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Research Article

Analysis of Green Supply Chain Management Performance Using the Green SCOR Method at XYZ Business

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Abstract: *Managing environmental repercussions is an integral part of green supply chain management, which begins with procuring raw materials and continues until the consumer receives the finished product. Using sustainable development-based green supply chain management strategies may provide businesses with a competitive advantage. A company's performance may be influenced by its use of green supply chain management practices. This study aims to assess the performance of XYZ company's green supply chain. The study relied on descriptive research and used a quantitative SCOR model method. Planning, sourcing, making, and delivering were the four factors that made up the SCOR model. The overall performance measurement result of green supply chain management at Khirwa Batik business was a performance score of 31.66, categorized as poor performance. This was due to 9 out of 17 indicators receiving poor performance scores, 2 indicators categorized as average performance, 1 indicator categorized as good performance, and 5 indicators categorized as excellent performance. The results of this study can be a consideration for the Khirwa Batik business and other similar textile companies to evaluate the performance of green supply chain management to be more effective and efficient, thereby increasing the performance score of green supply chain management.*

Keywords: *Green Supply Chain Management, Company Performance.*

I. INTRODUCTION

Performance is crucial in determining a company's success in winning business competition. Currently, competition among companies is very tight, and companies are striving to improve their performance (Sanjaya dan Purnawati, 2023). Performance is the level of success in a job, whether from an individual, group, or organization/company (Jumady dan Fajriah, 2020). Internal and external affairs of the company play an important role in the company's integration process, so performance calculation is needed to evaluate the comparison between expected results and actual results (Yuniarti et al., 2019:7).

Accorsi et al. (2022) define supply chain management as a comprehensive system that orchestrates the flow of various resources, including financial assets, from raw material suppliers to end consumers. Tama et al. (2019) state that there is a risk associated with each stage of the supply chain. Possible risks to the supply chain include shortages of raw materials, sudden increases in prices, failures in machinery, unforeseen fluctuations in demand, inaccurate estimates, revisions to orders, and delays in shipping. In order to enhance service quality while minimizing risks, it is essential for all connections within a supply chain to collaborate most effectively. Effective supply chain management may lead to enhanced customer satisfaction, increased revenue, and improved asset utilization (Wibowo and Sri, 2022). Green Supply Chain Management is a crucial mechanism for mitigating operational challenges by incorporating environmental performance into supply chain management.

Green Supply Chain Management is a novel strategy for managing the environmental impact of the supply chain (Nugraha and Hendayani, 2020). The primary stages of an environmentally aware supply chain include green sourcing, green manufacture, green delivery, and green reverse logistics. (Galaxy et al.,2021). Green procurement is the procurement process that fully considers environmental effects, including selecting suppliers and raw materials (Soeparto dan Surbakti, 2021). Green manufacturing in ISO 14001 is a production process where inputs aim to reduce generated waste. Green distribution generally involves green packaging and green logistics, while reverse logistics is the process of a company receiving back products sent to consumers for recycling (Yuniarti et al., 2019:7).

The Green SCOR approach may be used to measure the performance of green supply chain management. Businesses use Green SCOR to examine the factors that characterize the connection between the supply chain and preexisting environmental problems (Syuhada et al., 2021). The five primary steps of this approach are planning, sourcing, making, delivering, and returning (Primadasa dan Sokhibi, 2020). The results of this assessment data are expected to be used as an evaluation and information about which the company should prioritize tributes in implementing the supply chain management concept with environmental considerations (Zulfikar dan Ernawati, 2020).

Companies in the textile industry often cause environmental problems, especially pollution by textile dyes. Textile dyes contain sulfur, naphthol, insoluble dyes, nitrate compounds, acetic acid, soap, chromium compounds, mercury, nickel, cobalt, and other toxic chemical auxiliaries (Wijaya et al., 2020). Synthetic dye waste contains high values of COD (Chemical Oxygen Demand) and BOD (Biological Oxygen Demand), making the environment hostile to living organisms. Moreover, contaminated water can also become a breeding ground for bacteria and viruses (Enrico, 2019).

The XYZ business operates in the textile industry and is located in South Denpasar. During its production process, there are issues with dyeing waste being discharged into the sewers, which can corrode sewer pipes. If left to flow into rivers, it can affect drinking water quality, making it unfit for consumption (Enrico, 2019). Dye wastewater also significantly impacts environmental damage and human diseases due to the presence of carcinogenic chlorine (cancer-causing). These chemicals can evaporate into the air, be inhaled, or be absorbed through the skin, causing allergic reactions and potentially harming an unborn child (Wijaya et al., 2020).

Prior empirical studies that used the Green SCOR approach have classified performance results into five categories: terrible, marginal, medium, excellent, and exceptional. These categories were used to quantify the performance of green supply chain management. The study conducted by Syuhada et al. (2021), titled "Assessment of Green Supply Chain Management Practices: Pharmaceutical Wholesaler Company in Indonesia," concluded that the performance of green supply chain management was considered average. In Wibowo's (2022) study titled "Design of Supply Chain Performance Measurement Tool on Mask Products Using the Green SCOR Approach," the supply chain performance ratings were average. In their case study titled "Pengukuran Kinerja Supply Chain Dengan Pendekatan Metode SCOR (Supply Chain Operations Reference) Studi Kasus Di Pt Xyz" (Supply Chain Performance Measurement Using the SCOR Method Approach: A Case Study at PT XYZ), researchers Mutaqin and Sutandi (2021) determined that PT XYZ's supply chain performance was satisfactory.

