
**PERFORMANCE ASSESMENT OF THE IMPLEMENTATION
GREEN SUPPLY CHAIN MANAGEMENT IN THE MICRO SCALE
FOOD INDUSTRY COMPANIES: CASE STUDY OF BLACK
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Abstract

The development of the concept of an environmentally friendly industry enriches the paradigm of industrial management worldwide. The result of application concept from Green Supply Chain Management (GSCM) in large-scale industries has been widely published, while the result of application concept from GSCM in micro, small, and medium scale industries is insufficient. This study aims to explore the application of GSCM in the micro scale food industry, a case study in the black grass jelly manufacturing industry. In this study, GSCM performance assessment was carried out to find out how the company's overall performance improved. The methods used in this research are Green Supply Chain Operation Reference (GSCOR) and Analytical Hierarchy Process (AHP). The survey questionnaire was developed based on literature studies and interviews with three industry players producing black grass jelly and distributed to 100 respondents. The findings propose 20 Key Performance Indicators (KPI) to measure GSCM performance in micro, small and medium scale food industry companies. The value of GSCM performance measured based on economic, operational, and environmental aspects can improve the company's overall performance.

Keywords: Green Supply Chain Management (GSCM); Green Supply Chain Operation Reference (GSCOR); Analytical Hierarchy Process (AHP); Green Supply Chain Performance Assessment; Culinary Industry; Micro; Small; Medium Scale Enterprises.

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Introduction

The competition for creative industry players in the culinary sector to achieve profit and a broad market share both locally and globally requires a business process innovation strategy (Feby, 2021). From the perspective of environmental sociology, a large supply chain of food industry products is also a threat to human life, especially related to the industrial waste produced. A supply chain is an essential branch of operations management. The supply chain consists of all

parties involved, directly or indirectly in meeting customer demands. Supply chain management aims to enhance the efficiency and profitability of a company through managing product, financial and information networks along the supply chain. Management's attention to the environmental impact of industrial activities can be one of the competitive advantages for the organization.

The analysis of operating system trends in the food industry in the early 20th

century has focused on implementing industrial operating systems that can minimize environmental impacts by integrating environmental concerns in supply chain operations (Tseng, Islam, Karia, Fauzi, & Afrin, 2019). The concern of food industry to adopt environmentally friendly management principles will have a positive impact on organizational management and can support the achievement of sustainable development goals. The role of green industrial management to protect the environment from the dangers of industrial waste such as emissions, pollution, and public health hazards is a form of corporate social responsibility. This requires commitment and self-awareness from industry players. Modern organizational culture and behavior minimize environmental impact by integrating environmental concerns into their supply chain operations. The integration of environmental concerns into supply chain management practices is referred to as green supply chain management (Sarkis, 2012).

Green Supply Chain Management (GSCM) is a company's operational management innovation that can be a source of competitive advantage. GSCM is a combination of enterprise environmental management and supply chain management. GSCM covers all phases of the product life cycle, from the design, production, and distribution phases to the end user's use of the product and its disposal at the end of the product life cycle (Borade & Bansod, 2007 in Subagio et al., 2019). GSCM is an innovative industrial management approach that focuses on production and service activities based on risk reduction and environmental impact (Van Hock & Erasmus, 2000). A review of the literature on GSCM from 1998 to 2017 was conducted by (Tseng et al., 2019), which mentioned that GSCM proposes ways to protect the environment sustainably. Culinary industry actors are starting to pay attention to the environmental impact of the business processes to realize the concept of a green industry along the supply chain. Promoting an

environmentally friendly industry requires collaboration between three actors consisting of the government, scholars, and business people. The collaboration of the three actors will be the foundation for developing a sustainable and science-based creative industry. The theory regarding the collaboration of these three actors, referred to as the Triple Helix, was initially popularized by Etzkowitz and Leydersdorff, which was used as a strategy in innovation-based development (Feby, 2021). Today's reforestation efforts and targets are performed with a collaborative strategy between industry internal and external parties.

GSCM practices have been widely adopted by industrial companies using a reverse logistics perspective. This perspective in its development becomes irrelevant to the dynamic situation of green supply chain management. The value-seeking approach is the most relevant approach in greening the supply chain as a whole (Van Hock & Erasmus, 2000). Therefore, there is a need a greater understanding on how to support the evolution in industrial business management practices towards greening along the supply chain. A preliminary study on GSCM practices in the micro, small and medium scale industries was conducted in India and found that MSMEs are facing significant pressure from external stakeholders to adopt GSCM practices. Among internal pressures, on-the-job training is forcing MSMEs in India to adopt GSCM practices (Mohanty & Prakash, 2014).

