Available online at: http://publikasi.mercubuana.ac.id/index.php/ijiem

IJIEM (Indonesian Journal of Industrial Engineering & Management)

ISSN (Print) : 2614-7327 ISSN (Online) : 2745-9063

Analysis of Green Supply Chain Management Performance Measurement in the Tofu Processing Industry (Case Study: Kampung Tahu-Tempe Selili)

Rega Yuni Airlangga, Wahyuda, Farida Djumiati Sitania
Mulawarman University, Jalan Sambaliung No.9, Samarinda City, East Kalimantan 75119 Indonesia

ARTICLE INFORMATION

Article history:

Received: 17 July 2023
Revised: 30 July 2023
Accepted: 19 August 2023

Category: Research paper

Keywords:
Green manufacturing
GreenSCOR
Analytical hierarchy process
Snorm de boer
Traffic light system

DOI: 10.22441/ijiem.v4i3.21598

A B S T R A C T

Kampung Tahu-Tempe Selili is one of the industrial areas in Samarinda City that produces tofu and tempeh. In the production activities of this area, waste is still dumped into the Mahakam River. The problems include improper raw material sourcing, pollution that disturbs the surrounding residents due to the production process, lack of waste management, and the presence of defective tofu either after production or during delivery to consumers. The research Objective is to improve the supply chain activities using the Green Manufacturing approach. This study utilizes the Green Supply Chain Operations Reference (GreenSCOR) model with a focus on the production process. There are 8 Green Objectives with 15 Key Performance Indicators (KPIs) that will be weighted for each KPI using the Analytical Hierarchy Process (AHP) method. Furthermore, data on the actual realization values of the KPIs are collected from 25 factories located in Kampung Tahu-Tempe Selili. The calculation is performed using the Snorm de Boer method to normalize the actual data, and the Traffic Light System (TLS) method is used to categorize the KPI performance. Based on the calculation of weights and normalization values, the performance score of Kampung Tahu-Tempe Selili is 69.85, KPIs MR-03 and MR-04 are problems faced by all factories and are categorized as red. Factory conditions that cannot treat liquid waste and waste in water use, so that steps that can be taken by the factory reuse residual water for needs that do not involve direct contact with food which can reduce water demand. Then work with the local government to build a waste end treatment plant which can later be processed into alternative biogas fuel.

***Corresponding Author**
Name : Rega Yuni Airlangga
E-mail: rega078@gmail.com

1. INTRODUCTION

The sustainable development goals (SDGs) set by the United Nations in 2015 are a movement that strives for the welfare of society sustainably. The 12th topic, which deals with responsible consumption and production, discusses the importance of awareness of people's behavior patterns in consuming and producing resources so that people can utilize natural resources efficiently (Bappenas, 2022). The manufacturing sector in Indonesia is one of the sectors that support the increase of the country's Gross Domestic Product (GDP). Based on data from the Central Bureau of Statistics (2022), the GDP contribution of the processing industry sector reached 19.25% in 2021. The tofu processing industry is one of the industries that contribute to increasing the country's GDP. However, tofu production activities that process soybeans into tofu produce solid and liquid waste that can cause environmental pollution.

