JURNAL ILMIAH
MANAJEMEN DAN BISNIS

Journal Ilmiah Manajemen dan Bisnis

ISSN 2460-8424
Volume 11, No. 3, November 2025, 319-336
E-ISSN 2655-7274

Unveiling Fisheries Supply Chain Performance with SCOR: Challenges for Food Security amid Climate Change

Yelita Anggiane Iskandar, Resista Vikaliana*, Echa Ratu Prety Claudia Situmeang, and Pauline Nancy Desline Layman

Universitas Pertamina, Indonesia
Email: resista.vikaliana@universitaspertamina.ac.id

Abstract

Indonesia's capture fisheries sector plays a critical role in sustaining coastal livelihoods and national food security; however, production from both aquaculture and capture fisheries has not shown stability nor met the targets of the KKP Strategic Plan (RENSTRA) 2020-2024. In Fisheries Management Area (WPP) 713, particularly Teluk Aru, South Kalimantan, fish catch volumes have been declining, driven by the dual pressures of climate change and inefficiencies in fishing practices, storage, and supply chain management. These challenges not only threaten the availability of fish as a key protein source but also undermine economic growth and community resilience. This study seeks to evaluate the performance of the fisheries supply chain in Teluk Aru by designing indicators that explicitly incorporate climate change adaptation and food security dimensions, which remain underexplored in prior research. Data were collected through surveys, observations, and Focus Group Discussions (FGDs) with fishers, collectors, consumers, and local stakeholders, and analyzed using the Analytic Hierarchy Process (AHP) within the Supply Chain Operations Reference (SCOR) framework. The results identified 17 valid and relevant key performance indicators (KPIs), yielding an overall performance score of 43.71 out of 81.00, categorized as "low." With only one KPI meeting its target, the findings underscore the urgent need for policy action and supply chain improvements to enhance resilience and sustainability in the fisheries sector.

Article info
Article history:
Received 25 August 2025
Received in revised form 17 November 2025
Accepted 28 November 2025
Available online 30 November 2025

Keywords: Fisheries Supply Chain, Climate Change Adaptation, Food Security, SCOR Model, Performance Measurement

How to Cite: Iskandar, Y.A., Vikaliana, R., Situmeang, E.R.P.C., & Layman, P.N.D,. (2025). Unveiling Fisheries Supply Chain Performance with SCOR: Challenges for Food Security amid Climate Change. *Journal Ilmiah Manajemen dan Bisnis, 11* (3), 319-336.

INTRODUCTION

The fisheries sector plays a vital role in supporting food security, livelihoods, and regional economies, particularly in coastal and island regions where marine resources form the backbone of local food systems. Globally, capture fisheries contribute significantly to protein supply, yet the sector faces persistent challenges related to sustainability, efficiency, and resilience. One of the most pressing issues is the high level of post-harvest losses, driven by the perishable nature of fish. Losses can reach up to 35%, translating into both economic inefficiency and reduced availability of nutritious food. Beyond perishability, other challenges such as inefficient supply chain practices, inadequate infrastructure, and unsustainable fishing methods contribute to resource depletion and threaten long-term fishery productivity (Anwar et al., 2019; Husen et al., 2024; Palo & Najamuddin, 2017).

These vulnerabilities are compounded by the growing impact of climate change. Rising sea surface temperatures, changing currents, and more frequent extreme weather events have disrupted traditional fishing patterns and heightened uncertainty in capture fisheries. Fishermen face shorter fishing seasons and increased risks, while poor cold chain infrastructure accelerates quality deterioration once fish are harvested (Choirunnisa et al., 2022; Pratama et al., 2016). The combined effect of these pressures has weakened the resilience of fisheries supply chains, particularly in developing regions where adaptive capacity is still limited. As a result, fisheries-dependent communities are increasingly vulnerable to food insecurity and economic instability.

Indonesia, as one of the world's largest maritime nations, illustrates these dynamics. The country is highly dependent on capture fisheries for both domestic consumption and export earnings. However, significant regional disparities exist in terms of productivity, efficiency, and resilience of fisheries supply chains. One of the regions most severely affected is Teluk Aru in South Kalimantan, which falls under Fisheries Management Area (WPP) 718. Recent data show that Teluk Aru has experienced the sharpest decline in capture fisheries production nationwide: from 242,049 tons in 2021 to only 66,576 tons in 2023, representing a 37.71% reduction (Badan Pusat Statistik, 2024; Setiawan et al., 2024). Key commodities such as mackerel, tuna, and anchovies have been heavily impacted.

