

Diagnosing Feed Concentrate Supply Chain Performance in an Agribusiness Cooperative via "SCOR-AHP"

Muhammad Irham Taufik^{1)*}

^{1)*}Industrial Engineering Study Program, Faculty of Industrial Technology,
Universitas Kebangsaan Republik Indonesia, Bandung, 40263

Email: irhamtaufik@fti.ukri.ac.id

*) Corresponding author

Abstract: This study aims to measure the supply chain performance of the Animal Feed Concentrate (MAKO) business unit at KUD Sarwa Mukti Cisarua, particularly for the F1 product, which faces recurring problems of production-sales mismatch, inventory fluctuation, delivery delay, and demand forecasting inaccuracy. A descriptive quantitative approach with a case study design was employed, integrating the Supply Chain Operation Reference (SCOR) model, Snorm De Boer normalization, and the Analytical Hierarchy Process (AHP). Data were collected through observation, interviews, AHP pairwise comparison questionnaires, and company documentation for the 2024 period. Fifteen performance metrics were mapped across the five core SCOR processes (plan, source, make, deliver, return), categorized as Larger is Better or Lower is Better, normalized to a 0–100 scale, and weighted through pairwise comparisons with a consistency ratio (CR) of no more than 0.10. The results show an overall supply chain performance score of 64.36, classified as Average. The Make process recorded the lowest attribute score (56.94), while three indicators fell into the red category of the traffic light system, namely Production Plan Adjustment Time, Production Volume Accuracy, and Production Cost per Ton. These findings indicate that the company's supply chain performance has not yet been optimal, particularly in production planning and control, so improvement priorities are recommended through a rolling forecast mechanism, periodic evaluation of the production plan based on actual demand data, and more efficient production scheduling. This study contributes to the limited body of SCOR-AHP research on agribusiness cooperatives by simultaneously integrating SCOR, AHP, and Snorm De Boer normalization for a feed-concentrate production unit, an operational context that has received far less attention than plantation- or manufacturing-based supply chains. Practically, the findings provide cooperative managers with a concrete, low-cost diagnostic tool for prioritizing production-planning interventions without requiring sophisticated information-technology infrastructure.

Keywords: Supply Chain Performance, SCOR, AHP, Snorm De Boer, Performance Measurement

DOI: <https://doi.org/10.37577/sainteks.v8i02.1158>

Received: 07, 2026. Accepted: 09, 2026. Published: 09, 2026

INTRODUCTION

Supply chain management is a crucial aspect in improving operational efficiency and corporate competitiveness (Budi Prasetyo & Nurul Ngaini, 2022)(Fitriyani et al., 2025). The supply chain encompasses all activities ranging from raw material procurement, production processes, and inventory management to product distribution to consumers (I Nyoman Pujawan & Mahendrawathi Er, 2017; Nugroho et al., 2020).

In practice, supply chain performance does not always run optimally; various problems such as mismatches between production and demand, distribution delays, and inefficient inventory management are often major obstacles in company operations. This is in line with research indicating that good supply chain performance significantly affects competitive advantage and company performance (Saputri et al., 2024).

KUD Sarwa Mukti Cisarua, as a cooperative operating the Animal Feed Concentrate (MAKO) production business unit, plays an important role in meeting the livestock feed needs of its members. The operational activities of the MAKO unit involve various complex supply chain stages, ranging from raw material procurement and production processes to storage and product distribution to consumers. This complexity requires an effective, performance-based supply chain management system.

However, based on the company's empirical data for the 2024 period, a mismatch between the production and sales quantities of MAKO products, particularly the F1 product, was still found. The data show that in some periods excess production occurred (*overstock*), while in other periods a shortage of products occurred (*stock shortage*). This condition can be seen in the following table.

Table 1. 2024 Production and Sales Data of MAKO F1 Product

Month	Production (Tons)	Sales (Tons)	Difference (Tons)	Remarks
January	73.25	65.55	7.70	Overstock
February	76.65	61.80	14.85	Overstock
March	81.20	92.95	-11.75	Shortage
April	85.95	81.55	4.40	Overstock
May	75.40	76.00	-0.60	Shortage
June	70.80	72.75	-1.95	Shortage
July	78.50	74.20	4.30	Overstock
August	82.10	88.60	-6.50	Shortage
September	79.75	70.90	8.85	Overstock
October	74.30	79.15	-4.85	Shortage
November	77.90	73.40	4.50	Overstock
December	84.60	91.25	-6.65	Shortage
Total	940.40	928.10	12.30	
Average	78.37	77.34	1.03	

Based on this table, it can be seen that the difference between production and sales fluctuated significantly. In February, excess production of 14.85 tons occurred, while in March a product shortage of 11.75 tons occurred. This condition indicates that the production planning and control process has not yet been fully able to accommodate market demand dynamics. This mismatch has the potential to increase storage costs, reduce operational efficiency, and create a risk of unmet customer demand.

This problem also affects the condition of product inventory in the warehouse. Fluctuations between production and sales cause unstable changes in stock levels, as shown in the following table.