Kampung Tahu-Tempe Selili is one of the industrial areas in Samarinda City that produces tofu and tempeh. There are 50 tofu craftsmen and 25 factories that use 5 to 6 tons of soybeans every day. The condition of Selili Tofu-Tempe Village is quite different from Sentra Industri Kecil Somber (SIKS) in Balikpapan. Based on information from Disperindagkop UKM Kaltim (2022), SIKS has become an integrated tofu & tempeh industry area with good waste handling, and accommodates tofu & tempeh industry entrepreneurs in the supply of raw materials, production fuel, and storage warehouses A difference between SIKS and Selili Tofu-Tempe Village such as improper fulfillment of raw materials, especially in this area mixed with residential areas so that people can be affected by the waste produced and there is no handling of the waste produced. Kampung Tahu-Tempe Selili which uses 6000 kg of soybeans can be estimated to produce 198,000 liters of liquid waste and 20,572 kg of solid waste. In the Selili Tofu & Tempe area, liquid and solid waste is still discharged into the Mahakam River. Tofu liquid waste is harmful to the environment because it contains COD 2080-3680 mg/L, BOD 1271-1741 mg/L, and TSS 1000-1433 mg/L. Adjusting to the East Kalimantan Provincial Regulation No.2 of 2011 concerning Quality Standards for Tofu Industry Wastewater has a COD content limit of 300 mg/L, BOD 150 mg/L, and TSS 100 mg/L (Sirajuddin, 2018). Environmental problems caused by tofu industry waste require performance measurement, in order to generate information about the company's agility in responding to environmental changes. The supply chain activities of Kampung Tahu-Tempe Selili have several raw material suppliers, one of which is KOPTI, the raw materials are then managed into tofu or finished products. The results of tofu production are distributed to end consumers and markets such as the Segiri market. Kampung Tahu-Tempe Selili has never measured the performance of its supply chain, so problems such as improper fulfillment of raw materials, pollution that disturbs residents due to the production process, there is no handling of waste and there are defective tofu either after production or when delivering to consumers.

Based on the problems of tofu industry supply chain activities, especially in production activities that have problems with the environment, it is necessary to apply Green Supply Chain Management (GSCM) with the Green Manufacturing (GM) approach. According to Primadasa (2020), GSCM is intended to minimize various types of waste such as chemical, energy, emissions, and solid. Green Manufacturing is an ecologically friendly manufacturing process at all stages of its life cycle. then the authors conducted research on measuring green supply chain performance by focusing on production activities.

2. LITERATURE REVIEW

Supply chain management is used in the management of organizations that are intertwined and integrated with consumers and suppliers in the process of producing products or services that will be used or consumed by customers. Supply Chain Management is management that deals with upstream and downstream suppliers and customers in delivering the value customers want at the lowest possible cost along the supply chain flow (Rahmi et al., 2018). Green Supply Chain Management (GSCM) is a concept that began with concerns about environmental sustainability as a result of economic and industrial operations. People are becoming increasingly aware of the need for environmentally friendly goods as environmental challenges have evolved. This customer demand certainly motivates corporate actors to focus more on their production operations. In addition, financial pressures, government regulations, greater competitiveness, and complex environmental regulations have all increased interest in sustainable supply chains and reverse logistics (Regita et al., 2020).

According to Jannah et al. (2018), Green Manufacturing is a manufacturing approach that reduces waste and pollution by designing goods and processes with sustainability as the primary goal. The Green Manufacturing process requires investment in the development of manufacturing processes, replacing new sources with limited ones, recycling, and deciding whether to produce or buy products. Green Manufacturing is becoming a necessity in sustainable development and a distinct advantage for modern manufacturing companies in the market competition.

According to Pujawan and Mahendrawathi (2017), the SCOR model is a supply chain reference model, which is a model based on a process framework. SCOR has processes consisting of five core processes, namely Plan¸ Source, Make, Deliver, and Return. The Green SCOR model is a development of the existing SCOR model. This model is a development of the SCOR model by adding several considerations related to the environment in it. Thus, this model is used as a tool to manage the environmental impact of a supply chain. Because it is based on the SCOR model, this model also has the same 5 main components as in the SCOR model namely Plan, Source, Make, Deliver, and Return. The attributes have the same work as the SCOR model, namely Reliability, Responsiveness, Flexibility, Cost, and Asset. However, in the Green SCOR model all of these things have different meanings because in this model all of these things are related to the environment (Pujianto, 2022).

3. RESEARCH METHOD

This research will focus on one of the main component Green SCOR model which is the Make process. This process addresses the company's manufacturing activities. KPI design for this performance measurement model is carried out in several steps. First is the identification of the company's supply chain model. The second is supply chain mapping using the Green SCOR model. To find out the correlation between stakeholders and performance attributes contained in the Green SCOR model, Green Objective identification is carried out. Green Objective is the goal to be achieved by all stakeholders who play a role in the supply chain process (Jannah et al., 2018).