II. LITERATURE REVIEW

A) Supply Chain Management

Suppliers, manufacturers, distributors, and logistics service providers are all players involved in the coordinated movement of products, information, and money known as Supply Chain Management (SCM) (Pujawan & Mahendrawathi, 2017:27). The objective of supply chain management (SCM) is to decrease expenses while enhancing the worth to customers by effectively organizing activities between suppliers and end users (Yuniarti et al., 2019:06). Supply chain management (SCM) systems are responsible for overseeing the movement of commodities, data, and resources in both the upstream and downstream directions (Karuntu et al., 2023). Supply chain management may be conceptualized as a means of synchronizing the strategic decisions made by various stakeholders throughout the chain (Saleheen and Habib, 2023).

B) Green Supply Chain Management

According to Novitasari (2021:03), "green supply chain management" refers to a method of managing the life cycle of a product that takes into account environmental factors at every step, starting from the initial idea to the final delivery to the customer. Environmental considerations are integrated into every stage of the supply chain, including sourcing raw materials, product design, manufacture, and ultimate consumer delivery. Dzikriansyah et al. (2023) describe this as the process of managing the end-of-life of a product, which includes reverse logistics. Yen Yung Hsueh et al. (2019) have identified four primary stages of green supply chain management: procurement, product creation, manufacturing, and operation. The majority of the actions required are identical to those in conventional supply chain management.

C) Performance

Performance refers to the work capability demonstrated through work outcomes. A company's performance is what the company achieves over a certain period based on predetermined criteria (Lestari and Sutrisna, 2021). Performance pertains to a company's alignment with market objectives and profitability (Rahadi, 2012: 2). According to Devaraj (2017), performance measurement consists of: (1) Quality, (2) Delivery accuracy, (3) Waste processing, (4) Frequency of defective goods occurrence, (5) Inventory procurement, (6) Cost-effectiveness of production, (7) Lead time.

D) Green SCOR Model

The Supply Chain Operations Reference (SCOR) model, as described by Adelino et al. (2024), is a technique used for the management and evaluation of performance inside supply chains. Anastasia et al. (2021) define SCOR as a mechanism for assessing and appraising supply chain operations and effectiveness. The Green SCOR model is a modified version of the original SCOR model that incorporates environmental considerations (Rozudin and Mahbubah, 2021). Hence, this model may be used to manage the adverse environmental impacts resulting from a supply chain. The five main elements of this method, which is based on the SCOR model (Celina et al., 2022), are Plan, Source, Make, Deliver, and Return. Zulfikar and Ernawati (2020) state that it has functional attributes similar to those of the SCOR model, such as responsiveness, agility, cost, and asset management.

E) Analytical Hierarchy Process (AHP)

In the AHP method, weighting is conducted using pairwise comparisons. To evaluate the level of importance of one element in relation to another, a scale from 1 to 9 is used. In these pairwise comparisons, if the Consistency Ratio (CR) value is less than 0.1, then the weighting of the criteria is accepted; conversely, if the CR value is greater than 0.1, then the criteria weighting is not accepted (Setiyono dan Ernawati, 2023).

F) Normalisasi Snorm De Boer

Each indicator across different work processes has varying weights and measurement units, necessitating the normalization process using Snorm De Boer normalization. This aims to standardize the parameters from these indicators (Adelino et al., 2024).

III RESEARCH METHODS

This study used a descriptive method with a quantitative approach. The selected research location was the XYZ business, whose factory is located at Jalan Pulau Saelus, Pedungan, South Denpasar. This study utilized variables that are the core processes of the SCOR method: Plan, Source, Make, Deliver, and Return. Data in this study were obtained directly through interviews with leadership, filling out importance levels by general managers, scoring by leadership levels, and observation. The study used a comparison of the importance of one element to another using a scale of 1 to 9. The SCOR method calculations will be performed using the Analytic Hierarchy Process in pairwise comparisons. If a CR value of less than 0.1 is obtained, the weighting of the criteria is accepted; conversely, if the CR value exceeds 0.1, the criteria weighting is not accepted. To calculate the Consistency Ratio (CR), the Consistency Index must first be determined using the following formula:

$$CI = \frac{(\lambda \max - n)}{n-1}$$
$$CR = CI/RI$$

In the Consistency Index (CI) formula, λ maks represents the largest eigenvalue from a matrix of order n, where n is the number of indicators. The Random Index (RI) is obtained from the matrix size of RI with values from the table below:

Table 1: Random Index Matrix

N	1, 2	3	4	5	6	7	8	9	10
RI	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Source: *Setiyono dan Ernawati, (2023)*

After calculating AHP, SNORM de Boer, normalization calculations will be performed with the formula:

For a higher score, being better $snorm = \frac{(SI - Smin)}{Smax - Smin} \times 100$

Lower is better $snorm = \frac{(Smax - SI)}{Smax - Smin} \times 100$

Each performance indicator will be converted into an interval ranging from 0 to 100 in this normalization. A value of zero is considered the worst, while a value of one hundred is considered the best. The following is the performance rating interval:

Table 2: Performance Indicators Monitoring System

Monitoring System	Performance Indicator
<40	Poor
41-50	Marginal
51-70	Average
71-90	Good
91-100	Excellent