The growing body of literature has been provided the application of GSCM practices in micro, small, and medium scale industries. A study has attempted to explore implementing GSCM in the black grass jelly-producing food industry in Kediri of East Java. This study focuses on the impact of implementing GSCM on the company's supply chain performance in economic, operational, and environmental aspects. Measurement activities are carried out to determine the

effectiveness of GSCM performance and to set performance targets in the future. Performance analysis of Supply Chain Management (SCM) is pivotal to achieve or increase organizational productivity and profitability through strategic, tactical, and operational planning focus and control (Saleheen, Habib, & Hanafi, 2018). The strategy to measure the performance of green supply chain management is to use the Green Supply Chain Operation Reference (GSCOR) and Analytical Hierarchy Process (AHP) approaches. This study aims to explore the application of GSCM in the food industry on a micro, small and medium scale, a case study in the food industry in Kediri. In this study, GSCM performance assessment was provided to examine how to improve the company's overall performance using the Green Supply Chain Operation Reference (GSCOR) and Analytical Hierarchy Process (AHP) methods. The study develops a survey questionnaire based on interviews with food industry players and literature studies. The results of this study promote GSCM practices and GSCM performance measurement methods that produce 20

Key Performance Indicators (KPI) based on economic, operational, and environmental aspects as a reference

Method

This research adopted a combination of qualitative and quantitative case study methods (Cresswell, 2017). The types of data collected in this study are primary data and secondary data. Primary data is data required in research that is obtained directly from sources. Secondary data is historical data obtained from the management of the black grass jelly food industry at UD RSA Kediri. In addition, researchers also obtained secondary data from various literature such as books and articles in journals. Data collection techniques using observation, interviews, and literature study. The data collected were analyzed descriptively to determine the results of the GSCM performance

measurement. The stages of research activities are depicted in Figure 2.

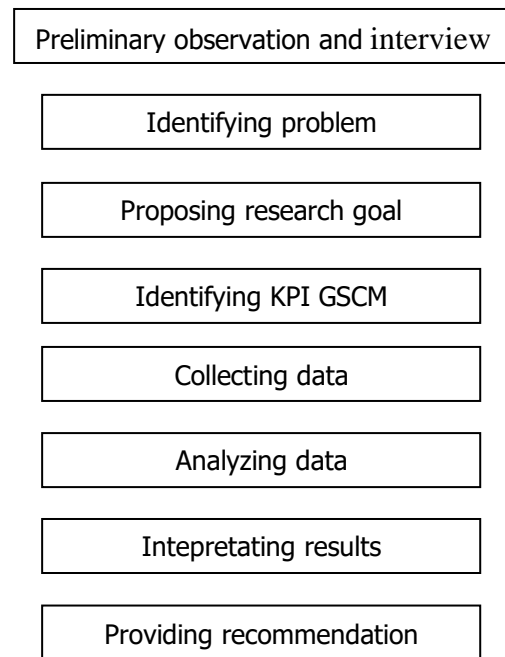


Figure 1
Research framework

In the preliminary observation and interview phase, the researcher collected information about implementing the company's green supply chain. The extent to which the company has applied the company's operations following GSCM principles. Researchers involved interview guidelines in exploring data on the implementation of green supply chains, including green manufacturing functions, green marketing, and sales functions, green procurement functions, green logistics functions, Green Human Resources functions, green finance functions, and green information technology functions. At the problem identification stage, the researcher determines the focus of the problem to be studied, and the answer is found. The problem of this research is related to the practice of GSCM in the black grass jelly food industry. At the stage of formulating research objectives, researchers communicate with industry partners about

the research objectives to be carried out. The purpose of this study was to explore the application of GSCM and measure the performance of GSCM in the micro, small and medium scale food industry. At the identification stage of the GSCM KPI, the researcher uses the data from the literature study to complement the data from the field study as the basis for designing the industrial GSCM KPI. The design of the industrial GSCM KPI was formulated based on the results of interviews and observations with industry owners, employees of UD RSA Kediri, and industrial partners (stakeholders). The three parties also validated the GSCM KPI indicators. At the stage of collecting research data, the activities carried out are collecting research data through questionnaires.