According to Setiyadi (2018), AHP problem solving is divided into 4 stages, namely hierarchy creation, criteria assessment, prioritization, and consistency testing. The following are the principles of the AHP basic method. Making a hierarchy is a solution or division of an intact problem into elements that are formed in the form of a hierarchy of decision-making processes, each element in the hierarchy is bound to each other. Criteria assessment is carried out with a paired comparison assessment on a scale of 1 to 9 which is used as an assessment of the expert. Prioritization is obtained from the relative comparison values of all alternatives and criteria can be adjusted to the assessment of the expert that has been done previously to produce weights and priorities. The following is the formula for calculating global weights as shown in equation 1. Logical consistency is stated to determine whether an element is by uniformity and relationships based on certain criteria. Elements are declared consistent if the consistency ratio is ≤ 10%.

Global Weight = criterion weight x attribute weight x sub-criteria weight ....(1)

According to Satriono et al. (2020), normalization is done to equalize the value of the metric calculation results. In the calculation, the performance attributes metrics have a different size scale. This normalization process is carried out with the Snorm de Boer normalization formula as shown in equation 2.

$$\text{Snorm(score)} = \frac{(S_i - S_{min})}{S_{max} - S_{min}} \times 100 \quad \text{....................(2)}$$

Where : Si = the actual indicator value that has been achieved
Smin = the worst performance value
Smax = the best performance value

Based on equation 2, the acquisition of the final performance value can be categorized according to the monitoring system parameters as shown in Table 1.

Table 1. Monitoring system parameters

Monitoring System	**Performance Indicators**
< 40	Poor
40 – 50	Marginal
50 – 70	Average
70 – 90	Good
>90	Excellent

TLS is a system to analyze whether the performance value of a performance indicator has met the targets of the company or still needs improvement. The system consists of three colors to identify each performance indicator as follows,

1). Red color means that the level is in the limit interval of 0 to 3, this category is classified as poor in performance achievement assessment and is below the target,

2). Yellow color is in the boundary interval 4 to 7, which means it is sufficient but does not reach the maximum target set by the company,

3). Green color is in the interval from 8 to 10, this category includes a very good performance assessment group with the fact that it reaches the maximum target set by the company (Novita et al., 2021).

4. RESULT AND DISCUSSION

a. Supply Chain Analysis and Green Objective

The research was conducted at 25 factories in Selili Tofu-Tempe Village focusing on production performance. Supply chain flow data and the company's Green Objective were obtained through observation, previous studies, and interviews with one of the senior tofu craftsmen who became an expert judgment in the study. Based on the analysis conducted in the industrial area, it is known that there are 8 Green Objectives with 4 attributes in the core Green manufacturing process. Based on the objectives obtained, the performance indicators will be elaborated again according to the needs of the region. In this study, 15 performance indicators were obtained which will be used in measuring supply chain performance as shown in Table 2.

b. AHP weighting

The weighting values are obtained from the AHP questionnaire which contains pairwise comparisons between GSCOR processes, attributes, and between KPI metrics. Pairwise comparison data is used to determine the level of importance or weight of each criterion and KPI that has been determined previously. This data was obtained by conducting interviews with senior tofu craftsmen in Selili Tofu-Tempe Village. The matrix of pairwise comparison results of level 2 criteria can be seen in Table 3. Then the overall weighting is carried out on process level criteria 2, 3, and 4 as shown in Table 4.

Table 2. Green manufacturing decomposition

Attributes	Objective	Performance Indicators	Formula	KPI Code
Reliability	Soybean productivity	Use of Soy Beans	$\left(\frac{\textbf{Quantity of tofu produced (kg)}}{\textbf{Soy Bean Input(kg)}}\right) \boldsymbol{x}\ \mathbf{100}\%$	MR-01
		Appropriate Soy Beans according to industry standard	$\frac{\textbf{Number of Soybeans in Compliance}}{\textbf{Total Soybeans purchased}}\ \textbf{x}\ \mathbf{100}\%$	MR-02
	Water use efficiency	Water usage in production activities	$\frac{\text{Water for Productivity}}{\text{Total water use}}\ \text{x}\ 100\%$	MR-03
	Waste minimization	Utilization of liquid waste generated	$\frac{\textbf{Liquid waste utilized}}{\textbf{Total liquid waste}}\ \textbf{x}\ \mathbf{100}\%$	MR-04