Source: *Listiyono et al. (2024)*

IV RESULTS AND DISCUSSION

A) Analytic Hierarchy Process

The Analytic Hierarchy Process is a comparison based on decision-makers' policies by assessing the importance of one element in relation to others. The pairwise comparison process starts from the highest hierarchy level, which is designated to select criteria down to the lowest hierarchy level. Below are the results from the AHP weighting:

Table 3: Pairwise Comparison Result Matrix Level 1 Process

Criteria	Plan	Source	Make	Delivery	Return
Plan	1	4	3	5	7

Source	0.25	1	0.33	2	5
Make	0.33	3	1	6	8
Delivery	0.20	0.50	0.17	1	3
Return	0.14	0.20	0.13	0.33	1
Total	**1.93**	**8.70**	**4.63**	**14.33**	**24**

Source: *processed data, 2024*

Table 4: Level 1 Normalization and Consistency Ratio Process

Criteria	Plan	Source	Make	Delivery	Return	Total	Weight	Eigenvector	λmax	CI	IR	CR
Plan	0.52	0.46	0.65	0.35	0.29	2.27	0.45	0.87	5.44	0.11	1.12	0.097
Source	0.13	0.11	0.07	0.14	0.21	0.66	0.13	1.16				
Make	0.17	0.34	0.22	0.42	0.33	1.49	0.30	1.37				
Delivery	0.10	0.06	0.04	0.07	0.13	0.39	0.08	1.12				
Return	0.07	0.02	0.03	0.02	0.04	0.19	0.04	0.91				
Total	**1**	**1**	**1**	**1**	**1**	**5**	**1**	**5.44**				

Source: *processed data, 2024*

Based on the results of the weighting process calculations, the λmax value was found to be 5.44 with a random index value of 1.12, resulting in a CI of 0.11. The resulting CR value of 0.097 < 0.1 indicates that the data used is consistent and suitable for proceeding with further research.

Table 5: Pairwise Comparison Result Matrix Level 2 Plan

Criteria	Reliability	Responsiveness	Cost
Reliability	1	3	6
Responsiveness	0.33	1	4
Cost	0.17	0.25	1
Total	**1.50**	**4.25**	**11**

Source: *processed data, 2024*

Table 6: Level 2 Normalization and Consistency Ratio Process for Plan

Criteria	Reliability	Responsiveness	Cost	Total	Weight	Eigen Vektor	λmax	CI	IR	CR
Reliability	0.67	0.71	0.55	1.92	0.64	0.96	3.08	0.04	0.58	0.07
Responsiveness	0.22	0.24	0.36	0.82	0.27	1.16				
Cost	0.11	0.06	0.09	0.26	0.09	0.96				
Total	**1**	**1**	**1**	**3**	**1**	**3.08**				

Source: *processed data, 2024*

Based on the results from the attribute calculations in the Plan process, the λmax value was 3.08 with an IR value of 0.58, resulting in a CI of 0.04. The resulting CR value of 0.07 ≤ 0.1 indicates that the data used is consistent and suitable for proceeding with further research.

Table 7: Pairwise Comparison Result Matrix Level 2 Source

Criteria	Reliability	Responsiveness
Reliability	1	7
Responsiveness	0.14	1
Total	**1.14**	**8**

Source: *processed data, 2024*

Table 8: Level 2 Normalization and Consistency Ratio Process for Source

Criteria	Reliability	Responsiveness	Total	Weight	Eigen Vektor	λmax	CI	IR	CR
Reliability	0.88	0.88	1.75	0.88	1	2	0	0	0.0
Responsiveness	0.13	0.13	0.25	0.13	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the attribute calculations in the Source process, the λmax value was 2 with an IR value of 0, resulting in a CI of 0.00. A CR value of 0 indicates that the data used is consistent and suitable for proceeding with further research.

Table 9: Pairwise Comparison Result Matrix Level 2 Make

Criteria	Reliability	Responsiveness	Management asset
Reliability	1	3	8
Responsiveness	0.33	1	5
Management asset	0.13	0.20	1
Total	**1.46**	**4.20**	**14**

Source: *processed data, 2024*

Table 10: Level 2 Normalization and Consistency Ratio Process for Make

Criteria	Reliability	Responsiveness	Management asset	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Reliability	0.69	0.71	0.57	1.97	0.66	0.96	3.07	0.03	0.58	0.06
Responsiveness	0.23	0.24	0.36	0.82	0.27	1.15				
Asset Management	0.09	0.05	0.07	0.20	0.07	0.96				
Total	**1**	**1**	**1**	**3**	**1**	**3.07**				

Source: *processed data, 2024*

Based on the results from the attribute calculations in the Make process, the λmax value was 3.07 with an IR value of 0.58, resulting in a CI of 0.03. The resulting CR value of 0.06 ≤ 0.1 indicates that the data used is consistent and suitable for proceeding with further research.

