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Supply Chain Performance Measurement at XYZ Company Distribution Center Using SCOR 12

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Abstract

Recognizing the limitations of their current, subjective evaluation system focused solely on delivery, XYZ Company seeks to implement a more standardized and comprehensive approach to supply chain performance measurement. This research aims to evaluate the performance of XYZ Company's Distribution Center (DC) supply chain using the well-established Supply Chain Operations Reference (SCOR) model. SCOR provides a validated set of performance indicators, which will be further weighted using the Analytical Hierarchy Process (AHP) to reflect their relative importance to XYZ Company's specific goals. The Snorm De Boer method will then be employed to normalize the final score for each indicator. A traffic light system will visually represent performance gaps, highlighting areas requiring immediate improvement. This research will analyze data from 27 key metrics across 2022 and 2023, providing a holistic picture of DC performance. While preliminary results indicate an overall "average" to "good" performance (69.54 and 70.08, respectively), further analysis will identify specific areas for improvement based on SCOR Best Practices. This research will ultimately propose practical solutions to enhance XYZ Company's overall supply chain efficiency and effectiveness.

Keywords: Supply Chain, Performance Measurement, Retail, Supply Chain Operation Reference (SCOR), Analytical Hierarchy Process, Snorm De Boer.

1. Introduction

The retail landscape is shifting due to the rise of minimarkets and changing consumer preferences. In cities like Bandung, Indonesia, Nielsen's 2018 survey exemplifies that supermarket sales declined by 5.2% compared to 7.4% for convenience stores. This shift towards convenience and competitive pricing requires a proactive response from supermarket leaders like XYZ Company.

Beyond minimarkets, supermarkets and mini-markets grapple with managing costs in a thin-margin environment. Intense competition compels retailers to offer attractive promotions, demanding a focus on profit generation for each business (Jiputra et al., 2020). The narrow gap between the cost of goods sold (COGS) and the selling price necessitates meticulous management of all operational expenses (Raharja et al., 2022). Research by Beverley et al. (2016) emphasizes the critical role of supply chain optimization in this scenario. Streamlining logistics and optimizing the flow of goods can yield cost savings and control, enabling competitive pricing and profit maximization.

Recognizing the importance of supply chain optimization, XYZ Company has established a Distribution Center (DC) to manage all logistical activities for delivering goods to its branch stores. This initiative has demonstrably yielded positive results, with quarterly performance evaluations from 2022 until 2023 reflecting satisfactory levels and year-on-year progress (average indicator achievement of 76%), as seen in Figures 1 and 2.

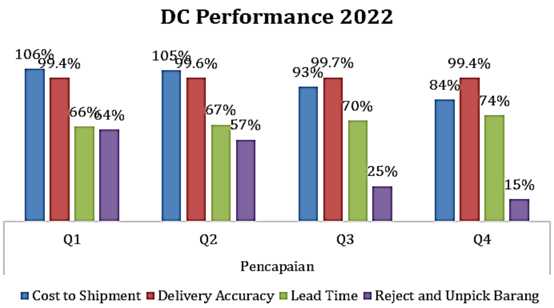

Figure 1. DC performance in 2022

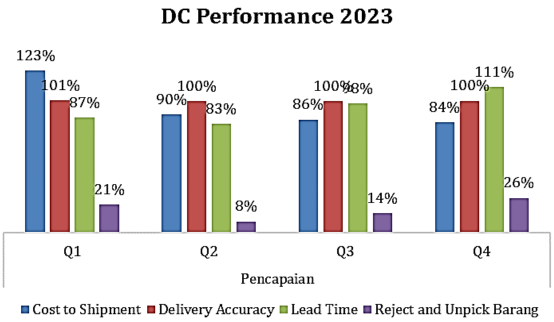

Figure 2. DC performance in 2023

However, the current performance evaluation system employed by XYZ Company's supply chain division exhibits limitations that hinder a comprehensive assessment of its effectiveness. Interviews with the DC Manager (June 2023) revealed an overreliance on individual staff expertise, introducing subjectivity and potentially overlooking crucial aspects. Additionally, the system's narrow focus on the delivery process neglects vital areas like procurement. This limited scope is further exemplified by the unmeasured phenomenon of inconsistent supplier delivery schedules, which creates bottlenecks in the receiving process and disrupts downstream activities. Consequently, the current system fails to provide a holistic understanding of XYZ Company's supply chain performance.

Ineffective supply chain performance evaluation hinders continuous improvement. This research proposes the Supply Chain Operations Reference (SCOR) model to address this limitation for XYZ Company, a supermarket facing rising competition from minimarkets. SCOR's five key dimensions (reliability, responsiveness, agility, cost, and asset management) offer a comprehensive framework for assessing performance in 2022 and 2023. By leveraging SCOR, XYZ can gain valuable insights into its supply chain's strengths and weaknesses, enabling targeted improvements across various aspects.

While existing research highlights the benefits of supply chain optimization for retail profitability (Beverley et al., 2016), there's a gap in knowledge regarding SCOR's application for Indonesian supermarkets facing minimarket competition. This study aims to bridge this gap by utilizing SCOR to evaluate XYZ Company's supply chain performance. The primary research question is: How can the SCOR model be used to evaluate and improve XYZ's overall supply chain performance? This research seeks a more holistic assessment by expanding the evaluation beyond delivery processes to include procurement. The expected outcome is to identify specific metrics or areas for improvement using SCOR best practices. These findings will provide valuable insights for XYZ's management to implement targeted improvements and enhance overall supply chain effectiveness.

2. Literature Review

2.1. Supply Chain Management (SCM)

The supply chain, a network of interconnected businesses (suppliers, manufacturers, distributors, retailers, etc.), plays a critical role in delivering products to end users (Pujawan et al., 2010). Effective management of these flows – goods, information, and finances – is crucial for a company's success (Chopra et al., 2016). An integrated supply chain optimizes customer service, profitability, and market responsiveness (Rainer et al., 2011). Benefits include increased efficiency, reduced variability, and improved risk management. However, competitiveness necessitates continuous adaptation to technological advancements and evolving customer demands.