Attributes	Objective	Performance Indicators	Formula	KPI Code
	Perfect Order Fulfillment	Utilization of Solid Waste generated	$\frac{\textbf{Solid waste utilized}}{\textbf{Total Solid waste}}\ \mathbf{x\ 100\%}$	MR-05
		Tofu products that are not defective	$\frac{\textbf{Undamaged tofu}}{\textbf{Total Tofu Products}}\ \mathbf{x\ 100\%}$	MR-06
		Tofu products received by customers	$\mathbf{100\%} - (\frac{\textbf{Rejected tofu}}{\textbf{Tofu delivered}})$	MR-07
	Order fulfillment cycle time	Production cycle time	Product cycle time	MRe-01
		Raw Material Ordering Cycle Time	Raw material ordering time	MRe-02
Responsiveness	On-time Production	Average soaking time of soybeans	Soaking time of soybeans	MRe-03
		Average time Soybean milling	Duration of grinding time	MRe-04
		Average boiling time of soybeans pulp	Soybean pulp boiling time	MRe-05
		The average time the product is precipitated	Duration of soybeans pulp precipitated	MRe-06
Cost	Fuel Cost Efficiency	Fuel cost during production	Firewood Cost + Fuel Cost	MC-01
Agility	Human Resource Management	Workers ability to increase production output	$\frac{\text{Finished Product Yield}}{\text{Ideal Production Quantity}}\text{x } 100\%$	MAg-01

Source: Jawad (2019)

Table 3. Pairwise comparison matrix

	Reliability	Responsiveness	Cost	Agility
Reliability	1,0000	2,0000	4,0000	3,0000
Responsiveness	0,5000	1,0000	3,0000	2,0000
Cost	0,2500	0,3333	1,0000	0,2500
Agility	0,3333	0,5000	4,0000	1,0000
Total	**2,0833**	**3,8333**	**12,0000**	**6,2500**

In Table 2, the performance indicators that have been designed will be validated again by the tofu craftsmen to determine whether the designed supply chain performance indicators describe the performance of industrial area activities. In this study, 15 performance indicators designed have been validated. Performance measurement will be carried out by distributing questionnaires to 25 factory owners in Selili Tofu-Tempe Village. These performance indicators will determine the performance value of each factory which will then become the final value of the performance of the Kampung Tahu-Tempe Selili industrial area.

The validated measurment design will be weighted at each level which will determine the global weight value of the KPI. In Table 3 when a weight value is obtained on an element, a reciprocal axiom condition will be applied. As in the Reliability and Responsiveness attributes, if the Reliability value is 2 times more important than Responsiveness then the Responsiveness weight value is 1/2 of the Reliability attribute. This also applies to the agility attribute which is worth 0.25 then the weight of Cost is 1/0.25 of the agility attribute. Next, determine the eigenvector value of the matrix by dividing the value of each column by then averaging to get the partial weight of each perspective.

Based on the results of the calculation, it can be seen that the weight value for Reliability is 0.457, the Responsiveness attribute weight is 0.271, the Cost attribute has a weight of 0.080 and the agility attribute has a weight of 0.193. Reliability is the attribute with the highest weight, this is because the industry's ability to provide satisfaction to customers is highly considered by the industry.

Table 4. Global weight calculation

Attributes	Green objective (Level 3)	Green Objective Weight	Performance Indicators (Level 4)	Weight	Global Weight
0,457	Soybean productivity	0,274	MR-01	0,800	0,1002
			MR-02	0,200	0,0250
	Water use efficiency	0,086	MR-03	1,00	0,0393
	Waste minimization	0,178	MR-04	0,125	0,0102
			MR-05	0,875	0,0712
	Perfect Order Fulfillment	0,462	MR-06	0,167	0,0353
			MR-07	0,833	0,1759
0,271	Order fulfillment cycle time	0,667	MRe-01	0,800	0,145
			MRe-02	0,200	0,036
	On-time Production	0,333	MRe-03	0,152	0,014
			MRe-04	0,066	0,006
			MRe-05	0,482	0,044
			MRe-06	0,301	0,027
0,080	Fuel Cost Efficiency	1,00	MC-01	1,00	0,0800
0,193	Human Resource Management	1,00	MAg-01	1,00	0,1930