Table 11: Pairwise Comparison Result Matrix Level 2 Deliver

Criteria	Reliability	Responsiveness	Cost
Reliability	1	3	0.25
Responsiveness	0.33	1	0.17
Cost	4	6	1
Total	**5.33**	**10**	**1.42**

Source: *processed data, 2024*

Table 12: Level 2 Normalization and Consistency Ratio Process for Deliver

Criteria	Reliability	Responsiveness	Cost	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Reliability	0.19	0.30	0.18	0.66	0.22	1.18	3.09	0.04	0.58	0.07
Responsiveness	0.06	0.10	0.12	0.28	0.09	0.93				
Cost	0.75	0.60	0.71	2.06	0.69	0.97				
Total	**1**	**1**	**1**	**3**	**1**	**3.09**				

Source: *processed data, 2024*

Based on the results from the attribute calculations in the delivery process, the λmax value was 3.09 with an IR value of 0.58, resulting in a CI of 0.04. The resulting CR value of 0.07 ≤ 0.1 indicates that the data used is consistent and suitable for proceeding with further research.

Table 13: Pairwise Comparison Result Matrix Level 2 Return

Criteria	Reliability	Responsiveness
Reliability	1	6
Responsiveness	0.17	1
Total	**1.17**	**7**

Source: *processed data, 2024*

Table 14: Level 2 Normalization and Consistency Ratio Process for Return

Criteria	Reliability	Responsiveness	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Reliability	0.86	0.86	1.71	0.86	1	2	0	0	0
Responsiveness	0.14	0.14	0.29	0.14	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the attribute calculations in the Return process, the λmax value was 2 with a Random Index value of 0, resulting in a CI of 0.0. A CR value of 0 indicates that the data used is "perfectly consistent," which means it is consistent enough to proceed with further research.

Table 15: Pairwise Comparison Result Matrix Level 3 Reliability Attribute in the Plan Process

Criteria	Synthetic chemical usage	Water usage
Synthetic chemical usage	1	7
Water usage	0.14	1
Total	**1.14**	**8**

Source: *processed data, 2024*

Table 16: Level 3 Normalization and Consistency Ratio of Reliability Attribute in the Plan Process

Criteria	*Synthetic chemical usage*	*Water usage*	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Synthetic Chemical Usage	0.88	0.88	1.75	0.88	1	2	0	0	0
Water Usage	0.13	0.13	0.25	0.13	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the indicator calculations for the Reliability attribute in the Plan process, the λmax value was 2 with a Random Index value of 0, resulting in a CI of 0.0. A CR value of 0 indicates that the data used is "perfectly consistent," which means it is consistent enough to proceed with further research.

Table 17: Pairwise Comparison Result Matrix Level 3 Reliability Attribute in the Source Process

Criteria	Supplier with iso 14001 certification	Hazardous material in inventory
Supplier with iso 14001 certification	1	0.33
Hazardous material in inventory	3	1
Total	**4**	**1.33**

Source: *processed data, 2024*

Table 18: Level 3 Normalization and Consistency Ratio of Reliability Attribute in the Source Process

Criteria	Supplier with iso 14001 certification	Hazardous materials	Total	Weight	Eigen Vector	λmax	CI	IR	CR
A supplier with ISO 14001 certification	0.25	0.25	0.50	0.25	1	2	0	0	0.0
Hazardous Material in Inventory	0.75	0.75	1.50	0.75	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the indicator calculations for the Reliability attribute in the Source process, the λmax value was 2 with a Random Index value of 0, resulting in a CI of 0.0. A CR value of 0 indicates that the data used is "perfectly consistent," which means it is consistent enough to proceed with further research.

Table 19: Pairwise Comparison Result Matrix Level 3 Asset Management Attribute in the Make Process

Criteria	Efficiency of Tool Usage	Effectiveness of Workforce
Efficiency of Tool Usage	1	6
Effectiveness of Workforce	0.17	1
Total	**1.17**	**7**

Source: *processed data, 2024*

Table 20: Level 3 Normalization and Consistency Ratio of Asset Management Attribute in the Make Process

Criteria	Efficiency of Tool Usage	Effectiveness of Workforce	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Efficiency of Tool Usage	0.86	0.86	1.71	0.86	1	2	0	0	0.0
Effectiveness of Workforce	0.14	0.14	0.29	0.14	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the indicator calculations for the Asset Management attribute in the Make process, the λmax value was 2 with a Random Index value of 0, resulting in a CI of 0.0. A CR value of 0 indicates that the data used is "perfectly consistent," which means it is consistent enough to proceed with further research.

Table 21: Pairwise Comparison Result Matrix Level 3 Responsiveness Attribute in the Make Process

Criteria	Reusable materials	Make cycle time
Reusable materials	1	0.14
Make cycle time	7	1
Total	**8**	**1.14**

Source: *processed data, 2024*

Table 22: Normalization and Consistency Ratio of Responsiveness Attribute Indicators in the Make Process

Criteria	Reusable materials	Make cycle time	Total	Weight	Eigen Vector	λmax	CI	IR	CR
Reusable Materials	0.13	0.13	0.25	0.13	1	2	0	0	0
Make Cycle Time	0.88	0.88	1.75	0.88	1				
Total	**1**	**1**	**2**	**1**	**2**				

Source: *processed data, 2024*

Based on the results from the indicator calculations for the Responsiveness attribute in the Make process, the λmax value was 3.10 with a Random Index value of 0.58, resulting in a CI of 0.05. A CR value of 0.09 ≤ 0.1 indicates that the data used is consistent and suitable for proceeding with further research.

