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Development and Preliminary Validation of a SCOR Racetrack Framework for Measuring Agroindustrial Supply Chain Reliability in Makassar

Asrul Fole[1*], Bambang Karsono[1], Yan Hardianzah[1], Muh. Ridzwan[1], Alifah Dwi Wulandari Putri[1], Khoerun Nisa Safitri[2]

[1]Industrial Engineering Study Program, Faculty of Industrial Technology, Muslim University of Indonesia, Makassar, Jl. Urip Sumoharjo No. km.5, Makassar City, South Sulawesi, 09231, Indonesia
[2]Logistics Engineering Study Program, Faculty of Engineering, Ibn Sina University, Batam, Jl. Teuku Umar, Batam City, Riau Islands, 29432, Indonesia
[*]Email Correspondence: asrulfole@umi.ac.id

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ABSTRACT*: Agroindustrial supply chains require reliable performance to ensure timely delivery, product quality, and accurate order fulfillment. This study aims to develop a SCOR Racetrack-based framework for measuring and prioritizing supply chain Reliability in small- and medium-scale agroindustrial enterprises in Makassar, Indonesia. A descriptive case-study approach was adopted, integrating supply chain mapping, SCOR Digital Standard 14.0, expert-based KPI screening, and hierarchical Analytical Hierarchy Process (AHP). The initial identification covered 60 Level-3 Reliability metrics, of which 33 were considered potentially applicable. An illustrative five-expert Likert assessment, representing three academics and two practitioners, provisionally retained 20 KPIs comprising 10 customer-related, eight supplier-related, and two return-related indicators. Hierarchical AHP calculations produced Level-1 priority weights of 0.5830 for customer fulfillment, 0.3119 for supplier fulfillment, and 0.1051 for return fulfillment. Customer Commit Date Achievement (RL.3.3) obtained the highest global weight (0.0993), followed by RL.3.10 and RL.3.12 (0.0875 each). The maximum aggregated Consistency Ratio was 0.0041, while sensitivity analysis indicated stable leading priorities across the examined scenarios. The proposed framework integrates SCOR processes with hierarchical Reliability indicators to support performance measurement and managerial prioritization. Further verification using original expert judgments and operational data is required to establish empirical validity, consistent with the preliminary proof-of-concept objectives of Technology Readiness Level 3.*

Keywords: *Agroindustry; Analytical Hierarchy Process; Reliability; SCOR Racetrack; Supply Chain Performance.*

1. INTRODUCTION

Agroindustry plays a strategic role in supporting food security, value creation, and regional economic development (Manikas et al., 2022). In Indonesia, Makassar serves as an important distribution and logistics hub connecting production and consumption activities across Eastern Indonesia (Lestari et

al., 2025). The effectiveness of agroindustrial supply chains depends not only on production capacity but also on the reliability of material procurement, processing, order fulfillment, and product distribution. However, agroindustrial enterprises frequently encounter challenges associated with raw material variability, production disruptions, delivery delays, product quality inconsistencies, and limited coordination among supply chain actors (Fole et al., 2026; Mishra et al., 2022). These challenges may reduce order fulfillment accuracy, increase operational costs, and weaken customer satisfaction and supply chain competitiveness (Reklitis et al., 2021). Consequently, a systematic and context-specific performance measurement framework is essential for identifying critical reliability indicators and supporting operational decision-making in agroindustrial supply chains.

In Makassar City, horticultural fruit commodities provide a relevant context for developing a supply chain reliability measurement framework, particularly for small- and medium-scale enterprises involved in agricultural product handling, processing, and distribution. According to Statistics Indonesia (BPS Makassar City, 2026), fruit production in 2025 was dominated by mangoes (1,624.00 quintals), followed by star fruit (296.15 quintals), soursop (215.50 quintals), and bananas (179.55 quintals). These production characteristics provide a statistical basis for focusing the proposed framework on fruit-based agroindustrial supply chains, with mangoes serving as the principal reference commodity.