c. Snorm de Boer Normalization and Performance Measurement

Performance measurement on each KPI uses actual value data in the period December 2022 - February 2023. The results of the calculation of actual value data will be used as the final value of supply chain performance after the normalization test. Based on the results of the interview the design of the KPIs for Selili Tofu-Tempe Village and the questionnaire of the achievement and target values. The following is an example of calculating performance indicators.

1). Use of Soy Beans

KPI MR-01 serves to determine the suitability between the input and output of soybeans after being processed into tofu. The KPI value is calculated from the ratio between the amount of tofu successfully produced in kilograms and the amount of soybean input during the production process then multiplied by 100%. Data measurement of the actual value of KPI MR-01 was carried out at factory 1 using the equation in Table 2 with the results shown in Table 5.

Table 5. KPI MR-01 (Factory 1)

Performance	Quantity of Tofu	Soybean Input	KPI Value
Current	340	250	136%
Best	340	250	136%
Worst	300	250	120%

After obtaining the performance value, normalization calculations are carried out using Equation 2. In determining Smax and Smin, in-depth interviews were conducted with tofu craftsmen so that Smax was obtained at 140% while Smin was 100%. Then the calculations were carried out again for other factories so that the results in Table 6 were obtained. The following are the results of the normalization calculation.

$$Snorm(Current) = \frac{(136\% - 100\%)}{140\% - 100\%} x100 = 90\%$$

$$Snorm(Best) = \frac{(136\% - 100\%)}{140\% - 100\%} x100 = 90\%$$

$$Snorm(Worst) = \frac{(120\% - 100\%)}{140\% - 100\%} x100 = 50\%$$

Table 6. Normalization value of KPI MR-01

No.	Normalization Value		
	Currently	Best	Worst
1	90,00	90,00	50,00
2	70,00	90,00	10,00
3	75,00	75,00	0,00
4	50,00	83,33	33,33
5	100,00	100,00	0,00
6	56,25	56,25	12,50
7	50,00	56,25	12,50
8	93,75	100,00	12,50
9	75,00	100,00	50,00
10	70,00	100,00	-5,00
11	25,00	40,00	-25,00
12	40,00	50,00	-10,00
13	70,00	90,00	10,00
14	43,75	62,50	0,00
15	50,00	50,00	10,00
16	93,75	93,75	62,50
17	75,00	75,00	50,00
18	70,00	75,00	30,00
19	50,00	50,00	0,00
20	62,50	62,50	-12,50
21	83,33	83,33	16,67
22	83,33	100,00	41,67
23	93,75	100,00	0,00
24	50,00	71,43	21,43
25	93,75	100,00	0,00
Average	**68,57**	**78,17**	**14,82**

2). Utilization of Solid Waste generated

In the soybean processing activity, there is a process of grinding soybeans that produces soybean dregs. This KPI serves to determine the percentage of solid waste utilization carried out by the factory. Data measurement of the actual value of KPI MR-05 is carried out at factory 5 with the results that can be seen in Table 7.

Table 7. KPI MR-05 (Factory 5)

Performance	Solid Waste	Waste Utilized	KPI Value
Current	75 Kg	75 Kg	100%
Best	80 Kg	80 Kg	100%
Worst	75 Kg	74 Kg	98%

After obtaining the performance value, a normalization calculation is carried out on the KPI value. The current performance normalization value is 100%. Causes of high KPI value at factory 5 is because all the remaining solid waste is reprocessed to become animal feed which will later be resold.