Supply Chain Management (SCM) encompasses the design, planning, and execution of all these activities (APICS, 2017). The goal is to establish competitive networks, enhance global logistics, fulfill customer demand, and measure overall performance. However, complexity and uncertainty pose significant challenges. The intricate network with diverse stakeholders can lead to conflicting interests, while uncertainties in demand, supplier performance, and internal operations can erode planning confidence (Sucahyowati et al., 2011). Effective SCM strategies are essential to navigate these complexities and ensure supply chain success.

2.2. Performance Measurement of Supply Chain Management

Effective supply chain performance measurement is not merely a formality; it's a cornerstone for data-driven decision-making and continuous improvement (Setyawan et al., 2022). By gauging its ability to meet customer demands promptly and cost-effectively, a company can identify areas of strength and weakness (Teja et al., 2022). This insight empowers streamlining procedures, optimizing resource allocation, and ultimately driving cost reduction and sustainable growth.

Selecting the right Key Performance Indicators (KPIs) is crucial. On-time delivery, for instance, reflects customer satisfaction and reliability, while inventory levels represent the delicate balance between efficient capital use and stock management. Monitoring procurement, warehousing, and transportation costs further aids in cost optimization. However, a one-size-fits-all approach does not exist.

Process-based methods offer a holistic view, integrating supplier-to-customer processes. Perspective-based approaches, like the Balanced Scorecard (BSC), translate strategy into measurable objectives across financial, customer, internal process, and learning & growth aspects (Helm et al., 2016). Hierarchy-based approaches allocate relevant metrics for targeted management levels.

Popular methods include the BSC, which translates strategy into tangible goals across four perspectives: Financial, Customer, Internal Processes, and Learning and growth. It focuses on a few key measures for simplicity and effectiveness (Reddy et al., 2019). The Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council (SCC), offers a comprehensive framework with performance attributes and metrics across five management processes: Plan, Source, Make, Deliver, and Return. It also provides thirteen level 1 metrics categorized as reliability, flexibility, responsiveness, cost, and asset metrics. The first three are customer-facing, while the latter two reflect internal operations.

Implementing a performance measurement system equips the supply chain with data to drive efficiency, competitiveness, and informed decision-making. Selecting the right KPIs, measurement approaches, and methods is vital to maximizing the benefits and achieving sustainable growth in today's dynamic market.

2.3. Supply Chain Operation Reference (SCOR)

The Supply Chain Operations Reference (SCOR) model, introduced in 1996 by the Supply Chain Council (SCC) and now maintained by the Association for Supply Chain Management (ASCM), has become a cornerstone of supply chain performance measurement (SCC, 2012; ASCM, 2017). This standardized framework, continuously updated to reflect evolving industry needs, provides a comprehensive approach to supply chain analysis.

Table 1. SCOR attributes and metrics

Attribute	Definition	Level 1 Metrics
Reliability	Ability to perform tasks as expected. Reliability focuses on the predictability of the outcome of a process. Typical metrics include On-time, the right quantity, and the right quality.	Perfect Order Fulfillment
Responsiveness	Speed at which tasks are performed. The speed at which a supply chain provides products to the customer. Examples include cycle-time metrics	Order Fulfillment Cycle Time
Agility	Ability to respond to external influences and make changes to gain or maintain competitive advantage. SCOR Agility metrics include Adaptability and Overall Value at Risk	Upside Supply Chain Flexibility & Adaptability
Cost	Cost of operating the supply chain processes. This includes labor costs, material costs, and management and transportation costs.	- Total cost of supply chain management - Cost of Goods Sold
Asset Management	Ability to efficiently utilize assets. Asset management strategies in a supply chain include inventory reduction.	- Cash Return Cycle Time - Cash to Cash Cycle Time

SCOR's strength lies in its holistic view. It encompasses all supply chain activities, from planning and procurement to production, distribution, and even returns (Aini et al., 2018). This empowers companies to gain a deeper understanding of their supply chain's complexities and design effective management systems aligned with overall business strategies (MacCarthy et al., 2016).

Beyond mere analysis, SCOR functions as a methodology for improvement. By focusing on activities rather than specific roles, SCOR employs a process-centric approach combined with performance metrics. This allows companies to assess critical dimensions like delivery, inventory, and cost efficiency (SCC, 2012). Importantly, SCOR goes a step further by recommending best practices based on industry benchmarks. This facilitates targeted process improvements, ensuring supply chain activities contribute directly to achieving company goals.

In this research, SCOR was used primarily because of its function of providing supply chain performance attributes and measurement metrics. The performance attributes and their metrics can be seen in Table 1 as a broad overview of the relationship between what the attributes and their metrics assess in the supply chain. Performance attributes are supply chain criteria that make it possible to analyze and evaluate the supply chain against other supply chains with competitive strategies. These attributes and metrics will be adjusted and narrowed down according to the company's existing activities, which act as variables to measure the overall supply chain performance.

3. Methods

3.1. Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a decision-support model developed by Thomas L. Saaty, that uses hierarchy to structure complex decision-making problems (Wulan, 2007). This method combines objective and subjective aspects of a situation in one hierarchy, which can be objectives, attributes, criteria, or alternatives, and can have as many levels as necessary.

The procedure for performing the AHP approach in the process of prioritizing metrics in supply chain performance measurement is as follows:

1. Determine criteria and sub-criteria.
2. Develop a metrics hierarchical structure as shown in Figure 3.
3. Creating a pairwise comparison matrix by compiling criteria in the form of paired metrics. This matrix model will also be used for data collection through questionnaires to the company, where variables are pairwise confronted and rated on a scale of one to nine.

