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Enhancing Supply Chain Performance Analysis Through Methodological Integration: A SCOR-Based Framework with AHP and Fishbone Application

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Abstract: This study presents a structured framework for supply chain performance evaluation by integrating the SCOR model with the Analytical Hierarchy Process (AHP) and Fishbone Diagram. The approach is applied to PT. XYZ, an Indonesian pharmaceutical company recently entering the medical device distribution sector. The objective is to demonstrate how combining these methods can enhance the accuracy and depth of supply chain diagnostics. SCOR Level 1 identifies performance gaps, AHP in Level 2 prioritizes improvement areas, and Fishbone in Level 3 explores root causes. Rather than focusing solely on outcome metrics, the study emphasizes how method integration enables clearer identification of performance issues and actionable priorities. Results indicate that reliability, responsiveness, and agility are the most pressing concerns, primarily due to workforce limitations, digitalization gaps, and planning inefficiencies. This integrated approach provides deeper insights, better alignment between strategy and operations, and more targeted recommendations. It offers a practical and replicable model for organizations operating in highly regulated or transitional industries.

Keyword: SCOR Model, Supply Chain, Integration Method, AHP, Fishbone

INTRODUCTION

In the era of Industry 4.0, supply chains are expected to be increasingly agile, responsive, and resilient especially in highly regulated industries such as medical devices. Measuring supply chain performance is not only essential for ensuring operational efficiency but also for maintaining competitiveness in dynamic markets (Agyabeng-Mensah et al., 2020).One of the most widely used frameworks for this purpose is the Supply Chain Operations Reference (SCOR) model developed by APICS. SCOR offers a standardized structure for analyzing performance across five key processes Plan, Source, Make, Deliver, and Return—and five performance attributes: reliability, responsiveness, agility, cost, and asset management (APICS, 2017).

However, while the SCOR model provides a comprehensive foundation, it may fall short in capturing contextual and causal factors behind performance gaps (Abolhasani & Ghasemi, 2020). To address this, recent studies have explored integrating SCOR with complementary decision-support and diagnostic tools. The Analytic Hierarchy Process (AHP) helps prioritize performance gaps by structuring expert judgments into a measurable hierarchy, enabling more objective and justifiable decision-making (Tran & Nguyen, 2023). Meanwhile, Fishbone Diagrams or Ishikawa Diagrams are widely used to identify root causes of problems in supply chains, offering structured cause-effect visualization (Ishikawa & Loftus, 1990).

This study aims to explore the integration of SCOR, AHP, and Fishbone Diagram methodologies in enhancing supply chain performance analysis. Using a case study of an Indonesian pharmaceutical company that recently entered the medical device distribution sector, we propose a structured framework that not only identifies performance gaps but also explains their root causes and prioritizes improvement actions. The integrated approach is expected to generate more actionable insights, particularly for organizations in transitional or regulated industries, and contribute to the literature on supply chain diagnostics and performance management.

The Supply Chain Operations Reference (SCOR) model has long been recognized as a global standard for evaluating and improving supply chain performance. Developed and maintained by the Association for Supply Chain Management (Association for Supply Chain Management (ASCM), 2022), SCOR provides a structured framework across five key processes Plan, Source, Make, Deliver, and Return alongside standardized performance attributes including reliability, responsiveness, agility, cost, and asset management. While the SCOR model offers a strong structural foundation, it has been noted to lack the depth needed to fully explain why performance issues occur or how to prioritize which issues to address first (Ivanov & Dolgui, 2020). This limitation has led scholars and practitioners to advocate for the integration of SCOR with other analytical methods to strengthen its diagnostic power.

One such method is the Analytic Hierarchy Process (AHP), which enables decision-makers to prioritize complex alternatives based on expert judgment and structured pairwise comparisons. AHP has been widely applied in supply chain decision-making for areas such as supplier selection, sourcing strategy, and risk assessment (Monczka et al., 2020). When integrated with SCOR, AHP enhances the model's ability to not only detect performance gaps but also rank them in order of business-critical urgency, providing a clearer direction for improvement initiatives.

Complementing this quantitative prioritization, qualitative tools like the Fishbone Diagram or Ishikawa Diagram serve to uncover the root causes behind identified problems. The understanding the underlying factors of supply chain disruptions and inefficiencies is essential to building resilience and sustainability (Sheffi, 2021). The Fishbone method enables teams to categorize potential causes into areas such as manpower, methods, materials, machinery, and environment, facilitating a more collaborative and systematic investigation. The usefulness of Fishbone analysis in identifying root causes of logistics inefficiencies and non-compliance within distribution networks, which are often overlooked by KPI-based evaluations (Immawan, 2020).