Research questionnaires were administered to industry owners, production, packaging, marketing, distribution, finance, and supply chain partners of companies involved in the GSCM program. The types of data collected include the process of applying industrial GSCM, identification of stakeholders, process management, and industrial waste management. Researchers weighted GSCM performance using the AHP method. Next, test the normalization

of the data using the Snorm de Boer method. At the research data analysis stage, the researcher calculates the final value of the GSCM performance with the GSCOR matrix. Supply chain mapping aims to determine the relationship between stakeholders and the performance attributes contained in the GSCOR model. This green SCOR work attribute divides the company's business processes into six: plan, source, make, deliver, return, and enable. At the interpretation stage of the research results, the researcher interprets the data processing results so that the right information is obtained. At the recommendation stage, researchers provide input to operations management regarding the performance and effort to enhance GSCM and improve GSCM performance in the future.

Results and Discussion

The research sample was chosen based on the objective of focusing on the perceptions and experiences of black grass jelly food industry players in GSCM practices applied in the industrial supply chain. This study identified 20 KPI indicators to measure the GSCM performance of the UD RSA Kediri industry as many as 26 indicators. The details of KPIs that experts have validated are as follows (see Table 1).

Table 1
GSCM Implementation KPI Indicators

Performance Function	KPI	Performance Indicator
1. Green operation or manufacturing function	1	Using environmentally friendly operations.
	2	Producing products that can reduce environmental damage.
	3	Budgeting of input costs in terms of regulation, energy use and disposal.
	4	Using materials, procedures and processes that are environmentally friendly and minimize emissions.
	5	Utilizing lean manufacturing to incorporate green goals into productive results.
	6	Involving production methods, tools and techniques must meet environmental requirements and market needs.
	7	Conducting research and development to explore new sustainable ways.
2. Green sales or marketing function	8	Enhancing consumer awareness of green products.
	9	Meeting consumer needs for environmentally friendly products

		in an environmentally friendly manner to ensure business credibility.
	10	Creating a balance between profitability and concern for the environment.
	11	Environmental awareness programs can provide a competitive advantage.
	12	Illustrating an environmentally friendly business image through green marketing communications.
3. Green procurement function.	13	Seeking out for suppliers with green production processes to offset environmental risks.
	14	Choosing a supplier with a good waste management system.
	15	Selecting suppliers who are committed to good environmental performance.
4. Green logistics function	16	Limiting carbon emissions associated with the transportation of goods.
	17	Using more environmentally friendly fuels and technologies
5. Green Human Resource Management Function	18	Communicating green business strategy to staff for effective goal achievement.
	19	Engaging green workplaces, corporate culture and reward systems to encourage green activities.
	20	Hiring experts in environmental development to implement eco-friendly systems.
	21	Designing business strategies to address environmental issues that meet stakeholder expectations.
	22	Fostering a green organizational culture through employee training and development.
6. Financial function or green information technology function.	23	Preparing of sustainability reports and GSCM practice audit system.
	24	Institutionalizing green accounting policies and use an integrated eco-friendly information system.
	25	Using state-of-the-art technology to switch to a paperless administrative environment.
	26	Obtaining the latest information about new technologies that are environmentally friendly.

The weighting process to determine the level of importance of each KPI criteria is carried out by filling out a pairwise comparison questionnaire given to respondents. The questionnaire data was processed by giving the GSCM performance weighting using the AHP method. Next, test the normalization of the data using the Snorm de Boer method. Normalization is used to equalize the value of each KPI that has different weights, making it easier to calculate the KPI value. According to Sumiati (2006), the normalization process uses the Snorm de Boer normalization formula. The normalization process has an essential role in achieving the final value of performance measurement. The following is the Snorm de Boer normalization formula for larger is better (See Equation 1).

$$S_{norm} = \left(\frac{S_i S_{min}}{S_{max} S_{min}} \right) \times 100 \dots \dots \dots (1)$$

Information:

S_{norm} = the actual value of the indicator that was successfully achieved

S_i = the actual indicator value that has been achieved

S_{min} = the value of the worst performance achievement of the work indicators

S_{max} = the value of achieving the best performance from the performance indicators

For lower is better

$$S_{norm} = \left(\frac{S_{max} S_i}{S_{max} S_{min}} \right) \times 100 \dots \dots \dots (2)$$

In this measurement, each indicator weight is converted into a certain value interval, namely 0 to 100. A value of 0 means the worst, and 100 means the best. Thus, the parameters of each indicator are the same, and the results can be analyzed. The following are the criteria for assessing

indicators for the implementation of GSCM (see Table 2).