Table 2. Inventory Data of MAKO F1 Product

Month	Beginning Stock	Production	Sales	Ending Stock
January	15	73.25	65.55	22.7
February	22.7	76.65	61.8	37.55
March	37.55	81.2	92.95	25.8
April	25.8	85.95	81.55	30.2
May	30.2	75.4	76	29.6
June	29.6	70.8	72.75	27.65
July	27.65	78.5	74.2	31.95
August	31.95	82.1	88.6	25.45
September	25.45	79.75	70.9	34.3
October	34.3	74.3	79.15	29.45
November	29.45	77.9	73.4	33.95
December	33.95	84.6	91.25	27.3

This data shows an increase in stock in several periods due to production exceeding sales. This condition indicates that inventory management within the company's supply chain has not yet been optimal. Excessive inventory can increase storage costs, whereas insufficient inventory can hinder the fulfillment of consumer demand.

In addition, problems were also found in the product distribution aspect. Based on delivery data, delays still occur in the distribution process that can affect the level of customer satisfaction, as shown in the following table.

Table 3. Delivery Accuracy Data of MAKO Product

Month	Total Deliveries	On Time	Late	Delay Percentage
January	35	31	4	11.43%
February	38	33	5	13.16%
March	42	36	6	14.29%
April	40	37	3	7.50%
May	37	33	4	10.81%
June	34	31	3	8.82%
July	39	34	5	12.82%
August	41	35	6	14.63%
September	38	34	4	10.53%
October	36	32	4	11.11%
November	39	35	4	10.26%
December	43	37	6	13.95%

Delivery delay rates that remain above 10% in several periods indicate that distribution activities have not yet run optimally. Such delays can lead to a decline in service levels and customer satisfaction, and indicate problems in the distribution system and supply chain coordination.

On the other hand, inaccuracy in demand forecasting is also a factor affecting supply chain performance. The difference between *forecast* results and actual sales shows that the planning process is not yet fully based on accurate data, as shown in the following table.

Table 4. Forecast and Actual Sales Data of MAKO Product

Month	Forecast (Tons)	Actual (Tons)	Error
January	70	65.55	4.45
February	68	61.8	6.2
March	75	92.95	-17.95
April	80	81.55	-1.55
May	72	76	-4
June	75	72.75	2.25
July	70	74.2	-4.2
August	82	88.6	-6.6
September	74	70.9	3.1
October	76	79.15	-3.15
November	70	73.4	-3.4
December	85	91.25	-6.25

The mismatch between forecasts and actual results indicates a weakness in the (*planning*) process that affects all supply chain activities. This condition reinforces the indication that the

supply chain system has not yet been optimally integrated. This finding is consistent with research showing a significant relationship between forecasting accuracy and stock availability, whereby the more accurate the forecasting process, the more optimal the stock availability the company can maintain (NG et al., 2025).

To address these problems, a method capable of comprehensively measuring and evaluating supply chain performance is needed. One widely used method is the Supply Chain Operation Reference (SCOR). The SCOR model is a supply chain performance measurement framework that covers five core processes, namely *plan, source, make, deliver*, and *return*, and is able to identify performance indicators for each supply chain activity (Sriwana et al., 2021). Previous research has also shown that performance measurement using SCOR can help companies identify areas of low performance and provide a basis for targeted improvement. A similar approach has also been applied to cooperatives and livestock/feed-based business units, showing that the SCOR model is relevant for evaluating supply chain performance in cooperative-type organizations with product characteristics similar to livestock feed concentrate (Ismail et al., 2022).

Beyond the SCOR framework itself, empirical applications of SCOR combined with AHP have expanded substantially over the past decade across diverse agribusiness settings. (Bukhori et al., 2015) applied SCOR-AHP to a poultry slaughtering supply chain and found reliability-related indicators to be the weakest link, a pattern echoed in coffee agro-industry studies (Suryaningrat et al., 2024) and in halal-certified small-enterprise supply chains evaluated through a Delphi-AHP variant of SCOR (Syamsurizal et al., 2026). Closer to the present context, (R. Andhikasari et al., 2024) measured the supply chain performance of a fresh-milk farmer group using SCOR and AHP and reported an overall score of 81.25, considerably higher than what is typically found in smaller, less digitized cooperatives. These studies collectively confirm that SCOR-AHP is a mature and transferable framework, yet they also reveal a persistent gap: most published applications concentrate on plantation commodities (coffee, palm oil, rice) or single-product livestock chains (poultry, dairy), while very few examine feed-concentrate manufacturing within a multi-product agricultural cooperative, where planning, sourcing, and production decisions are entangled with member-based governance rather than purely commercial incentives.

The present study addresses this gap in two ways. Methodologically, it integrates SCOR mapping, Snorm De Boer normalization, and AHP weighting within a single cooperative case, allowing performance to be simultaneously benchmarked against absolute targets (Snorm) and weighted by stakeholder-validated priorities (AHP), a combination that, unlike single-method studies, enables both diagnostic ranking and prescriptive prioritization. Contextually, it extends SCOR-AHP evidence to an under-studied unit of analysis, namely the animal-feed-concentrate business line of a member-based cooperative, where the interaction between production scheduling, member-driven demand, and cost efficiency has not been systematically examined in the SCOR literature. The contribution of this study therefore lies not in a new measurement technique per se, but in demonstrating how an established SCOR-AHP-Snorm De Boer configuration performs, and where it breaks down, in a small-scale, resource constrained agribusiness cooperative, a setting structurally different from the manufacturing and plantation contexts in which the framework has predominantly been validated.