B) SNORM De Boer Normalization

Each indicator in each work process has different weights and measurement units, necessitating the normalization process using SNORM De Boer normalization, which aims to standardize the parameters of these indicators. Below are the results of the calculations:

Table 23: Results of SNORM De Boer Normalization Calculations

Process	Attribute	Evaluation	Actual Value (Si)	Smin	Smax	Unit	Description	SNORM
Plan	Cost	Energy usage	196,167	150,000	250,000	IDR	small is better	53.83
	Reliability	Water usage	198,000	190,000	200,000	litre	small is better	20
		Synthetic chemical usage	100	96	100	percent	small is better	0
	Responsiveness	Cycle time selecting a supplier.	2.33	2	24	hours	small is better	98.5
Source	Reliability	Supplier with ISO 14100	0	0	100	percent	large is better	0
		Hazardous materials in inventory	100	96	100	percent	small is better	0
	Responsiveness	Source cycle time	26.83	24	48	hours	small is better	88.21
Make	Reliability	Material efficiency	80.43	70	100	percent	large is better	34.77
	Asset Management	Effectiveness of workforce	100	86	100	percent	large is better	100
		Efficiency of equipment usage	44	30	80	percent	large is better	28.89
	Responsiveness	Reusable material	0	0	50	percent	large is better	0.00
		Make cycle time	49	25	50	hours	small is better	4

Delivery	Reliability	Shipping document accuracy	100	96	100	percent	large is better	100
	Cost	Fuel consumption	420,583	300,000	500,000	IDR	small is better	0.40
	Responsiveness	Delivery cycle time	26.42	12	48	hours	small is better	59.95
Return	Responsiveness	Customer complaints about environmental specifications	0	0	10	percent	small is better	100
	Reliability	Returned products	0	0	10	percent	small is better	100

Source: *Khiwa Batik (processed data), 2024*

Based on the SNORM calculations, out of 17 indicators, 6 indicators are green, indicating that the KPIs have satisfactory performance. There are 2 indicators in the yellow category, meaning their performance is average, so these KPIs must be maintained to prevent them from turning red and should be improved to become green. There are 9 KPIs that received a red color, indicating that the KPIs have poor performance and thus need improvement.

C) Overall Final Performance Results

The final performance value calculation of the supply chain requires the weight values from the performance of the green SCOR. This weighting is performed to determine the overall performance value of a company.

Table 24: Final Performance Results

Process	Attribute	Evaluation	Final Weight	SNORM (Normalization)	Performance Category	Normalization x Weight	Final Value
Plan	Cost	Energy usage	0.0405	53.83	Average	2.18	31.66
	Reliability	Water usage	0.0374	20	Poor	0.75	
		Synthetic chemical usage	0.2534	0	Poor	0.00	
	Responsiveness	Cycle time selecting a supplier	0.1215	98.50	Excellent	11.97	
Source	Reliability	Supplier with ISO 14100	0.0286	0	Poor	0.00	
		Hazardous materials in inventory	0.0858	0	Poor	0.00	
	Responsiveness	Source cycle time	0.0169	88.21	Good	1.49	
Make	Reliability	Material efficiency	0.1980	34.77	Poor	6.88	
	Asset Management	Effectiveness of workforce	0.0181	100	Excellent	1.81	
		Efficiency of equipment usage	0.0029	28.89	Poor	0.08	
	Responsiveness	Reusable material	0.0105	0	Poor	0.00	
		Make cycle time	0.0713	4	Poor	0.29	
Delivery	Reliability	Shipping document accuracy	0.0176	100.00	Excellent	1.76	
	Cost	Fuel consumption	0.0552	0.4	Poor	0.02	
	Responsiveness	Delivery cycle time	0.0072	59.95	Average	0.43	
Return	Responsiveness	Customer complaints about environmental specifications	0.0056	100	Excellent	0.56	
	Reliability	Returned products	0.0344	100	Excellent	3.44	

Source: *Khiwa Batik (processed data), 2024*

The final score obtained was 31.66, indicating that XYZ business's green supply chain management performance is categorized as poor. This is due to the performance outcomes of 17 indicators, where 9 indicators are classified under the poor category, 2 indicators show average performance and 6 indicators are deemed to have good performance.

The performance score for energy usage is 54, which falls within the average performance category. The use of energy at XYZ business affects both cost and reliability performance in the planning process and, therefore, needs improvement. The current energy usage is not optimal because electrical cables are left connected to sockets when not in use, and lights or other electrically powered items are not turned off when no longer needed.

The indicator for water usage scored 20, placing it in the poor category. Excessive water use negatively impacts reliability and cost performance in the planning process. Exceeding water usage standards increases fixed costs, largely due to a lack of employee awareness about the standardization of minimal water use and the absence of checks for leaking pipes.

Synthetic Chemical Usage refers to using hazardous dyes in the production process, calculated from the total amount of dyes relative to the quantity used. The performance score for synthetic chemical usage is 0, which indicates poor performance.

Excessive use of hazardous dyes beyond the minimum standards for production adversely affects the reliability and cost performance in the planning process. This impact extends to environmental performance, potentially leading to legal violations for the company. Additionally, substandard employee qualifications and equipment contribute to a higher waste of dyes compared to what is used for fabric production.

Cycle Time in Supplier Selection and Negotiation represents the time required to choose and negotiate with suppliers. The cycle time for selecting suppliers and conducting negotiations was 98.5, categorized as excellent performance. The efficient cycle time in choosing suppliers at XYZ business positively influences the responsiveness performance in the planning process.