Given the complementary strengths of these three approaches, this study aims to integrate the SCOR model with AHP and Fishbone Diagram to form a comprehensive supply chain performance assessment framework. By applying this integrated approach to a case study of an Indonesian pharmaceutical company entering the medical device distribution sector, the study seeks to demonstrate how methodological integration enhances the depth, clarity, and actionability of supply chain diagnostics ultimately supporting better decision-making and performance improvement in a highly regulated and competitive environment.

METHOD

This research employed a mixed-method design that integrated both quantitative and qualitative approaches to gain a comprehensive and context-rich understanding of PT. XYZ's supply chain performance (Maxwell & Loomis, 2003). The use of mixed methods is particularly valuable in complex operational environments, as it allows researchers to triangulate findings, improve analytical depth, and capture both measurable outcomes and underlying causes (Creswell & Creswell, 2018). In the context of supply fail to chain assessment, relying solely on quantitative models often leads to limited insights, as these methods may account for operational context, managerial judgment, and qualitative nuances (Venkatesh et al., 2013). Therefore, this research integrated quantitative SCOR-based metrics at Level 1 and Level 2 with qualitative root cause analysis at Level 3 through the Fishbone Diagram. Such integration strengthens the rigor, applicability, and actionability of supply chain diagnostics, especially for organizations operating in regulated sectors like medical devices (Venkatesh et al., 2013).By combining structured measurement with expert input and contextual insight, this approach supports better prioritization, problem identification, and decision-making.

Data sources included secondary data derived from the company's internal operational records and primary data collected through in-depth interviews with key stakeholders. A literature review was also conducted to reinforce the analytical framework and ensure alignment with contemporary supply chain management concepts. The supply chain framework was determined at level using metrics aligned with the ASCM guide outlined in SCOR Version 14, which introduced eight key performance attributes in ***Table 1*** for evaluating and comparing supply chain performance (Association for Supply Chain Management (ASCM), 2022).

Table 1. SCOR Metrics Level 1

<table>
<tr><th></th><th>Performance Attributes</th><th>Definition</th></tr>
<tr><td rowspan="6">Economic</td><td>Reliability</td><td>Perfect Order Fulfilment
Perfect Supplier Order
Perfect Return Order Fulfilment</td></tr>
<tr><td>Responsiveness</td><td>Order Fulfilment Cycle Time</td></tr>
<tr><td>Agility</td><td>Supply Chain Agility</td></tr>
<tr><td>Costs</td><td>Total Supply Chain Management Costs
Cost of Goods Sold (COGS)</td></tr>
<tr><td>Profit</td><td>Earnings Before Interest and Taxes (EBIT) as a Percent of Revenue
Effective Tax Rate</td></tr>
<tr><td>Assets</td><td>Cash-to-Cash Cycle Time
Return on Fixed Assets
Return on Working Capital</td></tr>
<tr><td rowspan="2">Sustainability</td><td>Environmental</td><td>Material Used
Energy Consumed
GHG Emissions
Waste Generation
Water Consumed</td></tr>
<tr><td>Social</td><td>Diversity and Inclusion
Wage Level
Training</td></tr>
</table>

Source: (Association for Supply Chain Management (ASCM), 2022).

To gain a deeper understanding of the critical activities within each primary supply chain process, the study proceeded to SCOR Level 2 analysis. This stage aimed to identify which activities should be prioritized for optimization. The Analytical Hierarchy Process (AHP) was employed as a structured decision-making tool to determine these priorities (Ayyildiz & Taskin Gumus, 2021). Building on the secondary data analyzed in Level 1, a decision hierarchy was developed, and pairwise comparisons were conducted to assess the relative importance of each process element. From these comparisons, weighted priorities were calculated, and the results were evaluated using the Consistency Ratio (CR). A CR value below 0.1 indicated that the judgments were consistent and could be reliably used for decision-making (Saaty & Vargas, 2022).

The analysis then advanced to SCOR Level 3, where the broader process categories from Level 2 were disaggregated into detailed, operational-level activities. This granularity enabled a more precise diagnosis of specific supply chain problems and facilitated targeted resolution strategies (Immawan, 2020). At this level, root cause analysis was conducted using Fishbone diagrams, informed by primary data collected through structured interviews with internal stakeholders, including the operational director, medical device technical supervisor, heads of logistics, PPIC, and procurement, as well as the marketing manager. The Fishbone framework was constructed by synthesizing insights from these interviews: the core problem was placed at the “head” of the diagram, while its primary contributing factors were visualized as the “bones,” categorized according to major operational domains. This method allowed for a comprehensive exploration of underlying causes and supported the development of more actionable improvement strategies (Liliana, 2016).