Interviews with local stakeholder's attribute this decline to several interconnected factors. These include limited access to modern fishing equipment, reliance on simple storage facilities, underdeveloped distribution systems, and the growing effects of climate change (Pratomo & Rustamaji, 2020). WPP 718 is also considered one of the most climate-vulnerable fisheries zones in Indonesia, due to its high dependence on capture fisheries and the limited adaptive capacity of local fishermen. For instance, uncertain weather conditions and high waves have significantly reduced the number of fishing trips, while inadequate cooling facilities have led to quality deterioration before fish reach auction markets. Fishermen often maximize catches per trip to offset reduced operating days, yet this practice can drive overfishing when non-selective gear, such as small-mesh nets, captures juvenile fish (Munaeni et al., 2024).

At the same time, collectors who function as the first-tier suppliers in the local supply chain also face logistical constraints. Fish are typically transported using motorcycles equipped with basic ice boxes, which fail to maintain ideal storage conditions. As a result, fish quality deteriorates during distribution, contributing to post-harvest losses and higher market prices of IDR 5,000–10,000 per kilogram (Afiyah et al., 2019). These inefficiencies across the supply chain from harvesting to handling, storage, and distribution directly undermine food security, both by reducing fish availability and by making prices less affordable for local consumers.

Despite the urgency of these challenges, systematic performance measurement of the fisheries supply chain in Teluk Aru has not yet been conducted. The absence of structured performance evaluation limits the ability of stakeholders to identify critical bottlenecks, design targeted interventions, and monitor progress toward sustainability and resilience. Performance measurement models such as the Supply Chain Operations Reference (SCOR) framework provide a comprehensive approach to evaluating supply chain effectiveness and efficiency by examining multiple dimensions, including reliability, responsiveness, flexibility, cost, and asset management (Van Der Vorst, 2006). Applying such a model in the context of Teluk Aru is therefore timely and necessary, as it would provide evidence-based insights into supply chain weaknesses while also offering guidance for improving resilience in the face of climate change.

This study aims to evaluate the performance of the Teluk Aru fisheries supply chain using the SCOR model. Specifically, the objectives are to: Assess the efficiency and effectiveness of fisheries supply chain actors in Teluk Aru, focusing on fishermen and collectors as key players.; Identify critical bottlenecks and sources of post-harvest losses across different stages of the supply chain.; Examine the implications of climate change and infrastructure limitations on the resilience and sustainability of the supply chain.; Provide recommendations to improve fisheries supply chain performance, enhance food security, and support adaptation to climate change.

The contributions of this study are threefold. First, it extends the application of the SCOR model to a fisheries context in Indonesia, providing a structured framework for performance evaluation in a sector where such approaches remain underutilized. Second, it generates empirical insights into the specific challenges faced by the Teluk Aru fisheries supply chain, thereby filling a knowledge gap at the regional level. Third, the study contributes to broader policy discussions on food security and climate change adaptation by highlighting practical strategies for strengthening the efficiency, effectiveness, and resilience of fisheries supply chains in vulnerable coastal communities.

METHOD

This study is designed to evaluate the performance of the supply chain in the fisheries sector, with a particular focus on the Teluk Aru region. Problem identification was first conducted through a comprehensive literature review of books and journals, which revealed that the fisheries industry is currently facing a significant decline. Further field evidence shows that the most severe decrease in fish production has occurred in Teluk Aru Village, Kota Baru Regency, South Kalimantan. Given the critical role of the fisheries sector as a contributor to Gross Domestic Product (GDP) and as a source of foreign exchange for the country, an evaluation of the supply chain in this sector is urgently required.

To achieve this objective, the research will be carried out through several systematic stages to ensure the collection of accurate data and reliable information. The methodology will employ a combination of literature review, interviews, and data analysis to provide a comprehensive understanding of the existing supply chain conditions. Measuring the performance of the fisheries supply chain in Teluk Aru is therefore expected to serve as a crucial step toward identifying key inefficiencies, proposing strategic improvements, and supporting the sustainability and resilience of the fisheries sector.

Supply chain performance can be measured using the SCOR model (Figure 1), which commonly applies a four-level structure to develop an effective performance measurement system, with each level providing different depth in evaluating supply chain processes. In this study, the SCOR model was enhanced by incorporating parameters related to climate change adaptation and food security, allowing the traceability of key performance indicators (KPIs) toward achieving broader strategic goals such as SDG 13 (Climate Action), SDG 14 (Life Below Water), as well as Asta Cita 2 and Asta Cita 6 of Indonesia's national development agenda. These goals include promoting public participation in climate change mitigation and adaptation, integrating climate policies into national strategies, strengthening human and institutional capacity, ensuring sustainable fisheries management across the 11 Fisheries Management Areas of Indonesia (WPPNRI), advancing food, energy, and water self-sufficiency, and fostering economic equity through village-level development.