Suppliers with ISO 14001 can be utilized within an environmental management system to help companies or organizations identify, prioritize, and manage environmental issues. The performance score for suppliers with ISO 14001 is 0, indicating poor performance. XYZ business does not have suppliers with an environmental management system or ISO 14001 certification. Poor performance of suppliers with ISO 14001 affects the reliability performance due to non-compliance with the standards required for textile company suppliers.

Hazardous Material in Inventory refers to the percentage of the total weight of hazardous materials in the inventory compared to the overall materials used at XYZ business. The performance score for hazardous materials in inventory is 0, which falls into the poor category. The use of materials for production exceeds the standards set for the green textile industry, negatively impacting the reliability and cost performance in the sourcing process of XYZ business. The poor performance is due to the quality of employees and the equipment used not meeting standards, such as the use of inappropriate dye materials, resulting in more waste compared to what is used for production.

Source Cycle Time is the time required from when an order is placed until the goods are received by the warehouse, including loading and unloading time. Source cycle time scored 88, categorized as good. The time it takes for XYZ business to order raw materials is very effective, positively influencing the responsiveness performance in the sourcing process.

Material Use Efficiency is the ratio of the weight of materials used in production to the weight of available materials. Material use efficiency scored 34.77, categorized as poor. High raw material stock adversely affects reliability and cost performance in the making process. High inventory levels lead to storage costs due to raw materials remaining in the warehouse, necessitating expenditures to maintain the quality of the materials to prevent damage.

Effectiveness of Workforce is the percentage of how effective the existing number of employees is compared to the number required. The performance score for workforce effectiveness is 100, categorized as excellent or very effective. The number of employees at Khirwa Batik is already very effective for asset management and reliability performance in the make process.

Efficiency of Equipment Use is an indicator to measure how efficiently equipment is used in a month of production. At Khirwa Batik, the efficiency of equipment use scored 28.89, categorized as poor. The capacity of equipment used compared to the available capacity is ineffective, adversely affecting asset management and cost performance in the making process. Poor efficiency performance is due to equipment capacity underutilization; out of 45 pieces of equipment, only 20 are used, leading to high fixed costs.

Recyclable / Reusable Materials are indicators that measure the percentage of materials that can be recycled or reused for production processes. At XYZ business, the performance score for reusable materials is 0, categorized as poor. At XYZ business, waste from the production process is not recycled, adversely affecting the responsiveness performance in the making process because the company is slow to respond or address the reduction of negative environmental impacts. Textile industry waste, especially liquid waste, contains hazardous materials that, if not treated, can cause diseases in living organisms.

Make Cycle Time refers to the time taken to manufacture a product from the start of processing raw materials to packaging. The performance score for make cycle time is 4, categorized as poor. A long make cycle can negatively affect responsiveness performance in the make process. At XYZ business, prolonged make processes occur due to drying phases requiring one day due to insufficient sunlight during the drying and airing processes.

Shipping Document Accuracy determines the accuracy and completeness of shipping documents as required by customers and the government. The performance score for shipping document accuracy is 100, categorized as excellent. Consistently accurate shipping documents at XYZ business have a very positive impact on reliability performance in the delivery process.

Fuel Consumption is the average cost of fuel used to transport goods. Fuel consumption scored 0.48, categorized as poor. High average fuel costs negatively impact cost performance in the delivery process due to the lack of route determination that considers distance and carrying capacity.

Delivery Cycle Time is used to determine the cycle time for delivery. The indicator for delivery cycle time scored 59.94, which is categorized as average. The cycle time at Khirwa Batik affects the responsiveness performance in the delivery process if the performance exceeds the average cycle time. The long cycle time is due to delivery taking one day, although XYZ business customers are only around the Bali area. The extended delivery time is caused by insufficient route planning and cargo capacity.

Complaints Regarding Missing Environmental Requirements from Products is an indicator used to measure the percentage of customer complaints related to environmental requirements. This indicator scored 100, categorized as excellent. This will influence responsiveness performance because the company quickly responds to customer feedback on environmental specifications, such as using environmentally friendly packaging. The absence of complaints related to environmental specifications positively affects the responsiveness performance in the return process.

The percentage of Error-Free Returns is the percentage of products returned by customers to the company without errors. This indicator scored 100, categorized as excellent. The absence of returned products positively influences the reliability performance in the return process.

IV. CONCLUSION

The performance measurement results for green supply chain management at XYZ business yielded an overall performance score of 31.66, categorized as poor. In the Plan variable, the cycle time for selecting suppliers scored 98.5, indicating excellent performance, whereas water usage scored 20 and synthetic chemical usage scored 0, both categorized as poor. The energy usage indicator scored 54, indicating average performance. The Source variable with indicators for suppliers with ISO 14001 and hazardous materials scored 0, categorized as poor, while the Source cycle time scored 88, indicating good performance. The Make variable showed Material use efficiency at 34.77, equipment use efficiency at 28.89, reusable materials at 0, and make cycle time at 4, all categorized as poor except for workforce effectiveness, which scored 100, which indicates excellent performance. The Deliver variable showed shipping document accuracy at 100, categorized as excellent; fuel consumption at 0.40, categorized as poor; and delivery cycle time at 59.94, categorized as average. Both indicators in the Return variable scored 100, indicating excellent performance.