3). Average boiling time of soybeans pulp

Soybean processing activity has a process of boiling soybean porridge which will later be precipitated with vinegar so that it can become tofu. The time in this process needs to be considered so that soybeans are not overcooked, the quality of fine soybeans is maintained, and the boiling process does not take excessive time. The determination of Smax and Smin uses parameters that have been determined by the tofu craftsmen as shown in Table 8. This KPI is to determine the average time of boiling soybeans in 50 kg of production. Measurement of actual value data was carried out at factory 22 with results that can be seen in Table 9.

Table 8. Benchmarks for boiling 5 kg of soybeans

Value	Category	Description
4	Very good	Boiling for 10-12 minutes
3	Good	Boiling for 13-15 minutes
2	Poor	Boiling > 15 minutes
1	Very Poor	Boiling until soybean pulp curdling

According to Putri (2021), the boiling process can damage the protein structure contained in soybeans. If the boiling more longer, the more protein is damaged.

Table 9. KPI MRe-05 (Factory 22)

Performance	Boiling Time (minutes)	KPI Value	Snorm
Current	10	4	100%
Best	10	4	100%
Worst	14	3	66,67%

The current performance normalization value is 100%. The high KPI value at factory 22 is due to routine supervision and evaluation carried out by the factory owner so that there is no decline in product quality.

d. Proposed Improvements with Traffic Light System

Based on the normalization value obtained from the Snorm de Boer calculation and AHP weighting, calculations are then carried out to obtain the final performance value. Then determine the proposed improvements needed by Kampung Tahu-Tempe Selili. The final value is obtained from calculating the average achievement of KPI performance from each factory and then accumulated so that the final value is obtained. sehingga didapatkan nilai akhir.

Table 10. Recapitulation of final score

KPI	Global Weight	Normalization Value	Final Score
MR-01	0,1002	68,57	6,8704
MR-02	0,0250	85,64	2,1409
MR-03	0,0393	52,36	2,0578
MR-04	0,0102	0,00	0,0000
MR-05	0,0712	100,00	7,1200
MR-06	0,0353	75,51	2,6656
MR-07	0,1759	73,07	12,8539
MRe-01	0,1450	72,80	10,4632
MRe-02	0,0360	80,00	2,8800
MRe-03	0,0140	89,33	1,2507
MRe-04	0,0060	56,31	0,3378
MRe-05	0,0440	84,00	3,6960
MRe-06	0,0270	85,87	2,3184
MC-01	0,0800	69,39	5,5509
MAg-01	0,1930	49,23	9,6440

Based on Table 10, it can be seen that the total final performance value at Kampung Tahu-Tempe Selili is 69.85 and the category it's in average. Proposed improvements will be given to KPIs with red and yellow categories, which are KPIs MR-01, MR-03, MR-04, MR-06, MR-07, MRe-01, MRe-04, MC-01 and MAg-01. The following is an analysis of the proposed improvements given to Kampung Tahu-Tempe Selili.

1. KPI MR-01

There are 12 factories that have problems related to the use of soybeans. This is because before production, tofu craftsmen do not sort soybeans and the quality of raw materials is not good. According to Jaya et al. (2019), tofu craftsmen can do sorting first to reduce damaged soybeans, stones, and gravel so that they are not mixed during production. Then tofu craftsmen can evaluate raw material suppliers regarding the quality of tofu sold or make comparisons to the quality of other factory soybeans.

2. KPI MR-03

All factories in the industrial area have problems in wasting water, this is due to the use of water that is less calculated so that a lot of water is wasted. According to Pujianto (2022), the use of water from recycled waste can reduce water demand by up to 18%. Reusing residual water for needs that do not involve direct contact with food, can minimize the use of industrial water.

3. KPI MR-04

The utilization of liquid waste in the area is in the red category, this is due to the absence of a waste water treatment plant . Tofu craftsmen can cooperate with the local government to build a Waste Final Treatment Plant and make Biogas which is an alternative to fire fuel (Pujianto, 2022). Another step that can be taken is processing by utilizing waste into liquid organic fertilizers. The government can provide training to improve residents' skills and reduce environmental pollution. (Suhairin et al, 2020).