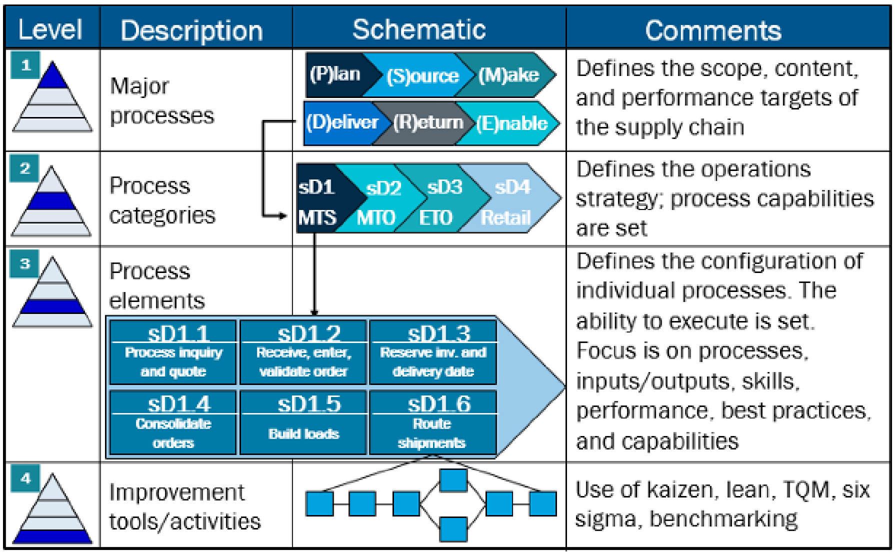

Figure 1. SCOR Model Hierarchy (APICS, 2017)

The determination of KPI weights was carried out using the Analytical Hierarchy Process (AHP) method, as KPI weights are a key factor in calculating the overall fisheries supply chain performance.

The weighting process was based on questionnaire results assessing the relative importance of each indicator across SCOR levels, and Expert Choice software was employed to ensure accuracy in AHP data processing. Once the weights were established, the actual values for each KPI were calculated using predefined formulas, followed by normalization to standardize diverse scales and units of measurement. This normalization was essential to enable fair and consistent comparisons across indicators with different parameters.

The final stage was the determination of the overall fisheries supply chain performance score, obtained by multiplying each KPI weight with its normalized value and then aggregating the results. This comprehensive score not only reflects the effectiveness of the fisheries supply chain but also provides insights into the level of adaptation to climate change within the fisheries sector. Consequently, the findings lay a foundation for developing more effective strategies to communicate climate-related risks, redesign marine food production policies, and support policymakers in addressing the needs of fishermen before implementing adaptive measures.

The analysis and discussion stage are a crucial part of this study, as all processed data will be examined in depth to determine the intended outcomes. The results of this analysis will provide a comprehensive overview of the fisheries supply chain conditions in Teluk Aru, from fishermen to consumers, and will serve as the basis for formulating solutions and recommendations needed to improve the efficiency of the fisheries supply chain system in the region. The analysis was carried out with two main focuses:

Evaluation of the KPI calculation results using the Traffic Light System (TLS). Each indicator and the overall supply chain performance were mapped using the TLS concept. This approach facilitates the identification of areas that need improvement or should be maintained. The classification standard follows a color scheme below (Parwati et al., 2019):

Table 1. TLS Standard Values for Indicators and Supply Chain Performance

Score Range (X)	Color	Performance Achievement Description
$X \leq 60$	Red	Unsatisfactory/Poor
$60 < X < 80$	Yellow	Marginal/Average
$X \geq 80$	Green	Satisfactory/Excellent

This method helps identify performance indicators that have not yet reached the established targets. The evaluation results form the basis for developing targeted improvement proposals, particularly in addressing the challenges faced by fisheries supply chain actors in Teluk Aru.

Analysis of the impact of KPI implementation on the sustainability and efficiency of the fisheries supply chain in Teluk Aru. This analysis is important to understand how the performance measurement system can support the development of a sustainable fisheries sector that benefits all stakeholders, from fishermen to end consumers.

RESULTS AND DISCUSSION

In this study, data were collected in two stages, consisting of primary and secondary data. Primary data were obtained through questionnaires completed by respondents, while secondary data were gathered from various sources based on a literature review related to supply chain performance measurements, such as vision and mission statements, general data required for the Teluk Aru context, and information on fisheries business processes. The SCOR model was used to analyze the questionnaire results, thereby generating the measurement of Key Performance Indicators (KPIs). Measurement of the supply chain flow was carried out by adjusting its levels based on the SCOR model structure. The mapping results of the KPIs at each level of the SCOR model can be seen in Table 2 for fishermen and Table 3 for collectors.