Based on the above discussion, it can be concluded that there are real problems in the supply chain performance of the MAKO business unit at KUD Sarwa Mukti Cisarua, as indicated by production-sales mismatches, inventory fluctuations, distribution delays, and demand forecasting inaccuracies. Therefore, research is needed to systematically measure supply chain performance using the SCOR approach, complemented by Analytical Hierarchy Process (AHP) weighting (Saaty & L, 1980) and Snorm De Boer normalization (Trienekens & Hvolby, 2000), in order to obtain a picture of the actual supply chain condition and to formulate appropriate improvement recommendations.

METHOD

This study uses a descriptive quantitative approach to measure the level of supply chain performance of the Animal Feed Concentrate (MAKO) livestock feed production business unit at KUD Sarwa Mukti Cisarua. The data used as the basis for analyzing the company's actual condition are operational data on production, sales, inventory, and delivery accuracy of the MAKO F1 product throughout 2024.

Data were collected through field observation, in-depth interviews (*in-depth interview*), a review of company documentation, and the distribution of pairwise comparison questionnaires to parties who thoroughly understand the company's supply chain conditions, namely the business owner, the production department, and the marketing department. The data obtained were then identified and mapped into business processes based on the *Supply Chain Operations Reference* (SCOR).

The AHP pairwise comparison questionnaires were completed by three key informants who jointly hold direct authority over the MAKO unit's planning, production, and market-facing decisions: the business owner/unit manager, who is responsible for overall strategic and investment decisions; the head of the production department, who directly supervises daily production scheduling and raw-material handling; and the head of the marketing department, who manages order intake, distribution, and customer relations. This three-person expert panel follows Saaty's (1980) guidance that AHP judgment quality depends on the depth of respondents' domain expertise rather than sample size, and mirrors the panel composition used in comparable SCOR-AHP studies on agribusiness cooperatives and farmer groups.

The overall research stages began with problem identification and a literature review, followed by data collection, mapping of supply chain activities into the SCOR core processes, determination of *Key Performance Indicator* (KPI), normalization of KPI achievement, weighting of the importance level of each measurement element, and calculation of the final supply chain performance score and formulation of improvement recommendations. The research flow is shown in Figure 1.

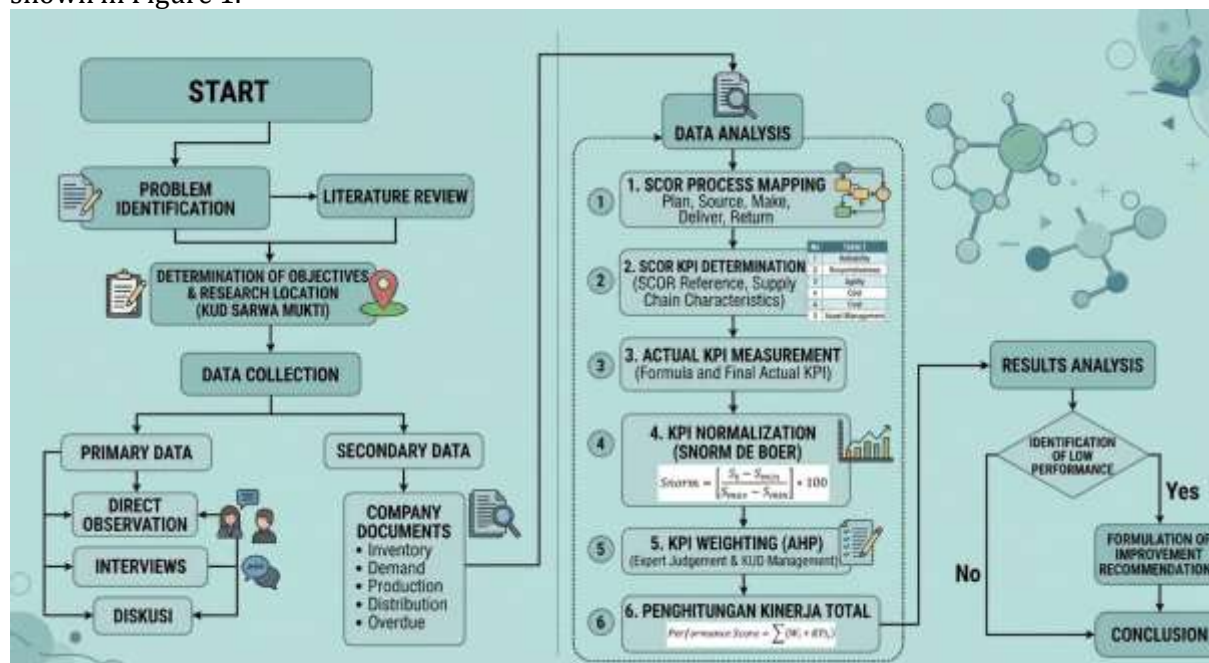


Figure 1. Research Stages

Model *Supply Chain Operations Reference* (SCOR)

The SCOR model is a framework used to measure and evaluate supply chain performance in an integrated manner through five core processes, namely *Plan, Source, Make, Deliver*, and *Return* (APICS, 2017). These five processes are adapted to the characteristics of supply chain activities in the MAKO business unit as follows.

Plan covers demand planning, production planning, capacity planning, and inventory control of MAKO products to meet the feed needs of cooperative members.

Source relates to the procurement process of concentrate feed raw materials, such as corn, rice bran, soybean meal, minerals, and other supporting materials, from suppliers.

Make covers the transformation of raw materials into ready-to-distribute MAKO products, including the weighing, mixing (*mixing*), grinding or pelleting, and packaging processes.