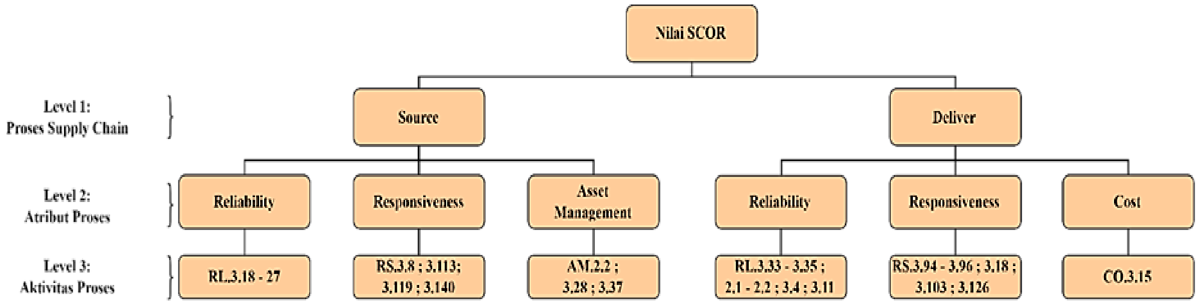

Figure 3. Metrics hierarchical structure for supply chain performance measurement at XYZ Company's DC

$$aij = \frac{Wi}{Wj}, i, j = 1,2, \ldots n \quad (1)$$

The description of the pairwise comparison value scale is shown in Table 2. An example of a pairwise comparison matrix is shown in Table 3.

Table 2. Pairwise comparison value scale

Level of Preference	Definition	Explanation
1	*Equal importance*	Two activities contribute equally to the goal
3	*Moderate importance*	Experience and judgment do not strongly differ between one activity and another
5	*Strong importance*	Experience and judgment strongly favor one activity over another
7	*Very Strong importance*	One activity is strongly preferred over another activity
9	*Extreme importance*	One activity ranks highest in the preference tier

Table 3. Pairwise comparison matrix

	j		
i	**A1**	**A2**	**A3**
A1	1	A12	A13
A2	A21	1	A23
A3	A31	A32	1

4. Calculating Priority Weight:
- Normalize each column by dividing each value in column I and row J by the largest value in column I.

$$aij = \frac{aij}{maxaij} \quad (2)$$

- Sum the values in each I column

$$aij = \Sigma aij \quad (3)$$

- Determine the priority weight of each Ith criterion.

$$Wi = \frac{aij}{n} \quad (4)$$

5. Perform Consistency Test
- EigenValue calculation (λ_(max))

$$\lambda max = \frac{\Sigma a}{n} \quad (5)$$

- Calculation of Consistency Index (CI) value

$$CI = \frac{\lambda max - n}{n - 1} \quad (6)$$

- The calculation of the Consistency Ratio (CR) value by dividing CI with random index (RI) for n can be seen in Table 4

$$CR = \frac{CI}{CR} \quad (7)$$

Table 4. Random index for n = 1 – 8

N	1	2	3	4	5	6	7	8
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41

- The comparison metric is acceptable if the consistency ratio value CR ≤ 10%.

6. Arrange the priorities of the existing activity metrics then determine which metrics have the highest weight as the priority.

In this research, the results of weight processing from the AHP method obtained from the questionnaire will be used as the priority weight for each metric assessed. The weight of each metric from each respondent will be combined into a global weight**,** which is used for the overall supply chain performance assessment.

3.2. Normalization Method *(Snorm de Boer)*

The Snorm de Boer method is crucial for normalizing performance indicators, as each has varying weight and size scales. This process determines the priority level of company performance fulfillment is essential for achieving the final value of supply chain performance measurement. Snorm de Boer normalization formula is as follows (Sumiati 2006):

$$S(Norm) = \frac{(Si - Smin)}{(Smax - Smin)} \times 100 \quad (8)$$

Where:
- Si = Real indicator value
- Smin = Minimum indicator value
- Smax = Maximum indicator value

In this measurement, each indicator value is converted into a certain value interval, namely 0 to 100. Zero (0) means the worst and one hundred (100) means the best. Table 5 shows the performance indicator monitoring system.

Table 5. Supply Chain Performance monitoring index (Sumiati et al. 2006)

Performance Value	Indicator
<40	*Poor*
40 – 50	*Marginal*
50 – 70	*Average*
70 – 90	*Good*
>90	*Excellent*

3.3. Traffic Light System (TLS)

The Traffic Light System (TLS) method is used to help analyze supply chain performance metrics based on the results of the snorm value. TLS classifies the performance value of each indicator into three color groups: red, yellow, and green (Tannady, 2015).

- The red color (performance value <60) indicates that a company's performance indicator is still below its target and requires immediate improvement.
- The yellow color (performance value $60 \leq x \leq 80$) indicates the company's performance indicators have approached their target but not yet reached it, requiring continuous improvement and control.
- Green color (performance value > 80) indicates a company's performance has exceeded its target, indicating the need for the company to maintain its achievements.

3.4. Questionnaire *(Pairwise Matrix)*

Table 6. Example of questionnaire completion

Process 1	Definition *(APICS 2017)*	Value Criteria	Definition *(APICS 2017)*	Process 2
Source	Ordering, receiving, and transferring goods based on company requests	(Scale 9-1-9)	Shipping goods ordered by customers that have been aggregated	**Deliver**

The questionnaire assesses the DC supply chain performance of XYZ Company using the SCOR model. It consists of eight sections based on three activity levels: Level 1, which aligns supply chain processes with existing core processes; Level 2, which assesses process attributes such as reliability, responsiveness, asset management, and cost; and Level 3, which focuses on day-to-day operational activities. An example of questionnaire can be seen in Table 6 with its scale as seen in Figure 4.

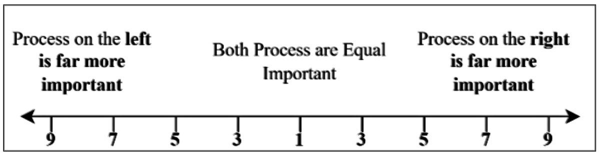

Figure 4. Scale 9-1-9

3.5. Respondents

Questionnaires were distributed at XYZ Company's Distribution Center (DC), and a filling session was held for respondents with a deep understanding of supply chain operational activities. The Head of the Warehouse Division, Supply Chain Division Manager, and Supply Chain Division Staff were invited to complete the questionnaire. The selection was based on previous studies indicating that AHP questionnaires require expert opinions to provide valuable subjective views.