Table 2. Key Performance Indicator: Fishermen

Level 1 (Main Process)	Index	Level 2 (Attribute)	Level 3 (KPI)	Unit
Plan	P1.1,2	Flexibility	KPI-01 Accuracy of Fishing Planning	%
	P1.4	Reliability	KPI-02 Suitability of Fishing Gear Usage to Fish Size and Species	%
	P1.5	Flexibility	KPI-03 Fishermen's Knowledge Level in Using GPS	%
Source	S1.1	Cost	KPI-04 Number of Training and Counseling Sessions Related to Safety, Navigation, and Operations	Times/Year
	S1.2	Reliability	KPI-05 Fishing Selectivity	%
Make	M1.1	Cost	KPI-06 Total Capture Fisheries Production	Kg/trip
	M1.2,2.2	Asset	KPI-07 Suitability of Storage Media Type to Catch Volume	%
	M1.3,4	Reliability	KPI-08 Quality of Landed Fish According to BSN Standards	Kg (ton)
	M1.5	Cost	KPI-09 Provision of Ice During Storage	Ratio (kg

				ice/kg fish)
Deliver	D1.1	Responsiveness	KPI-10 Transportation Time	Hours/day
Return	R1.1	Reliability	KPI-11 Percentage of Fish Damage After Catching and Handling at TPI	%

Table 3. Key Performance Indicator: Collectors

Level 1 (Main Process)	Index	Level 2 (Attribute)	Level 3 (KPI)	Unit
Make	M2.1	Reliability	KPI-12 Errors in Packaging	%
Deliver	D2.4	Responsiveness	KPI-13 Delivery Time	Hours
Return	R2.1	Reliability	KPI-14 Number of Damages During Distribution	%
Enable	E1.1,2.1	Responsiveness	KPI-15 Order Fulfillment Lead Time	Days
	E2.2	Asset	KPI-16 Temperature Control	Celsius
	E2.3,3,4	Reliability	KPI-17 Quality of Fish Sold According to BSN Standards	%

After the validation process for each performance indicator was completed, the next step was to establish the properties of each KPI. These properties include the indicator description, target to be achieved, unit of measurement, calculation formula, responsible party, measurement frequency, as well as the evaluation system that indicates whether the KPI is better if its value is higher (*higher is better*) or lower (*lower is better*). *Higher is better* indicates that the higher the value or score obtained, the more optimal or positive the performance. Conversely, *lower is better* indicates that the lower the value or score achieved, the better the performance or the more optimal the result (Ulfah, 2018). The selection of formulas in KPI measurement is closely related to the characteristics and evaluation system of each indicator, which can be further adjusted depending on the perception of success in the assessment context being applied. The development of KPI properties was based on literature reviews of previous studies that discussed similar KPIs.

The final stage of implementing the SCOR model is the weighting process of the performance indicators (KPIs). The weighting is carried out to identify the priority level of each perspective as well as its influence on the fisheries performance in Teluk Aru. This process was conducted by distributing questionnaires to respondents using a pairwise comparison approach, namely the Analytical Hierarchy Process (AHP). The results of this weighting serve as the determinant of the importance level of each performance indicator in achieving the fisheries performance in Teluk Aru.