The framework considers interconnected activities involving raw material sourcing, product handling and processing, order fulfillment, distribution, and returns. Particular attention is given to delivery timeliness, quantity accuracy, product conformity, and supplier reliability, which are relevant to maintaining consistent fulfillment performance for perishable agricultural products. Within this commodity-specific context, the study develops and preliminarily validates a SCOR Racetrack-based framework that integrates standardized Reliability indicators with expert judgment and AHP-based prioritization, providing a structured basis for evaluating supply chain reliability in agroindustrial enterprises in Makassar.

Supply chain reliability represents a critical performance attribute reflecting the ability of enterprises to fulfill customer and operational requirements consistently and accurately. Reliability is associated with the stability of supply chain operations and the ability to maintain dependable fulfillment under operational uncertainty (Dou et al., 2024; Fole et al., 2024). In agroindustrial supply chains, maintaining appropriate product conditions, preventing quality deterioration, and ensuring timely delivery are particularly important because product characteristics and handling requirements can influence supply chain performance (Mu et al., 2021). Furthermore, agroindustrial operations depend on interconnected material, information, and financial flows involving suppliers, processors, distributors, and customers (Baladraf, 2024; Ivo de Carvalho et al., 2022). Measuring supply chain performance therefore requires indicators capable of representing these interconnected activities and identifying specific operational weaknesses. Previous studies have highlighted the challenges of developing systematic performance measurement approaches for agri-food supply chains due to their operational complexity and diverse performance requirements (Ramos et al., 2022; Silvia et al., 2024).

The Supply Chain Operations Reference (SCOR) model provides a standardized framework for analyzing supply chain processes and evaluating performance through hierarchical metrics (Nguyen, 2024; Özkanlısoy & Bulutlar, 2023). The SCOR Digital Standard 14.0 organizes supply chain activities through Orchestrate, Plan, Order, Source, Transform, Fulfill, and Return, enabling systematic relationships between

operational processes and performance attributes (ASCM, 2022). Its Reliability attribute provides a basis for evaluating the accuracy, timeliness, completeness, and conformity of supply chain fulfillment activities. Previous studies have demonstrated the applicability of SCOR-based performance measurement in agricultural and agroindustrial contexts, including floriculture (Rodríguez Mañay et al., 2022), tofu and tempeh processing (Rosanti et al., 2025), and rice supply chains (Suryaningrat et al., 2025). Nevertheless, existing applications have generally emphasized performance measurement across multiple attributes, while the development and preliminary validation of a process-oriented framework integrating selected Level-3 Reliability indicators remain insufficiently explored in the specific context of small- and medium-scale agroindustrial enterprises in Makassar.

The SCOR Racetrack approach offers a structured mechanism for connecting supply chain processes, performance indicators, and improvement priorities within an integrated analytical framework. Kusrini et al. (2023) demonstrated the relevance of SCOR Racetrack for linking supply chain performance assessment with improvement activities, while Safitri et al. (2025) highlighted its application in identifying opportunities to enhance agricultural supply chain efficiency. Furthermore, integrating SCOR with multicriteria decision-making approaches, particularly the Analytical Hierarchy Process (AHP), enables the prioritization of performance indicators based on expert judgments (Kusrini et al., 2020; Rodríguez Mañay et al., 2022; Wardah et al., 2023). Expert-based indicator selection and prioritization have also been recognized as useful approaches for developing performance evaluation frameworks in complex supply chain environments (Gupta et al., 2023; Sharma et al., 2024). However, these methodological developments do not directly establish a validated Reliability-focused Racetrack framework for the agroindustrial cases considered in this study. Accordingly, the research gap addressed here concerns the integration of standardized Level-3 Reliability indicators, systematic expert screening, preliminary validation, and AHP-based prioritization into a coherent process-oriented measurement framework tailored to the selected agroindustrial supply chains.

Accordingly, this study aims to develop and preliminarily validate a SCOR Racetrack-based framework for measuring agroindustrial supply chain reliability in Makassar. The research involves identifying relevant Level-3 Reliability indicators from the SCOR Digital Standard 14.0, screening and validating the indicators through expert judgment, prioritizing the validated indicators using AHP, and integrating the resulting priorities into a conceptual SCOR Racetrack framework. Preliminary validation focuses on indicator relevance, clarity, measurability, and practical applicability, providing initial evidence of the framework's conceptual suitability without claiming full-scale operational implementation. The principal scientific contribution lies in integrating standardized Reliability metrics, expert-based validation, multicriteria prioritization, and process-oriented representation into a unified framework adapted to the operational context of the selected agroindustrial enterprises. Practically, the proposed framework is expected to assist agroindustrial managers in identifying critical reliability indicators and establishing structured performance evaluation priorities. The resulting framework provides an initial basis for subsequent empirical measurement, operational refinement, and broader validation of agroindustrial supply chain reliability.