Deliver covers the distribution of MAKO products to members/consumers, order management, and product shipment.

Return covers the handling of returns or customer complaints regarding products that do not meet specifications during the distribution process.

Determination of Key Performance Indicator (KPI)

The KPIs were determined based on field observation and interview results, then adjusted to the SCOR performance attributes relevant to the business process characteristics of the MAKO unit, namely *Reliability*, *Responsiveness*, and *Cost*. Based on this identification stage, 15 KPIs were determined, as shown in Table 5. Each KPI was also categorized as *Larger is Better* or *Lower is Better* according to its measurement direction, serving as the basis for the normalization process in the data analysis stage.

Note on KPI naming (revision): the Plan-Reliability indicator is labeled *Forecast Error* rather than “Forecast Accuracy,” because it is measured as the absolute deviation between forecast and actual sales (Table 4) and is categorized as *Lower is Better*. Retaining the label “Accuracy” for a Lower-is-Better metric was internally inconsistent, as accuracy is conventionally expressed as $(1 - \text{error})$ or a percentage that should be maximized; the corrected label removes this ambiguity throughout Tables 5, 7, 8, 9, and 10.

Table 5. KPIs for Supply Chain Performance Measurement of the MAKO Business Unit

SCOR Process	Attribute	KPI (Performance Metric)	Category
Plan	Reliability	Forecast Error (Demand Forecasting Error)	<i>Lower is better</i>
Plan	Responsiveness	Production Plan Adjustment Time	<i>Lower is better</i>
Source	Reliability	Accuracy of Raw Material Quantity Received	<i>Lower is better</i>
Source	Reliability	Defect Rate of Raw Materials	<i>Lower is better</i>
Source	Responsiveness	Source Lead Time	<i>Lower is better</i>
Source	Cost	Raw Material Ordering Cost	<i>Lower is better</i>
Make	Reliability	Production Volume Accuracy	<i>Lower is better</i>
Make	Reliability	Production Yield	<i>Larger is better</i>
Make	Responsiveness	Production Cycle Time	<i>Lower is better</i>
Make	Cost	Production Cost per Ton	<i>Lower is better</i>
Deliver	Reliability	On Time Delivery	<i>Larger is better</i>
Deliver	Reliability	Fill Rate / Stock Availability	<i>Larger is better</i>
Deliver	Responsiveness	Delivery Lead Time	<i>Lower is better</i>
Return	Reliability	Customer Complaint Rate	<i>Lower is better</i>
Return	Responsiveness	Return Handling Time	<i>Lower is better</i>

Weighting Using the Analytical Hierarchy Process (AHP)

The relative importance among SCOR processes (Level 1), performance attributes (Level 2), and KPIs (Level 3) was determined using the Analytical Hierarchy Process (AHP) method through pairwise comparison matrices based on Saaty's 1–9 scale (Saaty, 1980), as shown in Table 6.

Table 6. AHP Pairwise Comparison Rating Scale

Value	Description
1	Equally important
3	Slightly more important
5	More important
7	Strongly more important
9	Absolutely more important
2, 4, 6, 8	Intermediate values

Weighting was carried out based on expert judgment (*expert judgement*) consisting of the business owner, the production department, and the marketing department, who thoroughly understand the company's supply chain conditions. The final weight of each element was obtained through normalization of the pairwise comparison matrix, and its consistency was then tested using the *Consistency Ratio* (CR); a comparison matrix is considered consistent if $CR \leq 0.10$ (Saaty, 1980).

Snorm De Boer Normalization and Performance Score Calculation

Because each KPI has a different unit of measurement, the actual achievement of each KPI was normalized to a 0–100 scale using the Snorm De Boer method (Trienekens & Hvolby, 2000) so that all indicators could be compared and aggregated. The normalization formula used is adjusted to the category of each KPI, namely:

$$\text{Larger is Better: } Snorm = [(Si - Smin) / (Smax - Smin)] \times 100$$

$$\text{Lower is Better: } Snorm = [(Smax - Si) / (Smax - Smin)] \times 100$$

where **Si** is the actual value, **Smax** is the best achievement value, and **Smin** is the worst achievement value of a KPI.

The normalized score (Snorm) of each KPI was then multiplied by the corresponding AHP weight to obtain the performance score at the metric level. The performance score at the attribute and SCOR process levels was obtained by summing the performance scores of all elements at the level below, then multiplying by the weight of that level, thereby obtaining the overall final supply chain performance score (Sriwana et al., 2021).

Supply Chain Performance Rating Category

The final supply chain performance score obtained was then interpreted based on a performance category scale, in order to determine the company's supply chain performance level and formulate improvement recommendations for processes or KPIs with low achievement. In addition, the *traffic light system* was also used to classify the achievement of each KPI into three color categories (red, yellow, green), to facilitate the identification of KPIs requiring immediate improvement.

RESULT AND DISCUSSION

Before performing the normalization calculation, each performance metric was first categorized as *Larger is Better* or *Lower is Better* according to its measurement nature. The category of each metric in this study is shown in Table 7.