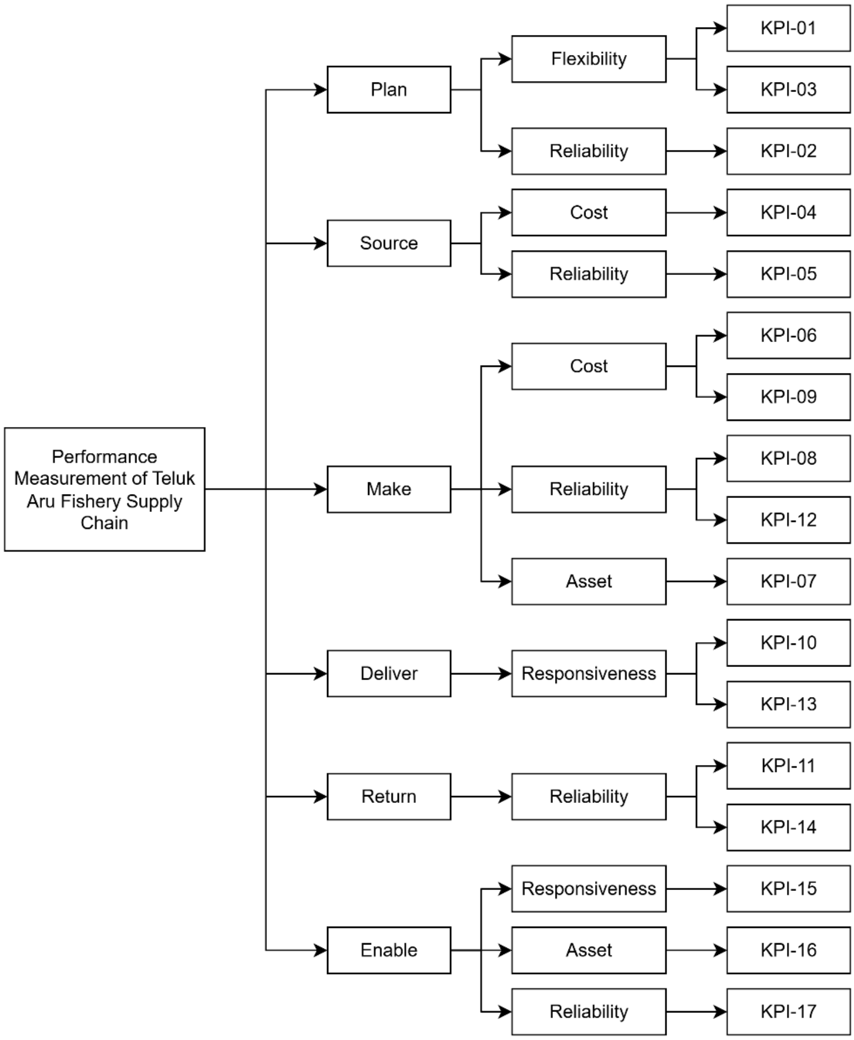

Figure 2. Hierarchical Structure of the SCOR Model

In this study, a total of 18 respondents were involved, consisting of two main actor groups, namely fishermen and collectors. For the fisherman group, respondents included 5 community members working as fishermen in Teluk Aru, 1 village head of Teluk Aru, 5 extension officers in Kotabaru Regency, and 1 head of the Fisheries Department of Kotabaru Regency. Similarly, for the collector group, respondents were composed of 5 community members working as collectors in Teluk Aru, 1 village head of Teluk Aru, 5 extension officers in Kotabaru Regency, and 1 head of the Fisheries Department of Kotabaru Regency. The respondents were asked to provide assessments at each level, covering the core processes, performance attributes, and individual KPIs, using the pairwise comparison method with a rating scale ranging from one to nine. To systematically support the complex decision-making process, Expert Choice version 11 software was used. This software enables the integration of assessments from multiple respondents into a single consolidated value (Ishizaka & Labib, 2009). The hierarchical structure of the SCOR model used to measure the performance of the Teluk Aru fisheries supply chain is presented in Figure 2.

The hierarchical structure illustrated in Figure 2 represents the implementation of the SCOR model within the Teluk Aru fisheries supply chain. The primary focus of this study is placed on the first hierarchy, namely the assessment of supply chain performance in the Teluk Aru fisheries sector. The second hierarchy encompasses the six core processes defined in the SCOR model (level 1), consisting of plan, source, make, deliver, return, and enable. Each of these processes is further specified by performance attributes in the third hierarchy (level 2). Specifically, the plan process emphasizes reliability and flexibility, source emphasizes cost and reliability, make emphasizes cost, reliability, and asset, deliver emphasizes responsiveness, return emphasizes reliability, and finally, enable emphasizes responsiveness, asset, and reliability. At the fourth hierarchy (level 3), key performance indicators (KPIs) are established to measure performance in alignment with the objectives of this research. The subsequent stage involves the weighting process up to the global level for each KPI. The results indicate the overall weighting at level 3 of the SCOR model, with an inconsistency value of 0.03, which is below the threshold of 0.1. This confirms that the evaluations provided by the respondents are consistent and therefore acceptable for use in this study. The weighting represents the combined outcome of core processes, performance attributes, and key performance indicators (KPIs), which are presented in detail in Table 4.

Table 4. SCOR Model Weighting Results by Level

Main Processes (Level 1)	**Weighting at Level 1**	**Performance Attributes (Level 2)**	**Weighting at Level 2**	**Key Performance Indicators (Level 3)**	**Weighting at Level 3**	**Global KPI Weights**
Plan	0.097	Flexibility	0.468	KPI-01 Accuracy of Fishing Planning	0.700	0.0138
				KPI-03 Fishermen's Knowledge Level in Using GPS	0.300	0.0316
		Reliability		KPI-02 Suitability of	1.000	0.0454

				Fishing Gear Usage to Fish Size and Species		
Source	0.122	Cost	0.377	KPI-04 Number of Training and Counseling Sessions Related to Safety, Navigation, and Operations	1.000	0.0460
		Reliability	0.623	KPI-05 Fishing Selectivity	1.000	0.0760
Make	0.366	Cost	0.329	KPI-06 Total Capture Fisheries Production	0.675	0.0813
				KPI-09 Provision of Ice During Storage	0.325	0.0836
Make	0.366	Asset	0.169	KPI-07 Suitability of Storage Media Type to Catch Volume	1.000	0.0619
		Reliability	0.501	KPI-08 Quality of Landed Fish According to BSN Standards	0.581	0.1065
				KPI-12 Errors in Packaging	0.419	0.0768
Deliver	0.060	Responsiveness	1.000	KPI-10 Transportation	0.516	0.0310