2. MATERIALS AND METHODS

2.1. Research Design and Data Collection

This study used a descriptive case-study approach to develop and preliminarily validate a SCOR Racetrack framework for supply chain reliability in small- and medium-scale agroindustrial enterprises in

Makassar, Indonesia. It examined suppliers, processors, distributors, and customers through interviews, questionnaires, observations, and operational records. The analysis addressed customer fulfillment, supplier performance, and returns, while Microsoft Excel supported data organization and indicator assessment. Enterprise numbers, study districts, and collection dates remain subject to verification against field records.

2.2. SCOR-Based Reliability KPI Identification

Supply chain activities were mapped using SCOR Racetrack and SCOR Digital Standard 14.0 (ASCM, 2022; Kusrini et al., 2023). The Reliability hierarchy comprised three Level-1, 12 Level-2, and 60 Level-3 metrics covering customer, supplier, and return order fulfillment. Preliminary relevance screening identified 33 potential Level-3 indicators, while 27 were provisionally excluded because of limited applicability, redundancy, or measurement constraints before subsequent expert evaluation and validation.

2.3. Expert Screening and Preliminary Validation

Five experts three academics and two agroindustrial practitioners were designated to assess 33 candidate Reliability indicators using a five-point Likert scale. Screening considered relevance, measurability, data availability, and applicability, with proposed acceptance requiring a mean score of at least 4.00 and ratings of 4 or higher from four experts. Illustrative calculations retained 20 Level-3 KPIs: 10 customer-related, eight supplier-related, and two return-related. Preliminary content validation additionally considered clarity. These selections require verification against original expert ratings from the five participating experts before being reported as empirical results.

2.4. AHP Weighting and Framework Development

The 20 provisionally selected Reliability KPIs were prioritized using hierarchical AHP across three levels: strategic, diagnostic, and operational metrics. Pairwise comparisons followed Saaty's 1–9 scale (Saaty, 2008). The illustrative model involved five expert matrices and 155 comparisons. Geometric mean aggregation generated local and global weights. Consistency was assessed using CI and CR (CR < 0.10), while 20% weight adjustments tested sensitivity. The results supported conceptual SCOR Racetrack framework development.

The 20 provisionally selected Reliability KPIs were prioritized using a three-level hierarchical Analytical Hierarchy Process (AHP), comprising Level-1 strategic metrics, Level-2 diagnostic metrics, and Level-3 operational indicators. Pairwise comparisons were structured using Saaty's 1–9 scale (Saaty, 2008). The illustrative assessment model included five expert judgment matrices, with 31 independent pairwise comparisons per expert and 155 comparisons overall. Expert judgments were aggregated using the geometric mean method to determine local priority weights, which were subsequently multiplied across the hierarchy to obtain global KPI weights. Judgment consistency was evaluated using the Consistency Index (CI) and Consistency Ratio (CR), with CR below 0.10 considered acceptable. Sensitivity analysis examined priority stability under 20% changes in Level-1 weights. The selected indicators and hierarchical priorities were integrated into the SCOR Racetrack structure to establish a conceptual Reliability measurement framework.

3. RESULTS AND DISCUSSION

3.1. Case Description and Supply Chain Mapping

This study focused on small- and medium-scale agroindustrial enterprises involved in agricultural product processing and distribution in Makassar, Indonesia. The

supply chain was mapped using the SCOR Racetrack approach based on SCOR Digital Standard 14.0 (ASCM, 2022; Kusrini et al., 2023), covering suppliers, agroindustrial processors, distributors, and customers. The mapping integrated planning, sourcing, transformation, fulfillment, and return activities through interconnected material, information, and return flows. This structure provides a conceptual basis for identifying and evaluating critical Reliability indicators within the proposed SCOR Racetrack framework, as illustrated in Figure 1.