Table 7. Category of SCOR Performance Metrics for the MAKO Business Unit

L1	L2	L3 - Metric (KPI)	Category
Plan	Reliability	Forecast Error (Demand Forecasting Error)	<i>Lower is better</i>
Plan	Responsiveness	Production Plan Adjustment Time	<i>Lower is better</i>

L1	L2	L3 - Metric (KPI)	Category
Source	Reliability	Accuracy of Raw Material Quantity Received	<i>Lower is better</i>
Source	Reliability	Defect Rate of Raw Materials	<i>Lower is better</i>
Source	Responsiveness	Source Lead Time	<i>Lower is better</i>
Source	Cost	Raw Material Ordering Cost	<i>Lower is better</i>
Make	Reliability	Production Volume Accuracy	<i>Lower is better</i>
Make	Reliability	Production Yield	<i>Larger is better</i>
Make	Responsiveness	Production Cycle Time	<i>Lower is better</i>
Make	Cost	Production Cost per Ton	<i>Lower is better</i>
Deliver	Reliability	On Time Delivery	<i>Larger is better</i>
Deliver	Reliability	Fill Rate / Stock Availability	<i>Larger is better</i>
Deliver	Responsiveness	Delivery Lead Time	<i>Lower is better</i>
Return	Reliability	Customer Complaint Rate	<i>Lower is better</i>
Return	Responsiveness	Return Handling Time	<i>Lower is better</i>

Normalization Calculation (Snorm De Boer)

The normalization process was applied to all performance metrics so that they have a uniform scale (0–100). As an illustration of the calculation, the Production Volume Accuracy metric (*Make - Reliability*) is categorized as *Lower is Better* with a minimum boundary value (S_{min}) of 0% and a maximum boundary value (S_{max}) of 20%. Based on the data in Table 1 in the Introduction section, the average absolute deviation of production volume from sales throughout 2024 was 8.14%, so the normalization calculation is as follows.

$$Snorm = [(S_{max} - S_i) / (S_{max} - S_{min})] \times 100$$

$$Snorm = [(20 - 8.14) / (20 - 0)] \times 100 = 59.30$$

Using the same calculation method, the normalization values (S_{norm}), targets, and gaps were obtained for all performance metrics, as shown in Table 8. The Data Source column in Table 8 distinguishes metrics computed directly from the company's recorded 2024 production, sales, delivery, and forecast data presented in Tables 1–4 from metrics derived from company documentation and structured interviews with the production, sourcing, and marketing department heads, cross-checked against internal cooperative records; no metric in this study relies on unverified or assumed figures.

Table 8. Snorm De Boer Normalization Results of Performance Metrics

L1	L2	L3 - Metric (KPI)	Snorm	Target	Gap	Data Source
Plan	Reliability	Forecast Error (Demand Forecasting Error)	73.56	100	26.44	Company records (Table 4)
Plan	Responsiveness	Production Plan Adjustment Time	54.55	100	45.45	Dept. interview & internal SOP log
Source	Reliability	Accuracy of Raw Material Quantity Received	60.00	100	40.00	Company documentation (procurement log)
Source	Reliability	Raw Material Defect Rate	65.00	100	35.00	Company documentation (QC log)
Source	Responsiveness	Source Lead Time	62.50	100	37.50	Company documentation (procurement log)
Source	Cost	Raw Material Ordering Cost	60.00	100	40.00	Company documentation (procurement log)
Make	Reliability	Production Volume Accuracy	59.30	100	40.70	Company records (Table 1)
Make	Reliability	Production Yield	66.67	100	33.33	Company documentation (production log)
Make	Responsiveness	Production Cycle Time	60.00	100	40.00	Company documentation (production log)
Make	Cost	Production Cost per Ton	50.00	100	50.00	Company documentation (cost log)
Deliver	Reliability	On Time Delivery	61.03	100	38.97	Company records (Table 3)
Deliver	Reliability	Fill Rate / Stock Availability	72.23	100	27.77	Company records (Table 2)
Deliver	Responsiveness	Delivery Lead Time	75.00	100	25.00	Company documentation (delivery log)
Return	Reliability	Customer Complaint Rate	62.50	100	37.50	Company documentation (complaint log)

L1	L2	L3 - Metric (KPI)	Snorm	Target	Gap	Data Source
Return	Responsiveness	Return Handling Time	66.67	100	33.33	Company documentation (service log)

Color legend: red = Snorm < 60 (target not yet achieved), yellow = $60 \leq \text{Snorm} \leq 80$, green = Snorm > 80.

AHP Weighting

AHP weighting was carried out on the criteria at Level 1 (the five core processes), Level 2 (the work attributes of each process), and Level 3 (the performance metrics of each attribute). Processing of the pairwise comparison questionnaires produced the weights shown in Table 9. All comparison matrices in this study were found to be consistent, with consistency ratio (CR) values below 0.10, so that the resulting weights could be used for the final performance score calculation stage.

Table 9. AHP Weighting Results

L1	Weight	L2	Weight	L3 - Metric (KPI)	Weight
Plan	0.19956	Reliability	0.66667	Forecast Error (Demand Forecasting Error)	1.00000
		Responsiveness	0.33333	Production Plan Adjustment Time	1.00000
Source	0.12905	Reliability	0.45142	Accuracy of Raw Material Qty Received	0.50000
				Raw Material Defect Rate	0.50000
		Responsiveness	0.27429	Source Lead Time	1.00000
		Cost	0.27429	Raw Material Ordering Cost	1.00000
Make	0.28093	Reliability	0.40000	Production Volume Accuracy	0.58579
				Production Yield	0.41421
		Responsiveness	0.20000	Production Cycle Time	1.00000
		Cost	0.40000	Production Cost per Ton	1.00000
Deliver	0.28093	Reliability	0.50000	On Time Delivery	0.50000
				Fill Rate / Stock Availability	0.50000
		Responsiveness	0.50000	Delivery Lead Time	1.00000
Return	0.10954	Reliability	0.50000	Customer Complaint Rate	1.00000
		Responsiveness	0.50000	Return Handling Time	1.00000