4. Result

This section presents the findings of the supply chain performance evaluation for XYZ Company's DC in 2022 and 2023. The analysis utilizes the SCOR model and incorporates a three-level weighting scheme (Figures 5-7) to assess performance across various metrics within the source and delivery processes. These metrics are based on SCOR metrics (APICS, 2017) and were specifically chosen for DC based on its supply chain operations. DC's managers and staff validate these metrics so that they can represent the whole supply chain performance measurement. The metrics are abbreviated using a code that stands for each of the metrics and can be seen in Tables 7 and 8.

The results are normalized using the Snorm de Boer method, enabling comparisons across different metrics in 2022 and 2023 (Tables 9-12). Table 13 shows the total supply chain performance. Further, an evaluation will be conducted for the changes in performance between 2022 and 2023 (Tables 14-15) to identify areas of sustained performance, decline, or improvement.

Based on these findings, Tables 16 and 17 show the metrics prioritized for improvement based on these conditions, the values that are still red and yellow based on the TLS, have a high global weight, fall into the cumulative Pareto percentage, and the metrics that have certainly decreased and/or have not progressed.

Finally, informed by SCOR best practices, Tables 18 and 19 offer specific solutions for each evaluation that occurs in each prioritized metric. The evaluations explained in Tables 16 and 19 are derived from potential problems that may occur in each metric, based on discussion with DC's manager and staff.

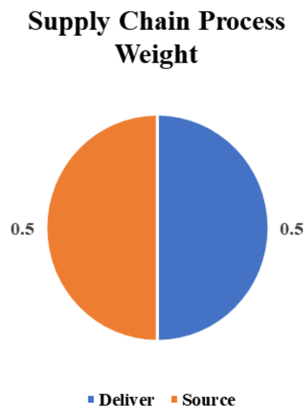

Figure 5. Process weight

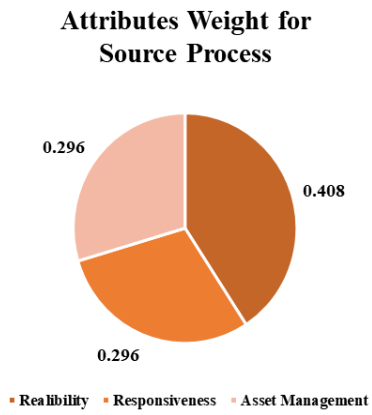

Figure 6. Source Atr. weight

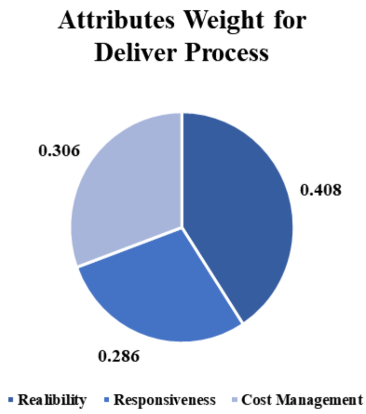

Figure 7. Deliver Atr. weight

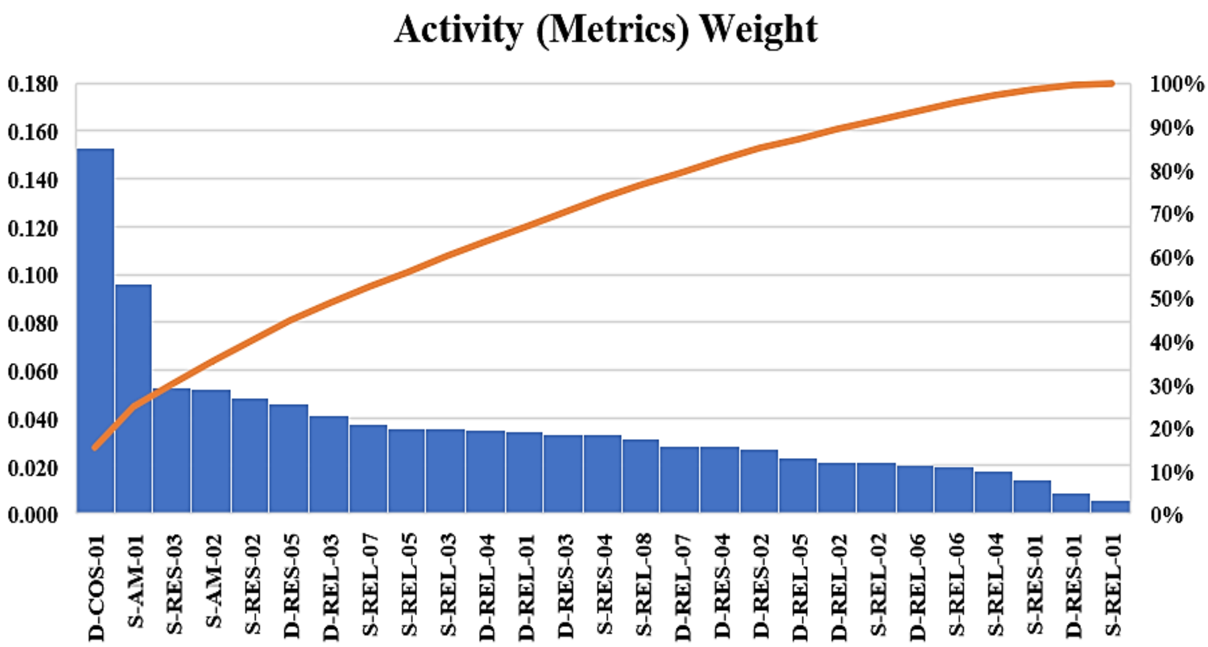

Figure 8 Weight for each metrics (Level 3)

Table 7. Table of meanings for each source metrics

Source Activity Metrics (APICS, 2017)	Abbreviated Code
RL.3.27 % Schedules Changed within Supplier's Lead Time	RL.3.27
RL.3.18 % Orders Processed Complete	RL.3.18
RL.3.19 % Orders Received Defect Free	RL.3.19
RL.3.20 % Orders Received On-Time	RL.3.20
RL.3.21 % Orders received with the correct content	RL.3.21
RL.3.22 % Orders received with correct packaging	RL.3.22
RL.3.23 % Orders Received with Correct Documents	RL.3.23
RL.3.24 % Orders received damage-free	RL.3.24
RS.3.8 Authorize Supplier Payment Cycle Time	RS.3.8
RS.3.113 Receiving Product Cycle Time	RS.3.113
RS.3.139 Put away Cycle Time	RS.3.139
RS.3.140 Verify Product Cycle Time	RS.3140
AM.3.28 Percentage Defective Inventory	AM.3.28
AM.3.37 Percentage Excess Inventory	AM.3.37