Table 2
GSCM Implementation Indicator Assessment Criteria

Evaluation Criteria	GSCM Implementation Indicators
<40	Poor
40 – 50	Marginal
50 – 70	Average
70 – 90	Good
> 90	Excellent

The results of normalization calculations and the value of each KPI indicator are provided in Table 3.

Table 3
Normalization Results and KPI Indicator Values for GSCM Implementation

Performance Function	KPI	Performance Indicator	Score
1. Green operation or manufacturing function.	1	Using environmentally friendly operations.	80
	2	Producing products that can reduce environmental damage.	85
	3	Budgeting of input costs in terms of regulation, energy use and disposal.	84
	4	Adopting environmentally friendly materials, procedures and processes and minimize emissions.	83
	5	Using lean manufacturing to incorporate green goals into productive results.	81
	6	Providing production methods, tools and techniques must meet environmental requirements and market needs.	79
	7	Conducting research and development to explore new sustainable ways.	76
2. Green sales or marketing function.	8	Enhancing consumer awareness of green products.	77
	9	Meeting consumer needs for environmentally friendly products in an environmentally friendly manner to ensure business credibility.	78
	10	Creating a balance between profitability and concern for the environment.	79
	11	Environmental awareness programs can provide a competitive advantage.	80
	12	Illustrating an environmentally friendly business image through green marketing communications.	74
3. Green procurement function	13	Looking for suppliers with green production processes to offset environmental risks.	73
	14	Choosing a supplier with a good waste	80

		management system.	
	15	Selecting suppliers who are committed to good environmental performance.	83
4. Green logistics function	16	Limiting carbon emissions associated with the transportation of goods.	70
	17	Using more environmentally friendly fuels and technologies	70
5. Green Human Resource Management Function	18	Communicating green business strategy to staff for effective goal achievement.	78
	19	Using a green workplace, corporate culture and reward system to encourage green activities.	74
	20	Hiring experts in environmental development to implement eco-friendly systems.	80
	21	Designing business strategies to address environmental issues that meet stakeholder expectations.	82
	22	Fostering a green organizational culture through employee training and development.	70
6. Finance function and green information technology function.	23	Preparing for sustainability reports and GSCM practice audit system.	73
	24	Institutionalizing green accounting policies and use an integrated eco-friendly information system.	74
	25	Using state-of-the-art technology to switch to a paperless administrative environment.	75
	26	Obtaining the latest information about new technologies that are environmentally friendly.	71

GSCOR performance measurement attributes are carried out at three levels, namely level 1, consisting of six primary business process attributes: plan, source, make, delivery, return, and enable. Level 2 consists of five attributes of the company's basic performance capabilities: reliability, asset management, responsiveness, flexibility, cost, and assets. Level 3 consists of 26 KPIs that have been formulated. According

to Thomas L. Saaty, a weighted questionnaire will be considered consistent if the Consistency Ratio value is less than 0.1 (10%). When the consistency ratio value of less than 0.1 is accomplished, then the weighting value can be used as the criterion weight value. The following is a description of the GSCOR performance measurement attributes (See Figure 2).

