JHSS (Journal of Humanities and Social Studies)
https://journal.unpak.ac.id/index.php/jhss
Volume 09, Number 02, Page 635-639
e-ISSN: 2598-120X; p-ISSN: 2598-117X

ANALYZING SUPPLY CHAIN RESILIENCE IN RESPONSE TO SUPPLIER LEVEL DISRUPTIONS USING THE GSCOR METHOD (CASE STUDY: ASSESSING SUPPLIER PERFORMANCE AT PT. TRAKINDO SURABAYA)

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Article history: *received 21 May 2025; revised 02 June 2025; accepted 27 July 2025* *DOI: https://doi.org/10.33751/jhss.v9i2.11998*

Abstract. Currently, environmental issues are largely connected to corporations that typically depend on complicated and extensive supply chains. At PT. TRAKINDO Surabaya, raw materials are housed in expansive storage facilities situated outside the city and at a considerable distance. This setup leads to significant carbon emissions from the vehicles used to transport these materials. PT. TRAKINDO Surabaya serves as an authorized distributor of heavy equipment from Caterpillar, a premier American manufacturer with a presence in industries such as mining, construction, oil and gas, forestry and agriculture, and power systems. In the industrial arena, global competition is intensifying as consumer demands escalate. Supply chain management can now be categorized into two kinds: conventional management, which primarily aims to raise value, and eco-friendly supply chain management. Consequently, a thorough analysis of different production facets is required, considering aspects like production, suppliers, and procurement. The GSCOR method is one such approach that can be adopted. This study introduces refreshing insights by offering recommendations to address challenges with suppliers, including delivery delays, constrained delivery capacity, price volatility of raw materials, and material quality concerns. These initiatives seek to enhance each supplier's efficiency at PT. TRAKINDO Surabaya and support the company in minimizing waste from production remains.

Keywords: GSCOR, Supply Chain, PT. Trakindo Surabaya

I. INTRODUCTION

The supply chain plays a crucial role in businesses, encompassing the connections between suppliers, manufacturers, and customers, creating a network that supports the production and delivery of goods and services (Stevenson, 2009). Supply chain management involves strategies to seamlessly link suppliers, manufacturers, warehouses, and storage spaces in order to produce and distribute goods efficiently, optimizing quantity, location, and time, thereby minimizing costs while maximizing service quality for customers (Yusuf and Soediantono, 2022). This chain integrates interactions among suppliers, manufacturers, distributors, and consumers, involving transportation, scheduling, financial transactions, and raw material delivery between stakeholders (Siagian, 2020). The aim of effective supply chain management is to synchronize activities from raw materials to fulfillment of customer satisfaction (Render, 2015). When implemented effectively, Supply Chain Management can enhance product competitiveness and strengthen the company's supply chain system (Heizer and Render, 2011). The aim of this study is to analyze the supply chain, establish Key Performance Indicators (KPIs), assess the green SCOR model to evaluate performance metrics, measure green supply chain performance, and offer proposals for enhancing low-value indicators (Hosseini et al., 2019). Although initial costs may rise, this approach is anticipated to improve long-term investment returns. Additionally, Supply Chain Management's continued implementation is likely to elevate customer service levels (Alam and Tui, 2022).

Transport choice is heavily shaped by the mode of shipment, dimensions, route, and efficient scheduling (Siagian, 2020). Key aspects of Supply Chain Management (SCM) incorporate: Plan, Source, Make, Deliver, and Return. Strategically, SCM seeks to remain competitive or, at the very least, viable within a competitive marketplace. To that end, SCM must offer economically viable, high-quality, timely, and varied products. Achieving this necessitates SCM effectiveness, a focus on value creation, adaptability to change, flexibility, and innovation (Sakinah et al., 2022). The objective is to ensure optimal customer service at a manageable cost while maximizing the value generated from meeting customer needs, and reducing total costs such as ordering, storage, and transport (Nabila et al., 2022). SCM benefits include inventory reduction, ensuring a smooth supply of goods, maintaining quality, reducing supplier numbers, and fostering supplier partnerships.

Supply chain management concepts have evolved from simple integration to synergy among functions, facilitating coordination and integration among organizations. GSCM targets reducing chemical residues, energy consumption, emissions, and solid waste (Primadasa and

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Sokhibi, 2020). Green Supply Chain Management (GSCM) infuses an environmental dimension into supply chains, including design, raw material selection, production processes, customer delivery, and post-life product management (Rahma, 2022). This eco-aware approach intertwines environmental consideration with supply chain management across design, raw material procurement, manufacturing, and consumer delivery, ensuring eco-friendliness (Zulfikar and Ernawati, 2020). Modernizing traditional supply chain management, Green Supply Chain Management supports activities like green sourcing, eco-friendly design, resource conservation, reducing hazardous material use, and recycling—aiming to lower environmental impacts (Puglieri and María, 2021). The upstream supply chain involves securing raw materials from suppliers, while internally, it manages the full process from material arrival to finished goods, guaranteeing timely and condition-approved delivery (Emilia and Supangkat, 2022). Should a product fail to meet consumer expectations, the company will accommodate a replacement or exchange upon request (Jumhur et al., 2024). According to Heriyanto and Noviardy (2019) as cited in (Putri, 2024), green manufacturing stresses regulating hazardous materials usage, assessing water and raw material quality before production, harnessing energy-efficient technologies, prolonging product lifecycle, enhancing machine and design efficiency, and promoting recycling and eco-awareness. Green manufacturing can be incorporated into green industrial sites to better the environmental outcome of production while minimizing raw material expenses by utilizing residual or defective raw materials rather than procuring new ones (Kurnia et al., 2022).