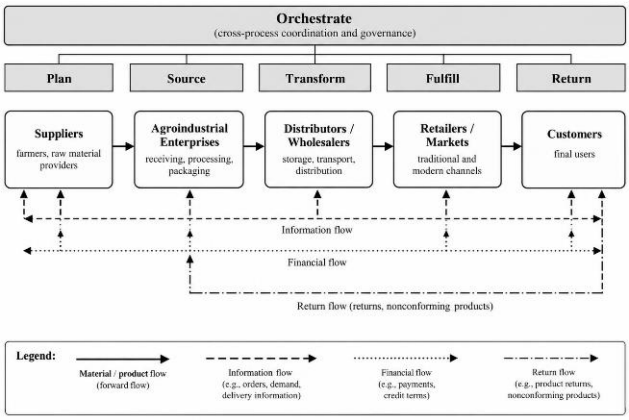


Figure 1. Supply Chain Mapping of Agroindustrial Enterprises in Makassar.

Figure 1 presents the conceptual supply chain mapping of agroindustrial enterprises in Makassar based on the SCOR DS 14.0 framework. The mapping illustrates the relationships among suppliers, agroindustrial enterprises, distributors, and customers through material, product, and information flows. These activities are associated with the SCOR processes of Plan, Order, Source, Transform, Fulfill, and Return, supported by Orchestrate as a cross-process management function. The framework identifies three principal Reliability measurement areas: supplier fulfillment, customer order fulfillment, and product returns. Supplier-related indicators focus on delivery accuracy and timeliness, while customer-related indicators emphasize order conformity, delivery commitments, and product quality. Return-related indicators address the management of returned products. This process-oriented mapping provides the conceptual foundation for identifying, screening, and prioritizing Reliability KPIs within the proposed SCOR Racetrack framework (Kusrini et al., 2023). It also supports the preliminary validation of the framework without implying full-scale operational implementation.

3.2. SCOR-Based Reliability KPI Identification

The study identified supply chain Reliability indicators using the SCOR Digital Standard 14.0 developed by ASCM.

Table 1. Summary of SCOR DS 14.0 Reliability Metric Structure

Metric Level	Number of Metrics	Function
Level 1	3	Strategic assessment of supply chain Reliability
Level 2	12	Diagnostic assessment of Level-1 performance
Level 3	60	Detailed operational performance measurement and diagnosis

Table 1 presents the hierarchical structure of Reliability metrics based on the SCOR Digital Standard 14.0, comprising three Level-1, 12 Level-2, and 60 Level-3 metrics. Level 1 represents strategic

performance through Perfect Customer Order Fulfillment, Perfect Supplier Order Fulfillment, and Perfect Return Order Fulfillment. Level 2 provides diagnostic metrics for evaluating these performance categories, while Level 3 offers detailed operational indicators for identifying specific supply chain performance issues. This hierarchy establishes a standardized foundation for identifying relevant Reliability KPIs in agroindustrial supply chains. At this stage, all metrics were considered as the initial reference without indicator screening, validation, or prioritization.