These three hierarchical levels, where Level 1 outlines the main process types, Level 2 organizes these into broader process categories, and Level 3 breaks them down into detailed operational elements. This structured approach enables organizations to manage their supply chain activities with greater efficiency, responsiveness, and sustainability—contributing to long-term business viability (Jacobs & Richards, 2011).

RESULT AND DISCUSSION

This section presents the results of supply chain performance analysis at PT. XYZ using an integrated SCOR, AHP, and Fishbone approach. Each method offers complementary insights—SCOR for structured measurement, AHP for priority setting, and Fishbone for root cause identification. The findings are discussed sequentially across SCOR Levels 1 to 3, supported by tables and figures. The integration of quantitative assessment (via SCOR and AHP) and qualitative diagnosis (via Fishbone Diagram) allowed for a comprehensive analysis of both performance metrics and root causes of inefficiencies.

At SCOR Level 1, the company’s performance was evaluated across five standard attributes: reliability, responsiveness, agility, cost, and asset management. As shown in ***Table 2***, reliability and responsiveness scored the lowest among the five, indicating challenges in order fulfillment accuracy and delivery timeliness. These findings are consistent with the study (Rudianto & Astuti, 2023), which identified similar performance bottlenecks in Indonesian medical device supply chains. These low scores suggest that PT. XYZ faces fundamental issues in upstream coordination and end-to-end visibility across its supply chain. Delays in delivery schedules and inaccuracies in order processing often indicate breakdowns in procurement planning and inventory management. Furthermore, the company’s recent entry into the medical device sector may contribute to process misalignments, as internal systems are still adapting to sector-specific compliance and service-level requirements. As a result, the need for a structured and prioritized improvement framework becomes even more critical. This sets the foundation for the next stage of analysis using AHP to determine which performance areas should be addressed first.

Table 2. Result SCOR Level 1

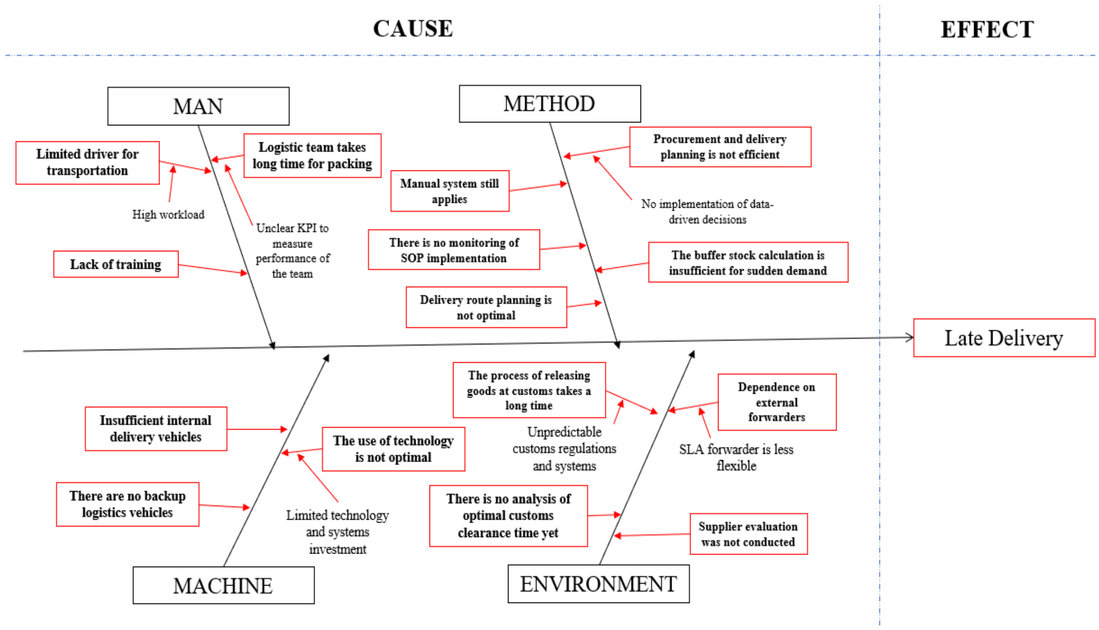
No.	*Performance Attribute*	*Metrics*	*Actual Performance*	*Company Target*	*Gap*
1	*Reliability*	*Perfect Order Fulfilment (POF)*	94,9%	99%	-4,1%
2	*Responsiveness*	*Order Fulfilment Cycle Time (OFCT)*	2 days	1 day	1 day
3	*Agility*	*Supply Chain Agility (SCA)*	9 days	2 days	7 days
4	*Cost*	*Total Supply Chain Management Cost (TSCMC)*	89%	60%	29%
5	*Profit*	*Earnings Before Interest & Taxes (EBIT)*	11%	20%	-9%
6	*Asset*	*Cash-to-Cash Cycle Time (CTCC)*	24 days	7 days	17 days
7	*Environmental*	*Energy Used*	33 kWh/unit	30 kWh/unit	3 kWh/unit
8	*Social*	*Wage Level*	150%	120%	30%