The Supply Chain Operations Reference (SCOR) model is a universal framework for assessing overall supply chain efficiency. SCOR facilitates better partner communication on supply chain matters and provides a basis for objective performance evaluation to advance supply chain efficiency. This model encapsulates business activities across the entire supply chain, from upstream suppliers to downstream customers, meeting supply chain goals and demands (Zulfikar and Ernawati, 2020). Originating from the Supply Chain Council (SCC), SCOR delivers standard terms for outlining, managing, and executing supply chain processes. The SCOR model, illustrated below, comprises processes such as plan, source, make, deliver, and return. SCOR performance assessments consist of two components: performance attributes and metrics.

II. RESEARCH METHOD

This study was carried out at PT. TRAKINDO Surabaya, beginning in January 2025 and continuing until all necessary data was gathered. Questionnaires were handed out to staff members directly involved in both the production and warehouse teams. The research considers dependent variables such as supplier performance evaluations and supplier rankings, with independent variables being plan, source, make, deliver, and return. Data collection included direct field observations and interviews with PT. Trakindo Surabaya employees associated with the warehouse and supply chain teams, followed by the completion of questionnaires by these teams.

III. RESULT AND DISCUSSION

PT. Trakindo Surabaya serves as the official Caterpillar products dealer within Indonesia, and has been operational since 1971 in the city of Surabaya. The company provides heavy machinery solutions and after-sales support to various industries, including mining, construction, forestry, agriculture, energy, and transportation. For this study, data was gathered over a 12-month span, from January to December 2024. Since the assembly volume at PT. Trakindo Surabaya isn't particularly high, data collection covered an entire year of production.

Once the business processes within the company are detailed, the following action is to perform an analysis using the SCOR method. SCOR is an approach that integrates business strategies, benchmarking, and best practices to optimize the supply chain. It's implemented within a holistic framework intended as a guide for enhancing a company's supply chain performance. The steps commence with planning, followed by procurement, production, and then shipping. The first calculation involves plan activity, specifically production planning:

Table 1. Accuracy Of Sales Demand Forecasting

Month	Demand Forecast (pcs)	Actual Demand (pcs)	Yield	Difference
January 2024	18	20	2	90%
February 2024	20	23	3	87%
March 2024	20	25	5	80%
April 2024	19	21	2	90%
May 2024	17	18	1	94%
June 2024	16	19	3	84%
July 2024	16	20	4	80%
August 2024	19	21	2	90%
September 2024	20	22	2	91%
October 2024	18	20	2	90%
November 2024	22	25	3	88%
December 2024	27	30	3	90%

(Source: Data Processing)

Based on the previously shared calculation outcomes, it is evident that the Sales Demand Forecasting Accuracy for January 2024 reached 90%. The forecast predicted 18 pieces, whereas the actual demand turned out to be 20 pieces, leading to a variance of 2 pieces. The forecasting accuracy chart indicates consistent monthly discrepancies between projected and actual demand. This discrepancy arises from the company's reliance on last year's data for projecting future demand, which results in some inaccuracy between forecasted and real demand. Nevertheless, the company operates a make-to-order system for its products, ensuring there is no surplus production. Below you'll find an assessment of sources

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(procurement) that evaluates the performance of suppliers in delivering raw materials:

Table 2. Performance Of Raw Material Delivery On Time

Month	Raw Material Delivery	On Time Raw Material	Delivery Difference in	Results
January 2024	10	10	0	100%
February 2024	9	8	1	89%
March 2024	8	8	0	100%
April 2024	11	10	1	91%
May 2024	12	12	0	100%
June 2024	9	9	0	100%
July 2024	9	8	1	89
August 2024	10	10	0	100%
September 2024	11	11	0	100%
October 2024	12	11	1	92%
November 2024	11	11	0	100%
December 2024	15	14	1	93%

(Source: Data Processing)

Based on the calculation results above, it is apparent that in the months of February, April, July, October, and December of 2024, there are discrepancies in the On-Time Raw Material Delivery Performance values. This indicates that during these months, suppliers failed to deliver raw materials punctually. The root of this delay stems from inadequate communication between the supplier and the company. Below is an analysis of the production process calculations, which evaluate the scheduling accuracy in the production process:

Table 3. Accuracy of production process with schedule

Month	Prodution	Just in Time Production	Yield	Difference
January 2024	5	4	1	80%
February 2024	6	6	0	100%
March 2024	7	6	1	85.71%
April 2024	8	7	1	87.50%
May 2024	9	7	2	77.78%
June 2024	6	6	0	100%
July 2024	5	5	0	100%
August 2024	6	5	1	83.33%
September 2024	7	6	1	85.71%
October 2024	8	8	0	100%
November 2024	6	6	0	100%
December 2024	11	10	1	90.91%

(Source: Data Processing)

The assessment of accuracy between the production timeline and schedule from January to December 2024 indicates a variance ranging from 9.09% to 100%. Factors such as a labor shortage caused by absenteeism contribute to time gaps between planned and actual production, leading to delays.