Table 8. Table of meanings for each delivery metrics

Deliver Activity Metrics (APICS, 2017)	Abbreviated Code
RL.3.33 Delivery Item Accuracy	RL.3.23
RL.3.34 Delivery Location Accuracy	RL.3.34
RL.3.35 Delivery Quantity Accuracy	RL.3.35
RL.2.1 % of Orders Delivered in Full	RL.2.1
RL.2.2 Delivery Performance to Date	RL.2.2
RL.3.4 % Correct Material Documentation	RL.3.4
RL.3.11 % of Faultless Invoices	RL.3.11
RS.3.94 Total Waiting Time (Dwell) of Order Fulfillment	RS.3.94
RS.3.18 Total Time to Consolidate Orders	RS.3.18
RS.3.96 Pick Product Cycle Time	RS.3.96
RS.3.95 Total Time for Product Packing	RS.3.95
RS.3.126 Product Delivery Cycle Time	RS.3.126
RS.3.103 Receive and Verify Product Cycle Time	CO.3.15
CO.3.15 Total Order Delivery Cost	RL.3.23

Table 9. Results for source process in 2022

Metrics *(APICS, 2017)*	Actual Value (Si)	Minimum Value (Smin)	Maximum Value (Smax)	Snorm (%)	Global Weight	Snorm * Weight
RL.3.18	99.99%	90.00%	100.00%	100	0.0212	2.1200
RL.3.22	99.83%	90.00%	99.90%	99	0.0198	1.9602
RL.3.2	99.61%	90.00%	99.90%	97	0.0356	3.4532
RL.3.24	99.11%	90.00%	99.90%	92	0.0315	2.8980
RL.3.19	99.08%	90.00%	99.90%	92	0.0354	3.2568
RL.3.20	98.92%	90.00%	99.90%	90	0.0179	1.6110
RL.3.27	16.30%	25.00%	15.00%	87	0.0053	0.4611
RL.3.23	98.18%	90.00%	99.90%	83	0.0373	3.0959
RS.3.8	25	30	23	79	0.0142	1.1218
RS.3.113	11	15	10	75	0.0483	3.6225
RS.3.140	11	15	10	75	0.0329	2.4675
AM.3.37	0.77%	1.00%	0.65%	67	0.0522	3.4974
AM.3.28	0.87%	1.00%	0.80%	64	0.0959	6.1376
RS.3.139	19	30	10	55	0.0526	2.8930
				Total Source Value		**38.596**

Table 10. Results for deliver process in 2022

Metrics	Actual Value (Si)	Minimum Value (Smin)	Maximum Value (Smax)	Snorm (%)	Global Weight	Snorm * Weight
RL.3.34	99.98%	95.00%	99.99%	100	0.0214	2.1345
RL.3.1	0.47%	5.00%	0.01%	91	0.0284	2.5820
RL.3.4	99.53%	95.00%	99.99%	91	0.0203	1.8471
RS.3.94	17	30	15	87	0.0087	0.7562
RL.3.33	99.06%	95.00%	99.99%	81	0.0345	2.8026
RL.3.35	98.92%	95.00%	99.99%	79	0.0408	3.2033
RS.3.96	9.75	15	8	75	0.0333	2.4988
RL.2.2	98.71%	95.00%	99.99%	74	0.0234	1.7420
RS.3.126	405	200	480	73	0.0457	3.3478
RS.3.18	174.25	210	160	72	0.0269	1.9199
RS.3.95	2.75	4	2	63	0.0284	1.7721
CO.3.15	Rp11,624,135,669	Rp15,000,000,000	Rp5,000,000,000	34	0.1530	5.1664
RL.2.1	96.67%	95.00%	99.99%	33	0.0351	1.1716
				Total Source Value		**30.944**

Table 11. Results for source process in 2023

Metrics	Actual Value (Si)	Minimum Value (Smin)	Maximum Value (Smax)	Snorm (%)	Global Weight	Snorm * Weight
RL.3.18	99.99%	95.00%	100.00%	100	0.0212	2.1200
RL.3.22	99.86%	95.00%	99.90%	99	0.0198	1.9602
RL.3.21	99.72%	95.00%	99.90%	96	0.0356	3.4176
RL.3.24	99.40%	95.00%	99.90%	90	0.0315	2.8350
RL.3.19	99.38%	95.00%	99.90%	89	0.0354	3.1506
RL.3.20	99.23%	95.00%	99.90%	86	0.0179	1.5394
RL.3.27	0.84%	1.00%	0.80%	82	0.0959	7.8638
RL.3.23	98.71%	95.00%	99.90%	76	0.0373	2.8348
RS.3.8	1.75	3.5	1	70	0.0142	0.9940
RS.3.113	10.5	14	9	70	0.0483	3.3810
RS.3.140	5.75	7.5	5	70	0.0329	2.3030
AM.3.37	20.75	30	10	46	0.0526	2.4196
AM.3.28	0.84%	1.00%	0.65%	44	0.0522	2.2968
RS.3.139	21.11%	25.00%	10.00%	26	0.0053	0.1378
				Total Source Value		**37.253**

Table 12. Results for delivery process in 2023

Metrics	Actual Value (Si)	Minimum Value (Smin)	Maximum Value (Smax)	Snorm (%)	Global Weight	Snorm * Weight
RL.3.34	99.99%	97.00%	99.99%	100	0.0214	2.1368
RL.3.11	16.25	30	15	92	0.0087	0.7999
RL.3.4	0.48%	3.00%	0.01%	84	0.0284	2.3973
RS.3.94	99.52%	97.00%	99.99%	84	0.0203	1.7150
RL.3.33	99.41%	97.00%	99.99%	80	0.0408	3.2824
RL.3.35	99.35%	97.00%	99.99%	79	0.0345	2.7081
RS.3.96	9.5	14.7	7.84	76	0.0333	2.5255
RL.2.2	2.5	3.92	1.96	72	0.0284	2.0542
RS.3.126	172	205.8	156.8	69	0.0269	1.8523
RS.3.18	390	235.2	470.4	66	0.0457	3.0096
RS.3.95	98.90%	97.00%	99.99%	64	0.0234	1.4920
CO.3.15	Rp8,985,150,443	Rp14,700,000,000	Rp4,900,000,000	58	0.1530	8.9244
RL.2.1	97.65%	97.00%	99.99%	22	0.0351	0.7583
				Total Source Value		**33.655**