Based on the research findings, the following recommendations and suggestions for improvement are provided to XYZ business:

1. For the energy usage indicator, create a Standard Operating Procedure (SOP) on energy saving by always unplugging cables from sockets when not in use, using energy-saving modes on electronic devices, especially computers and televisions, and using energy-efficient light bulbs.
2. To improve water usage, design an SOP for water effectiveness in the production process with a planning table. Train employees to ensure all production processes comply with standards. Check water pipes to ensure there are no leaks, and use water-saving taps (aerators) that can reduce water flow and pressure, thus saving water usage.
3. To improve synthetic chemical usage, synthetic dyes should be replaced with natural dyes. Options include using plants or fruits that produce color pigments, such as Strobilanthes cusia plants that produce a blue color of the same quality as synthetic dyes. Another option is to use microbial pigments, including carotenoids, melanin, prodigiosin, violacein, flavin, etc. Furthermore, the dye used for production should be greater than the waste, which can be achieved by checking the equipment used and ensuring fabric dyes dry properly so that dye absorption is more effective.
4. For the supplier with ISO 14001 indicator, implement policies for potential suppliers that must meet company needs, hold ISO 14001 certification and eco-labeling, provide good quality at a fair price, and ensure timeliness in raw material delivery.
5. For hazardous materials in inventory, propose using some safe materials for the environment, such as replacing some dyes used in production with natural dyes. Also, optimize the use of dyes and fabric treatments to ensure that less raw material is wasted by maximizing the production process, especially in the drying process, to ensure colors and treatments are well absorbed.
6. Materials efficiency can be improved by ordering materials according to the quantity of product demand and expanding production numbers based on the materials available in the warehouse, but this requires planning for product marketing.
7. Equipment use efficiency can be improved by using all available equipment capacity, but this will also impact the high production volume. High production volumes should be promoted by utilizing social media offering promotions to regular customers or retailers that partner with Khirwa Batik.
8. For recyclable material, improvement efforts for liquid waste should involve filtration or separation of hazardous particles from water, flotation (a waste handling process that removes floating particles), adsorption (using carbon to separate particles from water), and precipitation to separate insoluble materials from water by adding electrolytes. Solid waste

from slightly defective production fabrics can be sold at a lower price than the original, while those with more defects can be recycled into other products such as mats. Liquid waste can be utilized similarly.

9. Make cycle time can be improved by enhancing the quality of production time by identifying which parts of the process can be optimized. The area that needs improvement is drying. Initially, the lack of sunlight hampers the drying process, so drying should be conducted in a place with more sunlight.
10. Fuel consumption and delivery cycle time can be improved by determining delivery routes using the saving matrix method. This method calculates the distance to customer locations, carrying capacity, and costs.

V. REFERENCES

[1] Accorsi, R., Cholette, S., Guidani, B., Manzini, R., & Ronzoni, M. (2022). Sustainability assessment of transport operations in local Food Supply Chain networks. *Transportation Research Procedia*, *67*, pp. 1-11.

[2] Adelino, M. I., Farid, M., Fitri, M., & Febry, M. (2024). Pengukuran Kinerja Supply Chain Management dengan Metode Green SCOR. *Jurnal Teknologi Dan Sistem Informasi Bisnis*, *6*(1), pp. 236-244.

[3] Anastasia, R., Ridwan, A. Y., & Santosa, B. (2021). Perancangan Sistem Pengukuran Kinerja Rantai Pasok Pada Aktivitas Pergudangan Produk Benang Menggunakan Model Sustainable Balanced Scorecard–Scor Dan Pendekatan Iso 14001. *eProceedings of Engineering*, *8*(5).

[4] Celina, J. S., Kusumawardani, D. M., & Fathoni, M. Y. (2022). Evaluasi Kinerja Rantai Pasok Perpustakaan Institut Teknologi Telkom Purwokerto Menggunakan Supply Chain Operational Reference (SCOR) Model Berbasis Objective Matrix (OMAX). *JURIKOM (Jurnal Riset Komputer)*, *9*(2), pp. 296-304.

[5] Devaraj, Lee J. Krajewski. (2017). Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. Journal of Operations Management.

[6] Dzikriansyah, M. A., Masudin, I., Zulfikarijah, F., Jihadi, M., & Jatmiko, R. D. (2023). The role of green supply chain management practices on environmental performance: A case of Indonesian small and medium enterprises. *Cleaner Logistics and Supply Chain*, *6*, 100100.

[7] Zulfikar, D., & Ernawati, D. (2020). Pengukuran kinerja supply chain menggunakan metode green score di Pt. Xyz. *Juminten*, *1*(1), pp, 12-23.

[8] Enrico, E. (2019). Dampak limbah cair industri tekstil terhadap lingkungan dan aplikasi tehnik eco printing sebagai usaha mengurangi limbah. *Moda: The Fashion Journal*, *1*(1), pp. 1-9.

[9] Galaxy, A. B., Wibowo, M. A., & Suharyanto, S. (2021). Penghambat dan Pendorong Green Supply Chain Management (Studi Kasus: Aluminium Formwork). *Wahana Teknik Sipil: Jurnal Pengembangan Teknik Sipil*, *26*(2), pp. 189-208.

[10] Jumady, E., & Fajriah, Y. (2020). Green Supply Chain Management: Mediasi Daya Saing Dan Kinerja Perusahaan Manufaktur. *Jurnal Ilmiah Teknik Industri*, *8*(1).