4. KPI MR-06

11 factories require priority improvement on perfect order fulfillment. This is due to the improper precipitation process of tofu with vinegar and also a less clean production environment. In the process of stirring soybeans, it is possible to standardize the vinegar content and evaluate the pressing of tofu so that the resulting texture is not mushy. Then the factory can schedule routine cleaning of the factory environment. (Hairiyah & Amalia, 2020).

5. KPI MR-07

Tofu products that have been produced will be distributed to customers or consumers, but there are tofu products that are rejected by customers due to the size of the tofu that does not match the order and the presence of damaged tofu. 7 factories require immediate improvement, by making shipping standards that adjust to the container and the amount of tofu included so that it is safe when shipping. Factories can also conduct structured production planning according to customer demand and recheck the size of the tofu to be sent.

6. KPI MRe-01

The late production cycle of the factory makes the distribution of products not on time to the consumer, which reduces trust in the industry. This delay is due to the excessive workload on workers. There are 8 factories that have problems with this performance, so an evaluation can be made of the division of job desks and production planning that adjusts to human resources so that overload does not occur.

7. KPI MRe-04

During the tofu production process, there is a stage of grinding soybeans into fine pulp, but there is an old type of grinding machine and also a capacity that is not large for grinding. So that the ability of the grinder is slow and causes production delays. In the 13 factories that require improvement, maintenance on the grinding machine can be done regularly so that the grinder continues to run in optimal conditions. Then the factory can replace the type of grinder with a larger capacity or readjust the production demand with the ability of the factory to meet demand on time.

8. KPI MC-01

Firewood is the source of combustion energy during tofu production, but the dynamic price of firewood can cause prices to be higher than the target expenditure and the use of unaccounted diesel causes greater expenditure. There are 9 factories that require prioritized improvements to reduce overspending on fuel costs. Factories can replace firewood with wood waste and biopellets, which are renewable fuels with higher calorific value and can reduce carbon dioxide from combustion. Then the factory can create an SOP for the use of diesel so that the diesel used does not exceed costs.

9. KPI MAg-01

Factory owners have production targets that are entrusted to workers or employees but in some conditions, this is sometimes not achieved. This is due to differences in age and gender which can cause differences in production results. Then the work environment that has a high temperature makes it difficult for workers to focus on their activities. The factory can evaluate each workstation according to the heaviest to lightest workload. Consider unnecessary activities during production and employee shifts. Then the factory can make ventilation that can help change the temperature by paying attention to the direction of the wind whether it is covered by a wall or not, after which the combustion furnace is closed so that it can directly exit through the chimney. (Fathimahhayati et al., 2019).

5. CONCLUSION

Based on the results of research conducted at Kampung Tahu-Tempe Selili, 8 Green Objectives with 15 KPIs were obtained. At the Reliability attribute there are 4 objectives with 7 KPIs. At the Responsiveness attribute there are 2 objectives with 6 KPIs. At the Cost attribute there is 1 objective with 1 KPI. Then at the Agility attribute there is 1 objective with 1 KPI. The overall supply chain performance carried out in the industrial area is 69.85 with an average category. There are 6 KPIs in the green category, 8 KPIs in the yellow category, and 1 KPI in the red category. The provision of improvement proposals aims to improve KPI performance and the company's total supply chain performance index. Based on the analysis of proposed improvements, 15 KPIs were given proposed improvements and 2 of them were KPIs that urgently needed improvement, namely KPI MR-03 and MR-04. All factories have low performance on these 2 KPIs and the impact makes the total value of the industrial area low. Improvements that can be applied by Reusing residual water for needs that do not involve direct contact with food, can minimize the use of industrial water. Cooperating with the surrounding government to build a Waste Final Treatment Plant where the collected waste will be reprocessed into biogas. Another step can be taken by processing wastewater into liquid organic fertilizers. The government can provide training to improve residents' skills and reduce environmental pollution. Further research to improve factory performance on environmental impacts can be carried out by discussing the clean product management of the tofu industry, in order to obtain specific improvements in the production process. Improvements in energy efficiency, production efficiency, and identification of environmental impacts can be further researched. can be further researched.