To determine which attributes required immediate attention, the Analytic Hierarchy Process (AHP) was conducted at SCOR Level 2. The decision hierarchy was structured with the five SCOR attributes, and pairwise comparisons were obtained from six supply chain experts. As shown in ***Table 3***, reliability received the highest weight (0.37), followed by responsiveness (0.26) and agility (0.18). The calculated Consistency Ratio (CR) was 0.07, indicating acceptable consistency. These results echo the findings of (Mangla et al., 2022), who emphasized that prioritizing performance dimensions such as reliability and responsiveness is critical for supply chains in highly regulated industries like healthcare.

Table 3. Result SCOR Level 2 using AHP integration

Criteria	*Reliability*	*Responsiveness*	*Cost*	*Profit*	*Agility*	*Asset*	*Environmental*	*Social*	*Weight*	*Eigen Value*	*Rank*
Reliability	1	0,50	1	0,14	0,11	0,33	0,50	1	0,06	1,43	1
Responsiveness	2	1	1	0,33	0,14	0,33	1	1	0,08	1,32	2
Cost	1	1	1	0,50	0,33	1	1	1	0,09	1,00	5
Profit	7	3	2	1	0	1	1	1	0,15	1,22	4
Agility	9	7	3	3	1	1	1	1	0,25	1,23	3
Asset	3	3	1	1	1	1	1	1	0,14	0,69	8
Environmental	2	1	1	1	1	1	1	1	0,12	0,90	7
Social	1	1	1	1	1	1	1	1	0,12	0,92	6

At SCOR Level 3, operational process categories were broken down into more detailed activities to identify specific causes of underperformance. Using structured interviews with key internal stakeholders, a Fishbone Diagram was developed and display in ***Figure 1***. The diagram categorized root causes into four major areas: man, methods, machines, and environment. Key problems included insufficient training on handling sensitive medical devices, unstructured procurement planning, manual inventory tracking, and dependency on long-lead-time imported components. These findings are in line with (Purnomo et al., 2021), who concluded that systemic process misalignment and lack of process standardization often lie at the root of poor



healthcare logistics performance.

Figure 1. Result SCOR Level 3 using Fishbone Diagram integration

Overall, the results of this study confirm the research objective: integrating SCOR, AHP, and Fishbone Diagram enhances the accuracy and strategic relevance of supply chain performance analysis. SCOR provided a standardized performance measurement framework; AHP supported objective prioritization of improvement areas; and Fishbone enabled the identification of root causes not apparent in quantitative data alone. The combination of these methods led to actionable recommendations for PT. XYZ, including targeted workforce development, digital inventory transformation, and structured supplier evaluation mechanisms. This integrated approach is particularly effective for organizations operating in regulated and dynamic sectors such as medical devices.

CONCLUSION

This study demonstrated the value of integrating the SCOR model, Analytical Hierarchy Process (AHP), and Fishbone Diagram to evaluate and improve the supply chain performance of PT. XYZ, a pharmaceutical company entering the medical device distribution sector. By combining structured performance measurement (SCOR), objective prioritization (AHP), and qualitative root cause analysis (Fishbone), this approach enabled a more comprehensive, accurate, and actionable diagnosis of operational inefficiencies. The results revealed that reliability and responsiveness were the most critical gaps, driven by issues such as poor procurement planning, lack of employee training, and limited digital infrastructure. The integrated methodology not only provided insight into what needed improvement, but also why and how it should be addressed. Ultimately, this framework can support companies in regulated and dynamic sectors in building more responsive and resilient supply chains.

This study expands the theoretical application of the SCOR model by integrating it with AHP and Fishbone Diagram, offering a more comprehensive framework for supply chain analysis. It demonstrates that combining structured metrics with prioritization and root cause tools enhances the explanatory power of performance evaluation, especially in dynamic and regulated industries.

For companies, this integrated approach provides a practical toolkit to identify, prioritize, and resolve supply chain issues. It supports better resource allocation and encourages data-driven decisions, particularly in improving reliability, responsiveness, and operational readiness in sectors like medical devices.

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