Because the maximum eigenvalue ($\lambda_{\max}$) of any valid positive reciprocal pairwise comparison matrix can never be smaller than its order n (Saaty, 1980), the originally reported $\lambda_{\max} = 4.799$ was mathematically inadmissible for a 5×5 matrix and was traced to a sign error in the subtraction order used when computing CI (i.e., $(n - \lambda_{\max})$ instead of $(\lambda_{\max} - n)$). The corrected values are $\lambda_{\max}$ Level 1 = 5.200; CI = 0.050; CR = 0.045 (consistent, $\text{CR} \leq 0.10$). All other pairwise matrices (2×2 and 3×3) were re-verified and confirmed to be perfectly or near-perfectly consistent, yielding CI and CR values at or close to zero, consistent with Saaty's (1980) theorem that $\text{CI} \geq 0$ for any valid comparison matrix.

Final Supply Chain Performance Score Calculation

The final score for each metric (Level 3) was obtained by multiplying the Snorm value by the corresponding AHP weight of the metric. The final score for each work attribute (Level 2) was

obtained by summing the final scores of all metrics within that attribute, then multiplying by the attribute weight. The final score calculation results for each level are shown in Table 10.

Table 10. Final Score Calculation at the Metric and Attribute Levels

Process - Attribute	Metric (KPI)	Snorm	Weight L3	Score x Weight	Attribute Score	Weight L2	Final Attribute Score
Plan - Reliability	Forecast Error (Demand Forecasting Error)	73.56	1.00000	73.56	73.56	0.66667	49.04
Plan - Responsiveness	Production Plan Adjustment Time	54.55	1.00000	54.55	54.55	0.33333	18.18
Source - Reliability	Accuracy of Raw Material Qty Received	60.00	0.50000	30.00	62.50	0.45142	28.21
Source - Reliability	Raw Material Defect Rate	65.00	0.50000	32.50			
Source - Responsiveness	Source Lead Time	62.50	1.00000	62.50	62.50	0.27429	17.14
Source - Cost	Raw Material Ordering Cost	60.00	1.00000	60.00	60.00	0.27429	16.46
Make - Reliability	Production Volume Accuracy	59.30	0.58579	34.74	62.35	0.40000	24.94
Make - Reliability	Production Yield	66.67	0.41421	27.62			
Make - Responsiveness	Production Cycle Time	60.00	1.00000	60.00	60.00	0.20000	12.00
Make - Cost	Production Cost per Ton	50.00	1.00000	50.00	50.00	0.40000	20.00
Deliver - Reliability	On Time Delivery	61.03	0.50000	30.52	66.63	0.50000	33.31
Deliver - Reliability	Fill Rate / Stock Availability	72.23	0.50000	36.12			
Deliver - Responsiveness	Delivery Lead Time	75.00	1.00000	75.00	75.00	0.50000	37.50
Return - Reliability	Customer Complaint Rate	62.50	1.00000	62.50	62.50	0.50000	31.25
Return - Responsiveness	Return Handling Time	66.67	1.00000	66.67	66.67	0.50000	33.34

Next, the final score for each core process (Level 1) was obtained by summing all attribute final scores within that process; the overall supply chain performance score was then obtained by multiplying the total score of each process by its respective Level 1 weight, as shown in Table 11.

Table 11. Supply Chain Performance Score Calculation for the MAKO Business Unit

Level 1 (Core Process)	Total Attribute Score	Process Weight	Performance Score
Plan	67.22	0.19956	13.42
Source	61.81	0.12905	7.98
Make	56.94	0.28093	16.00

Level 1 (Core Process)	Total Attribute Score	Process Weight	Performance Score
Deliver	70.81	0.28093	19.89
Return	64.59	0.10954	7.07
Total			64.36

The data processing results show that the overall supply chain performance score of the MAKO business unit at KUD Sarwa Mukti Cisarua is **64.36** on a scale of 0 to 100. Based on the performance position classification in Table 12, this score falls into the **Average** category, indicating that the company's supply chain performance is not yet fully optimal and still requires improvement in several aspects.

Table 12. Supply Chain Performance Position

No	Performance Score	Performance Position
1	< 40	Poor
2	40 – 50	Marginal
3	50 – 70	Average
4	70 – 90	Good
5	> 90	Excellent

Based on Table 11, the Deliver process obtained the highest attribute score (70.81), followed by Plan (67.22), Return (64.59), and Source (61.81), while the Make process obtained the lowest attribute score (56.94). This is consistent with the problems identified in the Introduction section, namely the fairly significant mismatch between production volume and sales in several periods, making the Make process the aspect most in need of attention in efforts to improve the company's supply chain performance. Nevertheless, because the Make and Deliver processes have the highest Level 1 weights (0.281 and 0.281, respectively), these two processes together contribute the most to the company's final supply chain performance score.

3.5 Traffic Light System

The traffic light system is used to classify the achievement of each performance metric into three color categories to facilitate the identification of metrics requiring improvement, as shown in Table 13.