3.3. Expert Screening and KPI Selection

Table 2. Selected Level-3 Reliability KPIs and Bottom-Up SCOR Mapping

Level 3	Selected Reliability KPI	Level 2	Level 1	Selection rationale
RL.3.1	Delivery Item Accuracy to the Customer	RL.2.1	RL.1.1	Ensures correct product delivery
RL.3.2	Delivery Quantity Accuracy to the Customer	RL.2.1	RL.1.1	Ensures quantity conformity
RL.3.3	Customer Commit Date Achievement	RL.2.2	RL.1.1	Measures delivery timeliness
RL.3.4	Delivery Customer Location Accuracy	RL.2.2	RL.1.1	Ensures correct delivery location
RL.3.8	Customer Order Shipping Documentation Accuracy	RL.2.3	RL.1.1	Ensures accurate shipping documents
RL.3.10	Percentage of Customer Orders or Lines Received Damage Free	RL.2.4	RL.1.1	Evaluates damage-free delivery
RL.3.12	Customer Orders Delivered Defect-Free Conformance	RL.2.4	RL.1.1	Ensures product quality conformity
RL.3.13	Delivery Item Accuracy from the Supplier	RL.2.5	RL.1.2	Ensures correct material receipt
RL.3.14	Delivery Quantity Accuracy from the Supplier	RL.2.5	RL.1.2	Ensures incoming quantity accuracy
RL.3.15	Supplier Achievement to Original Organization Commit Date	RL.2.6	RL.1.2	Measures supplier delivery commitments
RL.3.17	Supplier Order Compliance Documentation Accuracy	RL.2.7	RL.1.2	Ensures supplier documentation compliance
RL.3.22	Percentage of Supplier Orders or Lines Received Damage Free	RL.2.8	RL.1.2	Evaluates damage-free material receipt
RL.3.24	Supplier Orders Delivered Defect-Free Conformance	RL.2.8	RL.1.2	Ensures supplier product conformity
RL.3.25	Warranty and Returns	—*	RL.1.3*	Measures warranty-related returns
RL.3.36	Percentage of Orders or Lines Processed Complete	—*	RL.1.1*	Evaluates order processing completeness
RL.3.38	Percentage of Orders or Lines Received On Time to Demand Requirement	—*	RL.1.2*	Evaluates timely material receipt
RL.3.40	Percentage of Orders or Lines Received with Correct Packaging	—*	RL.1.2*	Ensures packaging conformity
RL.3.46	Fill Rate	—*	RL.1.1*	Measures order fulfillment completeness
RL.3.51	Schedule Achievement	—*	RL.1.1*	Evaluates schedule adherence
RL.3.56	Delivery Item Return Accuracy from the Customer	—*	RL.1.3*	Ensures returned-item accuracy

The selection of Reliability KPIs was developed based on the SCOR Digital Standard 14.0, covering 60 Level-3 indicators. An initial relevance assessment identified 33 potential indicators suitable for agroindustrial supply chain operations in Makassar, while 27 indicators were provisionally excluded due to limited applicability, redundancy, or measurement constraints. To illustrate the subsequent screening procedure, a simulated assessment involving five experts, comprising three academics and two agroindustrial practitioners, was conducted using a five-point Likert scale. The indicators were evaluated based on relevance, measurability, data availability, and practical applicability. Applying an illustrative selection criterion of a mean score of at least 4.00 and agreement from at least four experts, 20 Level-3 KPIs were provisionally retained. These indicators were then mapped to their corresponding Level-2 and Level-1 Reliability categories using a bottom-up approach, as presented in Table 2.

Table 2 presents the provisional selection of 20 Level-3 Reliability KPIs from 33 candidates identified among the 60 metrics in SCOR DS 14.0. Using an illustrative five-expert assessment with a five-point Likert scale, 20 indicators satisfied the proposed screening criteria, whereas 13 were excluded. The retained set includes 10 customer-related, eight supplier-related, and two return-related indicators. Customer metrics address delivery accuracy, timeliness, documentation, and product conformity, while supplier metrics assess material accuracy, delivery performance, and incoming product condition. Return-related metrics represent warranty and reverse-flow activities. The selected indicators were mapped upward from Level 3 to Level 2 and Level 1 to establish a coherent measurement hierarchy for subsequent preliminary validation.

3.4. AHP-Based KPI Prioritization

3.4.1. Hierarchical AHP Weighting

The 20 selected Reliability KPIs were prioritized through a three-level AHP. Level 1 included customer, supplier, and return order fulfillment; Level 2 comprised diagnostic metrics; and Level 3 contained operational KPIs. Pairwise judgments from five simulated experts (three academics and two practitioners) were combined using the geometric mean. Local weights were calculated at each level and multiplied to obtain global KPI priorities. Consistency ratios (CR < 0.10) and sensitivity analysis assessed the coherence and stability of the simulated rankings across the proposed hierarchy.

Tables 3–5 present the hierarchical AHP priority weights for 20 Reliability KPIs. At Level 1, Perfect Customer Order Fulfillment obtained the highest weight (0.5830), followed by Supplier Order Fulfillment (0.3119) and Return Order Fulfillment (0.1051). At Level 2, customer delivery commitment (0.3047) and supplier order completeness (0.3194) showed the highest local priorities within their respective categories. At Level 3, Customer Commit Date Achievement (RL.3.3) ranked first (0.0993), followed by RL.3.10 and RL.3.12 (0.0875 each). These priorities emphasize delivery timeliness, order accuracy, product conformity, and reliable fulfillment across agroindustrial supply chain operations.