				Time		
				KPI-13 Delivery Time	0.484	0.0290
Return	0.101	Reliability	1.000	KPI-11 Percentage of Fish Damage After Catching and Handling at TPI	0.376	0.0380
				KPI-14 Number of Damages During Distribution	0.624	0.0630
		Responsiveness	0.092	KPI-15 Order Fulfillment Lead Time	1.000	0.0235
Enable	0.255	Asset	0.411	KPI-16 Temperature Control	1.000	0.1048
		Reliability	0.497	KPI-17 Quality of Fish Sold According to BSN Standards	1.000	0.1267
Overall KPI Weights						**1**

Computation of Actual KPI Values

One of the essential stages in the performance measurement process is the calculation of the actual values for each KPI. This calculation was derived from interviews and data provided by the Head of Teluk Aru Village and was aligned with the formulation of each KPI in accordance with its predefined characteristics and properties.

In supply chain performance measurement, each indicator employs different measurement parameters. Therefore, normalization is required to standardize the units of value (parameters) of each performance indicator used to calculate the final supply chain performance score of the company (Ulfah, 2018). In cases where the measurement follows the principle of higher is better in Equation 1:

$$Snorm = \frac{(Si - Smin)}{(Smax - Smin)} \times 100 \qquad (1)$$

Conversely, when the measurement follows the principle of lower is better, the target value is divided by the actual value, as shown in Equation 2.

$$Snorm = \frac{(Smax - Si)}{(Smax - Smin)} \times 100 \qquad (2)$$

In which:

Si = Actual indicator value achieved

$Smin$ = Worst performance achievement value of the performance indicator

$Smax$ = Best performance achievement value of the performance indicator

Table 5. KPI Value Calculation Results with Snorm de Boer Normalization

KPI	Characteristics	*Si*	*Smin*	*Smax*	*Snorm*	Traffic Light System
KPI - 01						
KPI – 02	*Lower is Better*	13%	10%	16%	50.00	*Marginal*
KPI – 03	*Higher is Better*	43%	43%	43%	43.00	*Poor*
KPI – 04	*Higher is Better*	50%	0%	100%	50.00	*Marginal*
KPI – 05	*Higher is Better*	86%	84%	90%	50.00	*Marginal*
KPI – 06	*Higher is Better*	21%	15%	26%	54.54	*Marginal*
KPI – 07	*Lower is Better*	89%	83%	97%	57.14	*Marginal*
KPI – 08	*Higher is Better*	69%	67%	77%	66.67	*Marginal*
KPI – 09	*Higher is Better*	33%	30%	40%	43.33	*Marginal*
KPI – 10	*Lower is Better*	89%	67%	100%	33.33	*Poor*
KPI – 11	*Lower is Better*	34%	33%	36%	66.67	*Marginal*
KPI – 12						
KPI – 13	*Lower is Better*	100%	100%	100%	100.00	*Excellent*
KPI – 14	*Lower is Better*	29%	23%	33%	40.00	*Poor*
KPI – 15	*Lower is Better*	72%	50%	100%	56.00	*Marginal*
KPI – 16						
KPI - 17	*Higher is Better*	71%	66%	77%	45.45	*Marginal*

In this study, the initial stage of the SCOR model was carried out by mapping six core processes in accordance with the ongoing business activities in Teluk Aru, namely plan, source, make, deliver, return, and enable, along with the business processes that reflect the company's mission. Following the mapping and validation at level 1 of the SCOR model, the next stage involved examining Key

Performance Indicators (KPIs) obtained from various sources, including academic journals, books, the Regulation of the Minister of Marine Affairs and Fisheries No. 9 of 2024, the National Fish Logistics System (SLIN), and the Sustainable Development Goals. At this stage, validated performance attributes were also mapped. Based on the identification results, 20 KPIs were selected and subsequently validated by several respondents involved in the study. The validation process resulted in 17 KPIs considered relevant and appropriate for measuring the performance of the Teluk Aru fisheries supply chain. The validated KPIs reflect the scope of assessment within the cycle view, which focuses on the replenishment cycle.