Table 13. Results for supply chain performance in 2022 and 2023

Year	Process	Value	Total Value
2022	*Source*	38.596	69.540
	Deliver	30.944	
2023	*Source*	37.253	70.908
	Deliver	33.655	

Table 14. Comparison of source performances

Metrics	2022 (Snorm)	2023 (Snorm)	Delta
RL.3.18	100	100	0%
RL.3.22	99	99	0%
RL.3.2	97	96	-1%
RL.3.24	92	90	-2%
RL.3.19	92	89	-2%
RL.3.20	90	86	-4%
RL.3.27	87	26	-61%
RL.3.23	83	76	-7%
RS.3.8	75	70	-5%
RS.3.113	75	70	-5%
RS.3.140	75	70	-5%
AM.3.37	67	44	-22%
AM.3.28	64	82	18%
RS.3.139	55	46	-9%
		Average	-7%

Table 15. Comparison of deliver performance

Metrics	2022	2023	Delta
RL.3.34	100	100	0%
RL.3.1	91	84	-6%
RL.3.4	91	84	-6%
RS.3.94	89	83	-6%
RL.3.33	81	79	-3%
RL.3.35	79	80	2%
RS.3.96	75	76	1%
RL.2.2	74	64	-11%
RS.3.126	72	69	-3%
RS.3.18	69	66	-3%
RS.3.95	63	72	10%
CO.3.15	34	58	25%
RL.2.1	33	22	-12%
		Average	-1%

Table 16. Prioritization of improvement for source process metrics based on global and pareto weights

Metrics	Global Weight	2022 (%)	2023 (%)	Delta (%)	Percentage (%)	Cumulative Percentage (%)
AM.3.28	0.0959	64	82	18	19.18	19.176
RS.3.139	0.0526	55	46	-9	10.52	29.694
AM.3.37	0.0522	67	44	-23	10.43	40.125
RS.3.113	0.0483	75	70	-5	9.67	49.792
RL.3.23	0.0373	83	76	-7	7.46	57.248
RL.3.21	0.0356	97	96	-1	7.12	64.372
RL.3.19	0.0354	92	89	-3	7.09	71.461
RS.3.140	0.0329	75	70	-5	6.57	78.033
RL.3.24	0.0315	92	90	-2	6.29	84.327
RL.3.18	0.0212	100	100	0	4.23	88.557
RL.3.22	0.0198	99	99	0	3.96	92.514
RL.3.20	0.0179	90	86	-4	3.58	96.09
RS.3.8	0.0142	75	70	-5	2.85	98.94
RL.3.27	0.0053	87	26	-61	1.06	100

Table 17. Prioritization of improvement for deliver process metrics based on global and pareto weights

Metrics	Global Weight	2022 (%)	2023 (%)	Delta (%)	Percentage (%)	Cumulative Percentage (%)
CO.3.15	0.153	34	58	24	30.61	30.608
RS.3.126	0.0457	69	66	-3	9.15	39.753
RL.3.35	0.0408	79	80	1	8.16	47.912
RL.2.1	0.0351	33	22	-11	7.02	54.936
RL.3.33	0.0345	81	79	-2	6.9	61.834
RS.3.96	0.0333	75	76	1	6.66	68.498
RL.3.11	0.0284	91	84	-7	5.69	74.184
RS.3.95	0.0284	63	72	9	5.67	79.855
RS.3.18	0.0269	72	69	-3	5.37	85.225
RL.2.2	0.0234	74	64	-10	4.68	89.91
RL.3.34	0.0214	100	100	0	4.28	94.187
RL.3.4	0.0203	91	84	-7	4.07	98.255
RS.3.94	0.0087	84	92	8	1.75	100

Table 18. Evaluation and improvement for prioritized metrics in the source process

Prioritized Metrics	Problems / Evaluations	Proposed Improvement ***(Refers to Best Practices on SCOR)***
RS.3.139	Batch sizes and complexity can cause put-away times to vary, and process bottlenecks, such as limited storage space, can cause delays	1. BP.089 Perfect Pick Put away: - This practice aims to optimize the put-away process by ensuring that the right quality and quantity of products are in the right place, which is essential for efficient downstream pick processes and customer delivery
RS.3.113	Batch size and complexity, process bottlenecks, such as dock space limitations or inefficient unloading procedures, can cause delays, and unexpected issues like damaged goods requiring inspection, system downtime, or staff absences could disrupt the receiving process and impact achievement.	1. BP.069 Raw Materials Receiving Process: - Streamline internal processes contributing to receiving cycle time by reducing manual data entry and processing time. This process includes components like receiving advanced shipping notifications, receiving inspections, barcode label scanning, master pack labels, shrink wrap, and receiving and putting away. It also includes optimizing paperwork and improving dock scheduling to minimize waiting times for unloading deliveries. 2. BP.068 Supplier Delivery Performance Analysis: - This practice directly addresses factors contributing to receiving cycle time. By analyzing supplier delivery data, delays caused by late deliveries or inconsistencies can be identified. This knowledge can then be used to adjust receiving schedules to anticipate supplier arrival times better.