Table 3. Result AHP Priority Weights at Level 1

Level 1	Reliability metric	Weight
RL.1.1	Perfect Customer Order Fulfillment	0.583
RL.1.2	Perfect Supplier Order Fulfillment	0.311z9
RL.1.3	Perfect Return Order Fulfillment	0.1051
Total		1.0000

Table 4. Result AHP Local Weights at Level 2

Level 1	Level 2	Diagnostic metric	Local weight
RL.1.1	RL.2.1	Orders Delivered In Full to Customer	0.2943
RL.1.1	RL.2.2	Delivery Performance to Customer Commit Date	0.3047
RL.1.1	RL.2.3	Customer Order Documentation Accuracy	0.1007
RL.1.1	RL.2.4	Customer Order Perfect Condition	0.3003
RL.1.2	RL.2.5	Orders Delivered In Full from Supplier	0.3194
RL.1.2	RL.2.6	Supplier Delivery Commitment Performance	0.2903
RL.1.2	RL.2.7	Supplier Order Documentation Accuracy	0.1210
RL.1.2	RL.2.8	Supplier Order Perfect Condition	0.2693
RL.1.3	RL.2.10	In Full (Correct Product)	0.6667
RL.1.3	RL.2.12	Perfect Condition	0.3333

Table 5. Result AHP Priority Weights of 20 Level-3 Reliability KPIs

KPI Code	Level 2	Local weight	Global weight
RL.3.3	RL.2.2	0.5593	0.0993
RL.3.10	RL.2.4	0.5000	0.0875
RL.3.12	RL.2.4	0.5000	0.0875
RL.3.56	RL.2.10*	10.000	0.0700
RL.3.8	RL.2.3	10.000	0.0587
RL.3.1	RL.2.1	0.3333	0.0572
RL.3.2	RL.2.1	0.3333	0.0572
RL.3.13	RL.2.5	0.5000	0.0498
RL.3.14	RL.2.5	0.5000	0.0498
RL.3.15	RL.2.6	0.5000	0.0453
RL.3.38	RL.2.6*	0.5000	0.0453
RL.3.4	RL.2.2	0.2424	0.0431
RL.3.17	RL.2.7	10.000	0.0377
RL.3.51	RL.2.2*	0.1983	0.0352
RL.3.25	RL.2.12*	10.000	0.0350
RL.3.22	RL.2.8	0.4000	0.0336
RL.3.24	RL.2.8	0.4000	0.0336
RL.3.36	RL.2.1*	0.1667	0.0286
RL.3.46	RL.2.1*	0.1667	0.0286
RL.3.40	RL.2.8*	0.2000	0.0168

3.4.2. Consistency and Expert Aggregation

The consistency of the hierarchical AHP judgments was evaluated using the Consistency Ratio (CR) at Levels 1, 2, and 3. Five expert judgment matrices were aggregated using the geometric mean method, involving 31 pairwise comparisons per expert and 155 comparisons overall. A CR below 0.10 was considered acceptable. The summary of consistency assessment results is presented in Table 6.

Table 6. Summary of AHP Consistency Test Results

AHP Level	Pairwise Comparisons per Expert	Maximum CR	Result
Level 1	3	0.0040	Consistent
Level 2	13	0.0041	Consistent
Level 3	15	0.0033	Consistent
Overall	31	0.0041	Consistent

Table 6 summarizes the consistency assessment across the three AHP levels. The maximum aggregated CR values were 0.0040 at Level 1, 0.0041 at Level 2, and 0.0033 at Level 3. The overall maximum CR was 0.0041, while the highest individual expert CR reached 0.0169. All values were below the acceptable threshold of 0.10, indicating consistent pairwise comparisons within the evaluated matrices. These results demonstrate the numerical consistency of the hierarchical weighting procedure used to prioritize the 20 Reliability KPIs.