In the current supply chain performance assessment, KPI–01, KPI–12, and KPI–16 was not included due to the limited availability of data from Teluk Aru Village to measure these indicators. Nevertheless, these three KPIs remain important indicators and have undergone validation by internal parties. Based on the processed data, the final performance score of the Teluk Aru fisheries supply chain was 43.71 out of a maximum possible score of 81.00. This reflects a performance achievement level of 53.96% of the maximum potential value. Although the final performance score has been obtained, further analysis of the achievement of each KPI is still required. Each performance indicator was normalized using the Snorm de Boer method and subsequently classified into achievement groups through the Traffic Light System (TLS) approach. This classification facilitates a clearer analysis of the performance of each indicator.

Based on the evaluation of the core process *plan* using the TLS approach, two KPIs were found to yield unsatisfactory results, namely KPI–02 and KPI–03. KPI–01 could not be calculated and therefore had a value of 0.00 due to limited available data. In practice, fishers in Teluk Aru do not plan fishing activities systematically but rather decide to go fishing based on the day's weather conditions, even during rainfall. In fact, fishing planning is a crucial indicator in supply chain management, as mistakes at this stage may result in suboptimal catches, shortages of fuel and ice, and a decline in fish quality. This, in turn, negatively affects the subsequent supply chain, as fish arriving at the Fish Auction Place (TPI) may no longer be marketable. Therefore, although KPI–01 was not included in the final performance calculation, this indicator remains highly urgent in supply chain performance measurement. Strengthening this aspect of planning can be achieved through simple training for fishers on the importance of planning fishing schedules, logistics, and destinations. Local government support is also essential in providing daily planning templates and encouraging the recording of fishing activities.

Furthermore, KPI–02 and KPI–03 were categorized as marginal, indicating that their achievements are still far below the expected targets. KPI–02 measures the appropriateness of fishing gear used by fishers in relation to the size and type of fish caught. Interviews revealed that undersized fish, below the *length of maturity (Lm)*, continue to be caught, with a total average reaching 160 tons over the past three months. This indicates that the fishing gear used is not yet in compliance with standards, as most have been modified by reducing mesh size to increase catches. Such practices pose a long-term threat to fisheries resource sustainability. The fishing equipment available to Teluk Aru fishers is very limited, prompting them to modify existing gear to maximize their catch. Government intervention is necessary to address this issue by providing standardized, environmentally friendly fishing gear. In addition, training and awareness programs are needed to emphasize the importance of using selective fishing gear to ensure the sustainability of fish resources. With targeted support, Teluk Aru fishers are expected to improve their catches in a sustainable manner without depleting existing fish stocks.

Finally, KPI–03 serves as an indicator of fishers' knowledge and skills in operating GPS as a navigation aid. The low evaluation results reflect fishers' limited mastery of this technology, which is likely due to insufficient training, low educational attainment, and limited access to technology. Improvement for this indicator can be achieved through technical training programs on GPS operation, basic navigation knowledge, and routine device maintenance, which would enhance fishers' ability to effectively use GPS in their fishing activities.

The Key Performance Indicators (KPIs) designed and validated in this study serve an important role as benchmarks for evaluating the performance of the Teluk Aru fisheries supply chain. A total of 16 KPIs are categorized under climate change adaptation and food security, while one KPI is solely categorized under food security. Based on the weighting results at level 1 of the SCOR model, the highest weight was assigned to the *make* process with a value of 0.366. This indicates that production processes, particularly those related to the handling and processing of fish catches, represent the most vital aspect of the supply chain. The strong emphasis on the *make* process highlights the importance of maintaining fish quality and freshness during production to preserve market value and ensure compliance with applicable standards. In contrast, the lowest weight was assigned to the *return* process at 0.101, suggesting that issues of fish damage during capture, handling, and distribution have not yet become a priority for fishers and traders, as damaged fish are often still sold as feed, albeit at lower prices.

At the KPI level (level 3), the indicator with the highest global weight was KPI–08, which measures the quality of fish unloaded from vessels according to the standards of the National Standardization Agency (BSN), with a score of 0.138. This high global weight is consistent with the importance of the *make* process, confirming that catch quality is a key determinant of supply chain success. KPI–08 also reflects the combined effectiveness of handling, capture, and distribution processes within *make*. Conversely, the lowest global weight was assigned to KPI–03, which measures fishers' knowledge of GPS usage, with a value of 0.015. This low weight suggests that, although GPS technology can enhance fishing efficiency, its use has not yet become a major concern for Teluk Aru fishers due to limited access to technology and insufficient knowledge. Many fishers without GPS skills rely on peers who are more proficient.

The results of supply chain performance measurements using the Snorm de Boer normalization method further indicate that most performance indicators remain suboptimal. Several KPIs fall into the red category (poor and marginal), signaling that critical aspects of the supply chain require immediate attention and improvement. The initial issues are evident in KPI–02 (appropriateness of fishing gear) and KPI–03 (knowledge of GPS usage), both of which scored low and reflect the limited technical understanding of fishers due to insufficient training and extension services, as also highlighted in KPI–04 (training frequency). These weaknesses directly affect KPI–05 (selectivity of fishing) and KPI–06 (catch volume), which remain below optimal levels. The use of inappropriate gear and limited navigational support not only reduces catch productivity but also threatens resource sustainability.