Prioritized Metrics	Problems / Evaluations	Proposed Improvement *(Refers to Best Practices on SCOR)*
AM.3.37	Despite the slight decrease in average excess inventory percentage, inefficiencies in inventory management processes may have persisted or worsened, leading to a lower achievement rate in 2023	1. BP.010 Min-Max Replenishment: - Method that involves Analyzing historical inventory data, setting minimum and maximum levels, and implementing an automated replenishment system. 2. BP.015 Safety Stock Planning - Process that calculates safety stock levels based on demand variability and replenishment cycle time, aiming to prevent excess inventory and stockouts by ensuring that inventory levels are not too low. 3. BP.123 Automated Identification/Disposition of Over Shipments: - Implementation of automated supply chain management systems to verify and identify over-shipped products, ensuring proper inventory identification and disposal and facilitating efficient inventory management. 4. BP.156 Collaborative Planning, Forecasting, and Replenishment: - Collaborating with suppliers and customers to improve forecasting and replenishment processes by sharing data and insights, understanding demand patterns, and adjusting inventory levels to ensure timely and accurate product delivery.
RL.3.23	Supplier Issues: Inconsistent or inaccurate documentation practices by suppliers	1. BP.068 Supplier Delivery Performance Analysis: - Tool used to assess the performance of suppliers in delivering products with accurate documentation, identifying those who consistently deliver incorrect information, and implementing corrective measures. 2. BP.147 Receiving Goods Inspection: - Verify the accuracy of invoices received from suppliers against the quantities received and the associated purchase order, contract, or vendor schedule. 3. BP.166 Document Management System: - System that streamlines the documentation process reduces errors, and improves supply chain efficiency by utilizing electronic data interchange (EDI) for seamless communication with suppliers and customers, including document control, standardization, verification, storage, retrieval, security, and audit.

Table 19. Evaluation and improvement for prioritized metrics in the delivery process

Improved Metrics	Problems / Evaluations	Proposed Improvement *(Refers to Best Practices on SCOR)*
CO.3.15	Unexpected events or cost increases (e.g., fuel price hikes and disruptions in delivery routes) could have pushed the actual cost.	1. BP.046 Expedite Outbound Customer Shipments: - Analyzing the cost of maintaining inventory vs. transportation for opportunities to optimize total cost. 2. BP.107 Distributed Order Management: - Managing orders across multiple locations and channels. It includes managing inventory levels, tracking orders, and optimizing delivery routes. 3. BP.115 Transportation Management System: - The TMS optimizes transportation plans by considering shipment lot size, per-shipment setup costs, and storage capacity to minimize freight costs.
RS.3.126	Unexpected events like traffic congestion, bad weather, or vehicle breakdowns can cause delays	1. BP.146 Cross-Docking: - Unloading materials from an incoming vehicle and loading these materials directly onto outbound vehicles without putting them away into the regular storage locations in a warehouse. It reduces time to deliver and some material handling and storage costs. 2. BP.024 Supply Chain Optimization (SCO): - Optimizing the supply chain to reduce costs and improve efficiency. It could be applied to the total order shipping time by optimizing the warehouse layout and the shipping process itself, reducing the time it takes to do shipping.

Improved Metrics	Problems / Evaluations	Proposed Improvement *(Refers to Best Practices on SCOR)*
RL.2.1 & RL.3.33	Human errors can occur during picking, packing, or shipping, while system inconsistencies or order processing errors can lead to incorrect information being sent to fulfillment. External factors, such as damage during transit or supplier issues, can also contribute to inaccuracies.	1. BP.012 Lot Tracking: - A lot tracking system tracks the movement of products from the time they are received in the warehouse until they are shipped out. This ensures that products are accurately tracked and that any discrepancies can be quickly identified and addressed. 2. BP.017 Distribution Planning: - A distribution planning process that ensures that products are appropriately planned and allocated to the right locations. This includes considering product demand, inventory levels, and shipping routes to optimize distribution. 3. BP.019 Demand Planning: - Demand planning process that accurately forecasts demand for products. This includes analyzing historical sales data, seasonality, and other factors to ensure the right products are stocked at the right levels. 4. BP.145 Vendor Collaboration: - Vendor collaboration process ensures that suppliers are properly managed and that products are accurately tracked and shipped out. 5. BP.144 Purchase Order Management: - Implement a purchase order management process that ensures that purchase orders are accurately managed and that products are properly tracked and shipped out.

5. Discussion

Supply chain performance measurement at XYZ Company's Distribution Center using SCOR 12 highlights the significance of adopting a standardized and comprehensive approach to evaluate supply chain performance. Compared to other studies that employ SCOR, this research emphasizes the importance of integrating two core processes of the SCOR model, including source and delivery, to gain a holistic understanding of supply chain performance. This approach is particularly relevant in XYZ Company, where the current evaluation system focuses primarily on the delivery process, neglecting other crucial aspects like procurement. By adopting SCOR, XYZ Company can better understand its supply chain's strengths and weaknesses, enabling targeted improvements across various aspects based on SCOR Best Practices.

Using SCOR in supply chain performance measurement is not new, as studies such as Fauziah et al. (2024) and Prasetyo et al. (2024) show. These studies demonstrate the effectiveness of SCOR in evaluating supply chain performance in various industries, including farm and manufacturing sectors. However, these studies differ from the present research regarding the scope and approach employed. For instance, Fauziah et al. (2024) measured five attributes with five metrics and compared the results to the company's target achievement, whereas Prasetyo et al. (2024) measured five processes with five attributes, concluding 21 metrics and used the Traffic Light System approach for each metric.

In contrast, this research measures two processes, with four attributes, concluding 27 metrics, and uses the Analytical Hierarchy Process (AHP) to weight each metric and normalize with Snorm de Boer. The result of the supply chain performance measurement will be interpreted with the Monitoring Index Table, and the Traffic Light System with Pareto method approaches will be used to identify which metrics still need improvement and have a large weight (impact) on the final value of supply chain performance. This measurement answers the need for the company to measure supply chain performance using a standardized method covering more than just the deliver process to find what the company lacks, especially in its supply chain processes. Furthermore, the solution provided for each problematic metric will be based on Best Practices in the SCOR Model, which can be seen in a general overview of this best practices approach. Each metric from each process, from 2022 until 2023 will be discussed later on this paper, including why differences occur, etc.

A. Source Process

1. Overall Trend:

There is an average decrease of 7% in achievement across most metrics.