3.4.3. Sensitivity Analysis of AHP Priority Weights

Sensitivity analysis was conducted to examine the stability of the 20 Reliability KPI priorities under changes in Level-1

weights. Five scenarios were evaluated, including the baseline condition and adjustments of 20% to customer, supplier, and return fulfillment weights. The adjusted weights were normalized, and global KPI priorities were recalculated to identify potential changes in the ranking. The results are summarized in Table 7.

Table 7. Sensitivity Analysis of AHP Priority Weights

Scenario	RL.3.3 Global Weight	Highest-Priority KPI
Baseline	0.0993	RL.3.3
Customer Reliability +20%	0.1068	RL.3.3
Supplier Reliability +20%	0.0935	RL.3.3
Return Reliability +20%	0.0973	RL.3.3
Customer Reliability −20%	0.0900	RL.3.3

Table 7 presents the sensitivity analysis of KPI priorities under five weighting scenarios. Customer Commit Date Achievement (RL.3.3) consistently maintained the highest ranking, with global weights ranging from 0.0900 to 0.1068. The highest weight occurred when Customer Reliability increased by 20%, while the lowest resulted from reducing its weight by 20%. Despite these adjustments, RL.3.3 remained the leading indicator, demonstrating ranking stability within the examined scenarios. This finding highlights the importance of delivery commitment achievement in the proposed agroindustrial supply chain Reliability framework.

3.5. Proposed SCOR Racetrack Reliability Framework

The proposed SCOR Racetrack Reliability framework integrates supply chain mapping, 20 provisionally selected Level-3 KPIs, and hierarchical AHP prioritization. The framework incorporates seven SCOR DS 14.0 processes: Orchestrate, Plan, Order, Source, Transform, Fulfill, and Return. The selected indicators are organized into three performance categories: customer order fulfillment, supplier order fulfillment, and return order fulfillment. Each category is linked to its corresponding Level-2 and Level-3 metrics, providing a structured approach to measuring supply chain Reliability in agroindustrial enterprises in Makassar, as illustrated in Figure 2

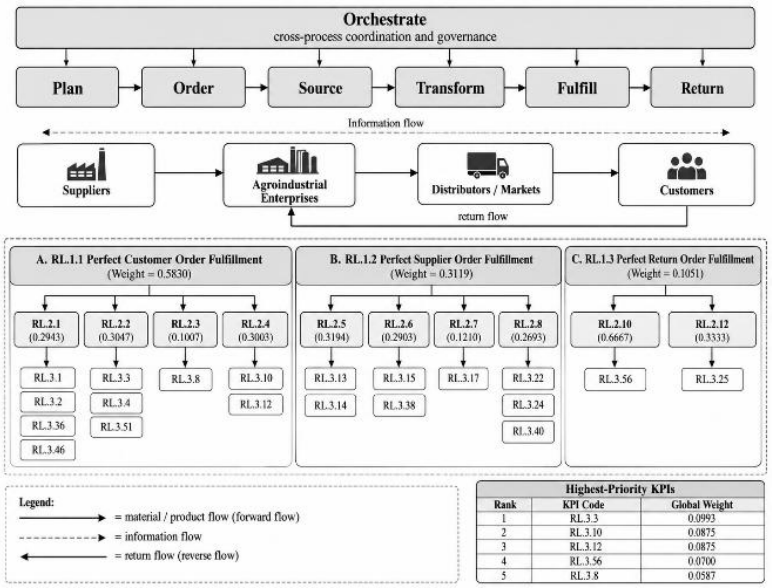


Figure 2. Proposed SCOR Racetrack Reliability Framework for Agroindustrial Enterprises in Makassar

Figure 2 illustrates the proposed SCOR Racetrack Reliability framework integrating supply chain processes, operational actors, and hierarchical performance indicators. The framework comprises 20 Level-3 KPIs, consisting of 10 customer-related, eight supplier-related, and two return-related indicators. The preliminary AHP analysis assigns the highest Level-1 weight to Perfect Customer Order Fulfillment (0.5830), followed by Perfect Supplier Order Fulfillment (0.3119) and Perfect Return Order Fulfillment (0.1051). At Level 3, Customer Commit Date Achievement (RL.3.3) obtains the highest global priority weight (0.0993), followed by RL.3.10 and RL.3.12 (0.0875 each). The framework establishes relationships between supply chain activities and Reliability performance measurement, providing a conceptual basis for identifying operational improvement priorities.