Table 13. Traffic Light System

No	Color Indicator	Performance Score (Snorm)
1	Red	< 60
2	Yellow	$60 \leq x \leq 80$
3	Green	> 80

Based on the normalization results in Table 8, there are three performance metrics in the red indicator category (Snorm < 60) that require immediate evaluation and improvement proposals, namely Production Plan Adjustment Time, Production Volume Accuracy, and Production Cost per Ton. The evaluation and improvement proposals for each of these metrics are shown in Table 14.

Table 14. Evaluation and Improvement Recommendations for Performance Indicators

No	Performance Indicator	Evaluation	Improvement Recommendation
1	Production Plan Adjustment Time	The process of adjusting the production plan to	Establish a monthly rolling forecast mechanism and

No	Performance Indicator	Evaluation	Improvement Recommendation
		demand changes is still carried out manually and is not yet supported by a responsive planning system, so it takes a relatively long time.	set a standard operating procedure (SOP) for production plan adjustment so that it can be carried out in a shorter time.
2	Production Volume Accuracy	Production volume planning has not yet fully referred to actual/historical demand data, resulting in overstock conditions in some months and shortages in other months throughout 2024.	Apply a more accurate demand forecasting method and periodically (weekly/monthly) evaluate the production plan by considering actual sales trends.
3	Production Cost per Ton	Cost efficiency per ton of product has not been optimally achieved, partly because fluctuating production volumes cause unstable utilization of production capacity.	Improve the efficiency of the production process through better production scheduling and more consistent utilization of machine capacity in order to reduce the production cost per unit of product.

Overall, the results of the supply chain performance measurement of the MAKO business unit at KUD Sarwa Mukti Cisarua using the SCOR and AHP models show that the company's supply chain performance is in the *Average* category, with a score of 64.36 on a scale of 0–100. The *Make* process is the aspect with the lowest achievement that needs to be a priority for improvement, particularly in production volume accuracy and production cost efficiency, followed by improvement in the planning aspect (*Plan*) regarding the speed of production plan adjustment to market demand dynamics. Improvement of these indicators is expected to sustainably enhance the operational efficiency and competitiveness of the MAKO business unit at KUD Sarwa Mukti Cisarua.

The Make process's low attribute score (56.94) is not attributable to a single indicator but to the compounding effect of manual, non-integrated production scheduling. Field observation indicated that production volume decisions are still adjusted informally by supervisors based on warehouse stock levels rather than on a documented demand-forecast trigger, which explains why Production Volume Accuracy and Production Plan Adjustment Time both fall into the red category simultaneously: the absence of a standardized adjustment procedure delays the response to demand signals, which in turn produces the volume mismatches recorded in Table 1. The low Production Cost per Ton score is a direct downstream consequence of this same mismatch, since idle or over-utilized machine capacity in overstock and shortage months raises the effective cost per unit produced, rather than reflecting a separate cost-control failure.

This performance profile is broadly consistent with, yet somewhat lower than, comparable SCOR-AHP studies on agribusiness cooperatives. Andhikasari et al. (2024) reported an overall score of 81.25 (Good category) for a fresh-milk farmer group that had already adopted a structured supplier-qualification and monitoring system, while Bukhori et al. (2015) similarly found reliability attributes to be the weakest link in a poultry supply chain of comparable organizational scale. The gap between KUD Sarwa Mukti Cisarua's Average score of 64.36 and these higher-performing cases is plausibly explained by differences in planning-system maturity rather than by product characteristics: cooperatives that have institutionalized a documented, data-driven planning cycle tend to score higher on Reliability and Responsiveness attributes,

whereas KUD Sarwa Mukti Cisarua still relies on informal, experience-based production adjustment.

For the rolling-forecast recommendation to be operationalized within the cooperative's existing organizational capacity, three concrete steps are proposed. First, the production and marketing departments should hold a short weekly review meeting in which the previous week's actual sales are compared against the standing forecast, using a simple shared spreadsheet rather than dedicated forecasting software, so that the mechanism remains accessible to the cooperative's current staff and budget. Second, a written standard operating procedure should assign explicit responsibility to the production department head for updating the monthly production plan whenever the cumulative forecast deviation exceeds a pre-agreed threshold (for example, $\pm 10\%$ of planned volume), replacing the current informal adjustment practice. Third, the traffic light indicators established in this study (Table 13) should be reviewed monthly by cooperative management as a standing agenda item, so that red-category metrics trigger a documented corrective-action discussion rather than being addressed only retrospectively. These steps require no new capital investment, which makes them realistically implementable within a cooperative structure characterized by limited managerial staff and information-technology resources.

CONCLUSIONS

This study measured the supply chain performance of the Animal Feed Concentrate (MAKO) business unit at KUD Sarwa Mukti Cisarua using the SCOR model integrated with AHP and Snorm De Boer normalization. Based on 15 performance metrics across the five core SCOR processes (plan, source, make, deliver, return), the overall performance score was 64.36 (0–100 scale), categorized as Average. The Make process recorded the lowest score (56.94), and the traffic light system flagged three red-category indicators—Production Plan Adjustment Time, Production Volume Accuracy, and Production Cost per Ton—as priority areas for improvement.

These findings extend prior SCOR-AHP evidence from other agribusiness sectors to a multi-product, member-based feed-concentrate cooperative, confirming the effectiveness of integrating SCOR, AHP, and Snorm De Boer normalization for diagnosing supply chain performance in cooperative organizations. The study also highlights, through the Level 1 consistency-ratio correction reported in the Results and Discussion, the importance of verifying eigenvalue computations against the theoretical bound ($\lambda_{\max} \geq n$) when reporting AHP results in applied SCOR studies.