Post-harvest challenges are reflected in the low performance of KPI–07 (storage capacity suitability) and KPI–09 (ice provision), which negatively impact KPI–08 (fish quality upon unloading). These findings indicate that fish quality deteriorates early due to insufficient cooling and inadequate storage facilities, accelerating physical degradation even before reaching consumers.

In the downstream stages, KPI–13 (delivery time), KPI–14 (distribution-related damage), and KPI–17 (final fish quality compliance with BSN standards) is closely interlinked. Distribution-related damages directly affect KPI–17, as poor logistics reduce final product quality and compliance with BSN standards. Although KPI–13 showed strong performance, the results of KPI–14 and KPI–17 indicate that speed alone cannot guarantee quality without proper distribution systems. This issue is largely attributed to inadequate logistics, such as transport vehicles lacking refrigeration facilities, and poor temperature and hygiene control during transport.

To address these challenges, the Kotabaru Fisheries Office should focus on improving fish quality, enhancing productivity, and strengthening overall supply chain efficiency in Teluk Aru. Recommended measures include providing regular annual training and extension programs for fishers, offering subsidies for standardized fishing gear, and expanding cold storage capacity both on fishing vessels and at the Teluk Aru Fish Auction Place (TPI). Without these improvements, the persistent resource and facility limitations faced by fishers and traders in Teluk Aru will continue to hinder the performance of the fisheries supply chain from upstream to downstream.

CONCLUSION

In designing the Key Performance Indicators (KPIs) for the Teluk Aru fisheries supply chain, the SCOR model was employed, consisting of three hierarchical levels: core processes (level 1), performance attributes (level 2), and Key Performance Indicators (level 3). Based on a literature review adapted to the company’s mission and business processes, 20 candidate KPIs were initially identified.

Following a validation process involving relevant respondents, 17 KPIs were deemed valid and relevant for performance evaluation. These indicators include: KPI–01 Accuracy of Fishing Planning, KPI–02 Appropriateness of Fishing Gear Use for the Size and Type of Fish Caught, KPI–03 Fishers' Knowledge of GPS Usage, KPI–04 Number of Trainings and Extension Programs on Safety, Navigation, and Fishing Operations, KPI–05 Fishing Selectivity, KPI–06 Capture Fisheries Production Volume, KPI–07 Suitability of Storage Capacity to Catch Volume, KPI–08 Quality of Fish Unloaded According to National Standardization Agency (BSN) Standards, KPI–09 Ice Provision During Storage, KPI–10 Transportation Time, KPI–11 Percentage of Damaged Fish After Capture and Handling at the Fish Auction Place (TPI), KPI–12 Packing Errors, KPI–13 Delivery Time, KPI–14 Distribution-Related Damage, KPI–15 Order Fulfillment Lead Time, KPI–16 Temperature Control, and KPI–17 Fish Quality Sold in Compliance with BSN Standards. The validated KPIs were then weighted using the Analytical Hierarchy Process (AHP) with pairwise comparisons, supported by the Expert Choice software. The performance of the Teluk Aru fisheries supply chain was subsequently evaluated based on the AHP weighting results.

After weighing, the actual values of each KPI were calculated and normalized. The results show that the total supply chain performance score reached 43.71 out of a maximum of 81 points. According to the Snorm de Boer evaluation system, this score indicates that the performance of the Teluk Aru fisheries supply chain falls into the "low" category. Using the Traffic Light System (TLS) approach, only one KPI achieved its target (KPI–13), while two KPIs were classified as marginal (KPI–08 and KPI–11), and eleven KPIs were found unsatisfactory and below target, namely KPI–02, KPI–03, KPI–04, KPI–07, KPI–09, KPI–10, KPI–14, KPI–15, and KPI–17. These unsatisfactory indicators provide a critical basis for the Kotabaru Fisheries Office to conduct evaluations and implement improvements in the performance of the fisheries supply chain.

ACKNOWLEDGMENTS

The authors would like to sincerely thank the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia (Kemdikbudristek) for the financial support provided through the Beginner Lecturer Research Grant (Penelitian Dosen Pemula/PDP) scheme, under the Directorate General of Higher Education, Research, and Technology (DIKTI). This research was funded with Contract Number 241/UPER-R/SK/HK.01/VII/2025. The authors also gratefully acknowledge the support from the Kotabaru Fisheries Office and the local fishers of Teluk Aru for their cooperation and valuable input during this research.

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