2. Metrics with Misinterpreted Declines:

- **RS.3.113, RS.3.140, RS.3.139**: Slight declines in these metrics (-5%) likely reflect stricter targets in 2023 despite slightly improved processing times per batch.
- **AM.3.37**: This metric's decrease (-22%) is likely due to a stricter target in 2023, even though the actual excess inventory percentage remained low.

3. **Genuine Declines:**
- **RL.3.18, RL.3.21, RL.3.22:** A slight decline in these metrics (-1%) might indicate issues with fulfillment processes.
- **RL.3.24, RL.3.19**: Declines in these metrics (-2%) and (-3%) suggest potential problems with supplier handling or transportation.
- **RL.3.20**: A significant decline in this metric (-4%) likely correlates with the increased RL.3.27 (-61%). This suggests unreliable supplier deliveries are impacting on the distributor's ability to meet on-time delivery targets.
- **RL.3.23**: A decline in this metric (-7%) could indicate communication issues with suppliers or inefficiencies in documentation procedures.
- **RL.3.27**: This metric's dramatic decrease (-61%) highlights a significant challenge with supplier reliability.

4. **Correlations Between Metrics:**
- **Supplier Issues:** The significant increase in RL.3.27 likely contributes to declines in RL.3.20, RL.3.23, RL.3.24, and RL.3.19 if items are rushed during handling.

B. Delivery Process

1. **Overall Trend:**

There is an average decrease of 1% in achievement across most metrics.

2. **Improved Metrics:**
- **RL.3.35**: Increased by 1% despite higher targets. This indicates a strong focus on accurate picking and order fulfillment.
- **RS.3.96**: Improved by 1%. This suggests efficient picking processes despite potentially more complex order structures due to higher targets.
- **RS.3.18**: Decreased by 3%. This signifies faster consolidation despite potentially more orders to manage due to increased targets.

3. **Consistent Metrics:**
- **RL.3.34**: Remained at 100%. This reflects consistent accuracy in delivery routing.

4. **Genuine Declines:**
- **RL.2.2**: Decreased by 10%. This is the most concerning metric.
- **RL.3.11 & % RL.3.4**: Both decreased by 7%. This points toward potential issues with documentation accuracy during order fulfillment.
- **RL.3.33**: Decreased by 2%. This aligns with the decline in overall delivery performance. It could be related to the factors mentioned above.
- **RS.3.94**: Decreased by 6%. Faster order fulfillment could lead to rushed picking, potentially impacting accuracy (seen in other metrics).
- **RS.3.95**: Increased by 9%. More complex packaging for higher-value items with increased targets could be a factor.
- **RL.2.1**: Decreased by 11%. This aligns with the decline in delivery performance and item accuracy. It suggests challenges in fulfilling complete orders on time.

5. **Correlations Between Metrics:**
- The decline in RL.2.2 could be linked to the decrease in RL.3.33 and RL.2.1. This suggests a potential issue with the picking and order fulfillment processes.
- The decrease in RL.3.11 and RL.3.4 might be correlated with the focus on faster order fulfillment seen in the decrease of RS.3.94.
- The increase in RS.3.95 could be related to the potential increase in Packaging Complexity due to higher-value items with increased targets.

C. Total Supply Chain Performance

There has been an increase in total supply chain performance in 2023 from 2022. Despite the decline in the average of each metric for each process, this is caused by the improvement of heavy-weighted metrics, especially CO.3.15 and AM.3.28. These two improved dramatically, and then, because their weight is the heaviest, they lifted the overall supply chain performance measurement. This can mean the company does something significant to improve these metrics. Meanwhile, other factors can also play a part, mainly in the number of total orders processed and total orders delivered. The point is that total supply chain performance is improving, but this cannot be why the company stays stagnant. They must stay competitive and improve each metric, especially metrics that still decline or have not improved, such as RS.3.139; AM.3.37; RS.3.113; RL.3.23; CO.3.15; RS.3.126; RL.2.1; RL.3.33

5.1. Managerial Implications

Supply chain performance measurement at PT XYZ Distribution Center can have substantial managerial benefits from adopting SCOR best practices. For example, the company can increase customer satisfaction, boost efficiency, and simplify operations by implementing these practices. To guarantee that orders are received with accurate and comprehensive documentation, for example, the practice of implementing a supplier delivery performance analysis can help identify and address supplier issues related to documentation. This raises the supply chain's overall efficiency and increases the accuracy of inventory management. To guarantee that materials are accurately documented before being used in production, it is also possible to detect any discrepancies in documentation by putting in place materials receiving processes that include comprehensive inspections.

5.2. Limitation and Future Research

Limitations still exist in this research, especially in its scope and depth of analysis. The performance metrics examined are confined to the source and delivery processes, neglecting the planning and return stages crucial for a holistic understanding of supply chain performance. Additionally, the analysis identifies general problem areas and proposes solutions based on SCOR best practices. While valuable, these lack specific implementation steps, limiting their immediate applicability.

Future research can overcome these limitations by extending the scope of analysis to include the planning and return processes as well as the entire supply chain. A more comprehensive analysis of the underlying factors influencing each metric's performance would offer a deeper understanding of the difficulties encountered. Furthermore, future studies could delve deeper into implementing best practices, outlining a step-by-step approach tailored to each prioritized metric. This would provide actionable insights for practitioners seeking to improve their supply chain performance.

6. Conclusions

This study successfully addressed the question of how the SCOR model can be utilized to evaluate and improve XYZ Company's overall supply chain performance. By employing SCOR's comprehensive framework, the research identified key metrics requiring improvement in efficiency and effectiveness. While the overall performance scores for 2022 and 2023 (69 and 70, respectively) indicate a baseline, opportunities for optimization exist.

The analysis pinpointed the need for more effective inventory management and procurement strategies to optimize costs and lead times. This finding aligns with XYZ's objective of enhancing supply chain performance through standard methods. Furthermore, adopting SCOR best practices, such as supplier delivery performance analysis, can improve documentation accuracy, overall efficiency, and, ultimately, customer satisfaction, which is crucial in XYZ's competitive retail environment. In conclusion, this research demonstrates the value of SCOR in identifying performance gaps and guiding improvement initiatives. By addressing the identified limitations, XYZ can strengthen its supply chain and achieve a competitive advantage in the retail industry.

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