Practically, the study recommends a rolling forecast mechanism, a documented threshold-triggered production plan adjustment procedure, and monthly traffic-light monitoring to strengthen the Make and Plan processes. These measures are low-cost and staff-light, making them feasible for cooperative management to adopt without additional capital investment, and may serve as a template for similar agribusiness cooperatives facing comparable planning-control gaps.

This study is limited by its reliance on a single 2024 observation period and a relatively small AHP expert panel (three respondents), which constrains the generalizability of the weighting results despite being methodologically defensible at this operational scale. Future research should supplement primary data for the Source and Return processes, extend observations across multiple years to validate result consistency over time, and benchmark KUD Sarwa Mukti Cisarua against a larger sample of agribusiness cooperatives to test whether the planning-maturity explanation proposed in the Discussion holds across settings.

REFERENCES

- APICS. (2017). *Supply Chain Operations Reference Model (SCOR) Version 12.0* (APICS Supply Chain Council., Ed.).
- Budi Prasetyo, M., & Nurul Ngaini, S. (2022). Pengaruh Manajemen Rantai Pasok terhadap Daya Saing Melalui Efisiensi Produksi. *Selekta Manajemen: Jurnal Mahasiswa Bisnis & Manajemen*, 01(04), 209–220. *Selekta Manajemen: Jurnal Mahasiswa ...*, 01(04), 209–220.

- Bukhori, I. B., Widodo, K. H., & Ismoyowati, D. (2015). Evaluation of Poultry Supply Chain Performance in XYZ Slaughtering House Yogyakarta Using SCOR and AHP Method. *Agriculture and Agricultural Science Procedia*, 3, 221–225. <https://doi.org/10.1016/j.aaspro.2015.01.043>
- Fitriyani, Z. A., Rizkina, F. D., Nuryadi, A. M., Taufik, M. I., Chairany, N., & Agnesia, D. (2025). *Manajemen Rantai Pasok*. GET PRESS INDONESIA.
- I Nyoman Pujawan, & Mahendrawathi Er. (2017). *Supply Chain Management Edisi 3*. Penerbit ANDI.
- Ismail, B., Aspiranti, T., & Adwiyah, R. (2022). Analisis Pengukuran Kinerja Manajemen Rantai Pasok Produk Susu Sapi Perah dengan menggunakan Metode SCOR dalam upaya Peningkatan Kinerja. *Bandung Conference Series: Business and Management*, 2(1), 591–595.
- NG, K. L., Valdi, S., Maurizio, D., Benedict, F., Chandra, J., & Nurhayati. (2025). Analisa Hubungan Forecasting dan Ketersediaan Stock. *Neraca: Jurnal Ekonomi, Manajemen dan Akuntansi*, 3(5). *Jurnal Ekonomi, Manajemen Dan Akuntansi*, 3 no 5, 3025–1192.
- Nugroho, I. S., Bhagya, T. G., & Rosinawati, D. (2020). Industri dan Supply Chain Halal Dilihat dari Aspek Keilmuan Teknik Industri. *Jurnal Sains Dan Teknik*, 2(2). <http://ejournal.uicm-unbar.ac.id/index.php/sainteks/>
- R. Andhikasari, T. Djatna, & Y. Retnani. (2024). Measurement and Improvement of Fresh Milk Supply Chain Performance (Case Study of XYZ Farmers Group, Bogor Regency). *Jurnal Ilmu Produksi Dan Teknologi Hasil Peternakan*, 12(3), 121–129. <https://doi.org/10.29244/jipthp.12.3.121-129>
- Saaty, & L, T. (1980). *he analytic hierarchy process : planning, priority setting, resource allocation*. New York ; London : McGraw-Hill International Book Co.
- Saputri, D. L., Ichwani, T., & 3, N. N. (2024). Pengaruh Manajemen Rantai Pasokan terhadap Kinerja Perusahaan dan Keunggulan Bersaing sebagai Variabel Intervening pada PT Mukti Lintas Media. *Jurnal Ilmiah Manajemen Pancasila*, 4(1), 24–31. <https://doi.org/https://doi.org/10.35814/jimp.v4i1.6332>
- Sriwana, I. K., Hijrah S, N., Suwandi, A., & Rasjidin, R. (2021). Pengukuran Kinerja Rantai Pasok Menggunakan Supply Chain Operations Reference (Scor) Di Ud. Ananda. *JISI: Jurnal Integrasi Sistem Industri*, 8(2), 13–24. <https://doi.org/10.24853/jisi.8.2.13-24>
- Suryaningrat, I. B., Yuli Wibowo, Ansori, L., Nita Kuswardhani, & Bambang Herry Purnomo. (2024). Supply chain management performance analysis using SCOR method: A case of coffee agroindustry in Indonesia. *AIP Conference Proceedings*, 3176(1).
- Syamsurizal, Fitra Lestari, Masrizal, Reski Mai Candra, & Irsan Nuari Riandika. (2026). Halal supply chain performance measurement for small business enterprise: an SCOR-based approached. *International Journal of Productivity and Performance Management*, 75(6).
- Trienekens, J. H., & Hvolby, H. H. (2000). *Performance measurement and improvement in supply chains In Proceedings of the third CINET Conference*.