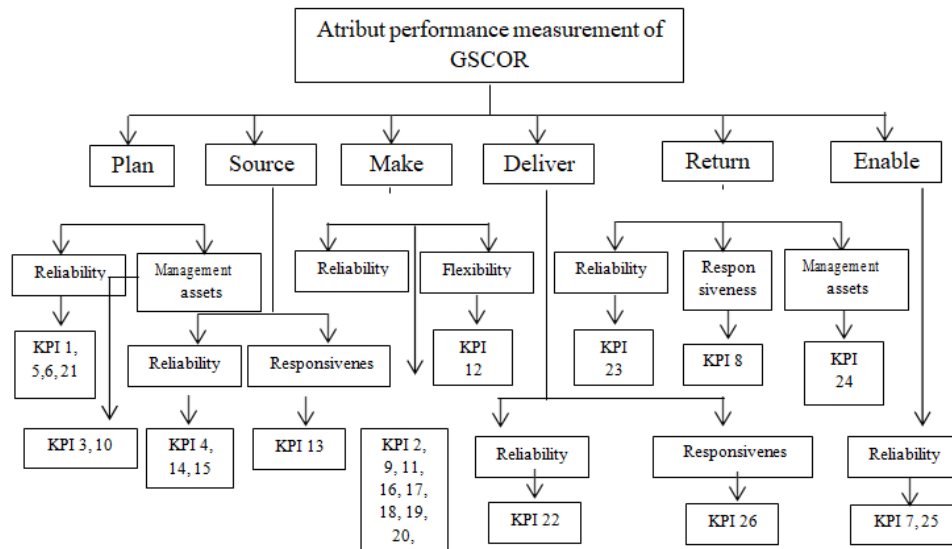


Figure 2
GSCOR Performance Measurement Attributes

The results of performance measurement based on GSCOR using 26 KPIs can be seen from Table 4. The results of performance measurement based on GSCOR using 26 KPIs can be seen from Table 4.

Table 4
GSCM Implementation

Criteria	Sub-criteria	KPI	Score	Average	Notes	Total
1. Plan	Reliability	1,5,6,21	80, 81, 79, 82	80.5	Good	75.7 (Good)
	Management assets	3, 10	84, 79	81.5	Good	
2. Source	Reliability	4, 14, 15	83, 80, 83	82	Good	
	Responsiveness	13	73	73	Good	
3. Make	Reliability	2, 9, 11, 16, 17, 18, 19, 20	85, 78, 80, 70, 74, 80	77.8	Good	
	Flexybility	12	74	74	Good	
4. Deliver	Reliability	22	70	70	Average	
	Responsiveness	26	71	71	Good	
5. Return	Reliability	23	73	73	Good	
	Responsiveness	8	77	77	Good	

Based on the results of the final performance measurement of the application of GSCM in the black grass jelly food industry at UD RSA Kediri, in general, the performance on the six aspects got good scores. One criterion has an average value, namely, growing a green organizational culture through employee training and development.

UD RSA has limitations in the number and ability of employees to treat industrial waste. This is due to the lack of cooperation with green industry partners or stakeholders experienced in implementing GSCM. Another function that still needs improvement is the sustainability aspect of GSCM practices related to green industry research and development. The preparation of the

sustainability report and the GSCM practice audit system has not been performed. The company has not yet instituted a green accounting policy and uses an integrated environmentally friendly information system. The company's performance has not built an provides asset management through budgeting for the cost of industrial waste management, use of materials, and environmentally friendly production processes with a score of 81.5 (good). The company produces products from industrial waste processing in solid and liquid organic fertilizers that can be used for plant needs. This can reduce the amount of industrial waste and create a clean work environment from waste. In addition, the company collaborates with experts to handle industrial waste so that the waste management process runs effectively. The activity received an assessment result of 77.8 (good). The assessment that is still lacking lies in finding suppliers with green production processes to offset environmental risks.

Conclusion

This study provides information about the practice of green supply chain management in the micro-scale food industry, namely the black grass jelly manufacturing plant. GSCM practices are manifested in the central business processes, including plan, source, make, delivery, return, and enable activities. Based on the measurements made, it is known that the performance of the implementation of GSCM has a good score (75.7). In the operational function, the company has been able to process industrial waste, which is manifested in the processing of black grass jelly industrial waste into solid and liquid organic fertilizers. The implemented green manufacturing function has been supported by other functions such as green sales and marketing, green procurement, green logistics, green human resource management, finance, and green information technology. Implementing GSCM is still carried out within one year, so it has

environmentally friendly business image through green marketing communications. The implementation of GSCM in the operations function is carried out by planning and designing business strategies based on environmental concerns. The company not shown optimal performance values. The recommended recommendation is for companies to develop learning with experienced green industries and collaborate with local governments, academics, and green suppliers to optimize current and future GSCM performance. This study has limited time for data collection and research samples that use one area, namely Kediri, East Java. The results of research on the practice of applying GSCM focus on the black grass jelly food industry, which is included in the category of micro-scale industry, so it does not represent the application of GSCM practices in small and medium industries. It is recommended for further research to enlarge the research sample to explore the practice of GSCM on a small and medium scale industry so that more general research results are obtained.

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