3.6. Discussion, Managerial Implications, and Limitations

The proposed SCOR Racetrack Reliability framework highlights the importance of customer fulfillment in agroindustrial supply chain performance. The hierarchical AHP calculations assign the highest Level-1 priority to Perfect Customer Order Fulfillment (0.5830), followed by Perfect Supplier Order Fulfillment (0.3119) and Perfect Return Order Fulfillment (0.1051). Among the 20 Level-3 KPIs, Customer Commit Date Achievement (RL.3.3) obtains the highest global weight (0.0993), followed by Percentage of Customer Orders or Lines Received Damage Free (RL.3.10) and Customer Orders Delivered Defect Free Conformance (RL.3.12), each with a weight of 0.0875. These priorities suggest that delivery timeliness, product condition, and order conformity are important considerations in developing a Reliability measurement framework.

The proposed framework is consistent with previous studies demonstrating the usefulness of SCOR-based performance measurement and multicriteria decision-making. Kusrini et al. (2023) demonstrated the application of the SCOR Racetrack approach for systematic supply chain performance improvement, while Rodríguez Mañay et al. (2022) integrated SCOR and AHP to evaluate supply chain performance in the floricultural sector. Similarly, Fole et al. (2026) applied SCOR DS 14.0 Racetrack to examine supply chain resilience in agroindustrial processing. Compared with these studies, the present research focuses specifically on developing a hierarchical Reliability measurement framework by integrating Level-1, Level-2, and Level-3 indicators with expert-based KPI selection and prioritization.

From a managerial perspective, the proposed framework provides a structured basis for identifying critical Reliability indicators and supporting operational improvement decisions. Agroindustrial managers can use the prioritized KPIs to guide attention toward delivery scheduling, order accuracy, product quality control, supplier evaluation, and return management. The integration of SCOR processes and hierarchical KPI weights also facilitates performance monitoring and the identification of activities requiring further investigation. Consequently, the framework offers a potential decision-support instrument for small- and medium-scale agroindustrial enterprises seeking to strengthen supply chain coordination and establish more systematic performance measurement practices (Kusrini et al., 2023; Fole et al., 2026).

Nevertheless, several limitations should be acknowledged. The preliminary framework considers 20 selected KPIs and a five-expert assessment structure, which may limit its generalizability across different agroindustrial settings. Furthermore, the expanded KPI selection and hierarchical AHP calculations currently rely on illustrative judgment matrices rather than verified original expert responses, while several Level-2-to-Level-3 metric relationships require further confirmation.

Consequently, the reported priorities should not yet be interpreted as empirical findings. Additional expert assessments, verification of operational data, and application across agroindustrial enterprises are required to establish the framework's validity and practical effectiveness.

4. CONCLUSIONS AND RECOMMENDATIONS

This study developed a conceptual SCOR Racetrack framework for assessing supply chain Reliability in small- and medium-scale agroindustrial enterprises in Makassar, consistent with the research objectives of supply chain mapping, KPI identification, and preliminary validation. The SCOR DS 14.0 reference comprises 3 Level-1, 12 Level-2, and 60 Level-3 Reliability metrics. Preliminary relevance screening identified 33 indicators, while an illustrative five-expert assessment retained 20 KPIs: 10 customer-related, 8 supplier-related, and 2 return-related indicators. Hierarchical AHP calculations assigned Level-1 weights of 0.5830, 0.3119, and 0.1051, respectively. Customer Commit Date Achievement (RL.3.3) ranked highest (0.0993), followed by RL.3.10 and RL.3.12 (0.0875 each). The calculated maximum consistency ratio was 0.0041, below the 0.10 threshold. The framework provides a structured basis for prioritizing delivery timeliness, product conformity, supplier coordination, and return management. However, the expanded 20-KPI selection and AHP results are methodological illustrations rather than verified empirical findings. Future work should collect original ratings and pairwise comparisons from five experts, confirm the official SCOR metric hierarchy, and conduct limited operational testing before reporting validated priorities or recommending broader implementation.

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