[11] Karuntu, Merlyn & Dr. Arrazi Hasan & Febrianto PS. (2023). Analisis Penentuan Rute Distribusi Gas Elpiji 3 Kg Pada Pt. Surya Gas Mandiri Manado", *Jurnal Emba* Vol. 11, No. 1 Januari 2023, pp. 549-557.

[12] Lestari, S. P., & Sutrisna, A. (2021). Analisis Kinerja Operasi Pada Masa Pandemi Covid-19 Dengan Penerapan Total Quality Management (TQM) Dan Supply Chain Management (SCM) Di UMKM Kota Tasikmalaya. *Eksis: Jurnal Ilmiah Ekonomi dan Bisnis*, *12*(2), 164-169.

[13] Listiyono, F. Z., Kurniawan, A. P. S., & Lazuardi, M. F. (2024). Analisis Kinerja Manajemen CV Inyong Bing Menggunakan Metode SCOR dan AHP. *JATI (Jurnal Mahasiswa Teknik Informatika)*, *8*(3), pp. 4200-4208.

[14] Mutaqin, J. Z., & Sutandi, S. (2021). Pengukuran Kinerja Supply Chain Dengan Pendekatan Metode Scor (Supply Chain Operations Reference) Studi Kasus Di Pt Xyz. *Jurnal Logistik Indonesia*, *5*(1), pp. 13-23.

[15] Novitasari, Maya. (2021). *Green Supply Chain Management: environmental sustainable* Bagi Industri Dunia. UNIPMA Press Universitas PGRI Madiun.

[16] Nugraha, S. A., & Hendayani, R. (2020). Pengaruh Green Supply Chain Management Terhadap Kinerja Lingkungan Organisasi (studi Kasus The Body Shop Di Kota Bandung). *eProceedings of Management*, *7*(2).

[17] Primadasa, R., & Sokhibi, A. (2020). Model Green Scor Untuk Pengukuran Kinerja Green Supply Chain Management (Gscm) Industri Kelapa Sawit Di Indonesia. *Quantum Teknika: Jurnal Teknik Mesin Terapan*, *1*(2), pp. 55-62.

[18] Pujawan, I Nyoman & Er, Mahendrawati. (2017). Supply Chain Management Edisi 3. Surabaya: Andi Yogyakarta

[19] Rahadi, Dedi Rianto. 2012. Pengaruh Supply Chain Management Terhadap Kinerja Operasional Perusahaan. Proceeding Seminar Sistem Produksi X Universitas Universitas Bina Darma.

[20] Rozudin, M., & Mahbubah, N. A. (2021). Implementasi Metode House Of Risk Pada Pengelolaan Risiko Rantai Pasokan Hijau Produk Bogie S2hd9c (Studi Kasus: PT Barata Indonesia). *JISI: Jurnal Integrasi Sistem Industri*, *8*(1), pp. 1-11.

[21] Saleheen, F., & Habib, M. M. (2023). Embedding attributes towards the supply chain performance measurement. *Cleaner Logistics and Supply Chain*, *6*, 100090.

[22] Sanjaya, I. N. P., & Purnawatii, N. K. (2023). Pengaruh Total Quality Management Terhadap Kinerja Perusahaan CV. Sari Yoga Katering. *E-Jurnal Manajemen Universitas Udayana*, *12*(4).

[23] Setiyono, Y. R., & Ernawati, D. (2023). Analisis Performansi Aktivitas Green Suplly Chain Management Dengan Metode Green Scor Berbasis AHP Dan OMAX (Studi Kasus: Perusahaan Minyak dan Gas). *Jurnal Teknik Mesin, Industri, Elektro dan Informatika*, *2*(1), pp. 125-142.

[24] Soeparto, WH, & Surbakti, EEB. (2021). Dampak Green Supply Chain Management Terhadap Kinerja Bisnis (Inbound Perspective). *Ekonomika45: Jurnal Ilmiah Manajemen, Ekonomi Bisnis, Kewirausahaan* , *9* (1), pp. 11-21.

[25] Syuhada, W. B., Baihaqi, I., & Ardiantono, D. S. (2021). Penilaian Praktik Green Supply Chain Management (Studi Kasus: Perusahaan Pedagang Besar Farmasi di Indonesia). *Jurnal Teknik ITS*, *10*(2), pp. F177-F182.
[26] Tama, I. P., Yuniarti, R., Eunike, A., Azlia, W., & Hamdala, I. (2019). *Model Supply Chain Agroindustri di Indonesia: Studi Kasus Produk Singkong*. Universitas Brawijaya Press.
[27] Wibowo, D. C. W. (2022). Perancangan Alat Ukur Kinerja Rantai Pasok Produk Masker Dengan Pendekatan Green SCOR. *Industrial Engineering Online Journal*, *11*(3).
[28] Wijaya, A. D., Wicandra, O. B., & Asthararianty, A. (2020). Perancangan ilustrasi sebagai edukasi tentang polusi akibat limbah cair produksi fashion. *Jurnal Desain Komunikasi Visual Nirmana*, *20*(2), pp. 62-71.
[29] Yen Yung Hsueh, Yi Zhang, Yuichi Fukaumi, J.G. (2019). Montage Technology. In Yen Yung Hsueh, Yi Zhang, Yuichi Fukaumi, J. G.
[30] Yuniarti, R., et.al. (2019). *Green Supply Chain Management*. Malang: UB Press.