Here is the computation for the delivery process; it represents the percentage accuracy of items ordered and subsequently dispatched.

Table 4. Percentage of accuracy of ordered delivery items

Month	Product Delivery	Product Delivery Right Item	Percentage
January 2024	15	13	87%
February 2024	18	16	89%
March 2024	20	17	85%
April 2024	16	16	100%
May 2024	14	13	93%
June 2024	16	15	94%
July 2024	17	15	88%
August 2024	15	14	93%
September 2024	18	18	100%
October 2024	17	17	100%
November 2024	21	20	95%
December 2024	25	21	84%

(Source: Data Processing)

The table above illustrates that, between January 2024 and December 2024, the company consistently dispatched products that failed to align with customer orders. Each month, the rate of non-conformity fluctuated between 84% and 95%. This suggests that consumers frequently receive products that do not meet their expectations, leading to significant discrepancies. Monitoring this issue is crucial for the company to maintain consumer trust.

Outlined below is the method for calculating the percentage of product returns by consumers in relation to this issue, explained as follows:

Table 5. Percentage of returns of defective or damaged products from customers

Month	Products Shipped	Number of Products Returned	Results
January 2024	15	2	13%
February 2024	18	3	17%
March 2024	20	4	20%
April 2024	16	2	13%
May 2024	14	2	14%
June 2024	16	1	6%
July 2024	17	3	18%
August 2024	15	4	27%
September 2024	18	4	22%
October 2024	17	3	18%
November 2024	21	4	19%
December 2024	25	5	20%

(Source: Data Processing)

Drawing from the existing table, it's evident that each step in the GSCOR method—plan, source, make, deliver, and return—displays a range of percentages, indicating none are flawless. This stems from various factors affecting each step differently. Companies must take this into account, particularly with suppliers, in order to mitigate delays in their hose assembly process. Here are some strategies for

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enhancing supplier performance across the five GSCOR method processes:

1. Plan:
   - Implement a demand forecasting system using historical data.
   - Establish integrated information systems with suppliers.
2. Source:
   - Evaluate and categorize suppliers.
   - Conduct regular audits and establish a Service Level Agreement (SLA).
3. Make:
   - Employ lean manufacturing techniques.
   - Enforce SOPs and quality inspections during the production phase.
4. Deliver:
   - Utilize a logistics system with real-time tracking capabilities.
   - Standardize packaging procedures.
5. Return:
   - Develop a streamlined goods return (RMA) system.
   - Perform root cause analysis on returned goods.

II. CONCLUSIONS

Through scrutinizing the derived data, one can infer that the GSCOR method comprises five significant steps: plan, source, make, deliver, and return. Each of these steps holds a unique percentage that illustrates supplier effectiveness. Within the Plan phase, the precision of sales demand projections from January through December 2024 stands at 90%, 87%, 80%, 90%, 94%, 84%, 80%, 90%, 91%, 90%, 88%, and 90% respectively. Similarly, the accuracy of raw material needs forecasting within the same timeframe hits 99%, 98%, 97%, 99%, 98%, 99%, 99%, 99%, 98%, 99%, 97%, and 98%. Production planning typically extends over two days. In the Source phase, 40% of the focus lies in opting for suppliers with eco-friendly systems. Timeliness of raw material deliveries ranges from 100% to 89% over the months in 2024. Suppliers' delivery precision hits figures like 90%, 78%, and up to 100%, while shipping quantity accuracy lands at percentages between 97.96% and 98.99%. Raw material inventory accuracy compared to reports exhibit figures such as 85.06% to 92.11%. Within the Make process, production accuracy versus scheduled timelines shows fluctuations from 80% to 100%, while defective production rates range from 10% to 20%. Machine downtimes occur between 1 to 4 instances monthly. Material efficiency during production scores range from 83% to 95%. In the Deliver process, the reliability of shipping meets demands at rates of 87% to 100%, with defect-free product deliveries standing between 0% to 14.3%. During Return, returns due to defects or damage are marked at 13% to 27%, and recyclable waste percentages observed from 57% to 85%. Suggested improvements by researchers for supplier performance at the company, based on each GSCOR process, involve a forecasting system based on historical data and supplier info system integration for the Plan process. For the Source phase, activities include supplier evaluation and categorization, regular audits, and SLA implementation. Lean manufacturing, SOP adherence, and in-line quality checks are advised for the Make phase. For the Deliver process, a real-time tracking logistics system and packaging standardization are recommended. The Return improvements suggest an efficient RMA system and root cause analysis of returns. PT. Trakindo Surabaya should heed these recommendations to optimize process handling. Consideration of the improvement proposals intends to enhance supplier performance. Future research could explore unexamined variables and alternative techniques to optimize supply chain performance assessment within firms or industries.

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