplifying the network where fewer suppliers and distributors are involved but have a stronger role.

ACKNOWLEDGMENT
Thank you to STIE EKUITAS and Apriadi Illalang's research partner.

DECLARATION OF CONFLICTING INTERESTS
The authors declared no potential conflicts of interest.

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