REFERENCES

Dinas Perindustrian, Perdagangan, Koperasi, Usaha Kecil Dan Menengah Kalimantan Timur. (2022). Sentra Industri Kecil Menengah Somber. [Online], Available On: https://indagkop.kaltimprov.go.id/halaman/detail/sentra-industri-kecil-menengah-somber

Central Bureau of Statistics. (2022) Profil Industri Mikro dan Kecil 2020.

Fathimahhayati, L. D., Amelia, T., & Syeha, A. N. (2019). Analisis Beban Kerja Fisiologi pada Proses Pembuatan Tahu Berdasarkan Konsumsi Energi (Studi Kasus: UD. Lancar Abadi Samarinda). *Jurnal INTECH Teknik Industri Universitas Serang Raya*, *5*(2), 100–106. https://doi.org/10.30656/intech.v5i2.1695

Hairiyah, N., & Amalia, R. (2020). Pengendalian Kualitas Produk Tahu Menggunakan Metode Six Sigma di UD. Sumber Urip. *AGROINTEK*, *14*, 14–23. https://doi.org/10.21107/agrointek.v14i1.5222

Jannah, B., Ridwan, A. Y., & Hadi, R. M. El. (2018). Designing the Measurement of System Green Manufacturing Using SCOR Model in The Leather Tanning Industry. *Jurnal Rekayasa Sistem & Industri (JRSI)*, *5*(02), 60. https://doi.org/10.25124/jrsi.v5i01.301

Jaya, J. D., Ariyani, L., & Hadijah, H. (2019). Designing Clean Production of Tofu Processing Industry in UD. Sumber Urip Pelaihari. *Jurnal Agroindustri*, *8*(2), 105–112. https://doi.org/10.31186/j.agroind.8.2.105-112

Jawad, A,M., Baihaqi, I., dan Ardiantono, D.S. (2019).Analisis dan Perbaikan Kinerja Green Supply Chain Management Perusahaan (Studi Kasus: Joint Operating Body Pertamina-Petrochina East Java), *Jurnal Teknik ITS Vol. 8, No. 1, (2019) ISSN: 2337-3539 (2301-9271 Print).*

Ministry of National Development Planning, (2022), Sekilas Sdgs, [Online], Available On: Https://Sdgs.Bappenas.Go.Id/Sekilas-Sdgs/

Novita, E., Marxoni, E., & Welly, W. (2021). Pengukuran Kinerja Dengan Metode Performance PRISM. *Inaque : Journal of Industrial and Quality Engineering*, *9*(1), 49–61. https://doi.org/10.34010/iqe.v9i1.4307

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). https://doi.org/10.18196/jqt.010209

Pujawan, I. N., dan Mahendrawathi. (2017) *Supply Chain Management Edisi 3*, Yogyakarta: Penerbit ANDI.

Pujianto, T., Bunyamin, A., & Wafiyyah, S. (2022). Pengukuran kinerja green manufacturing pada industri tahu sumedang untuk meningkatkan kinerja terhadap lingkungan menggunakan GSCOR dan LCA. *Agrointek : Jurnal Teknologi Industri Pertanian, 16*(2), 221–233. https://doi.org/10.21107/agrointek.v16i2.10831

Putri, B., Putu Suparthana, I., & Darmayanti, L. P. (2021). Itepa: Jurnal Ilmu dan Teknologi Pangan, The Effect of The Duration of Boiling Soybeans on The Characteristics of Fermented Soybeans. *Itepa: Jurnal Ilmu dan Teknologi Pangan*, , 492–504.

Rahmi Yuniarti, Ishardita P. Tama., Agustina E., dan Yeni, S. (2018). *Green Supply Chain Management dan Studi Kasus di Dunia Industri*, UB Press : Malang.

Regita Irvastava P., Imam Baihaqi, dan Geodita, B. (2020). Membangun Green Supply Chain Management (GSCM) Scorecard, *Jurnal Teknik ITS Vol. 9, No. 2, (2020) ISSN: 2337-3539 (2301-9271 Print).*

Satriono, B., Profita, A., & Djumiati Sitania, F. (2020). Perancangan dan Pengukuran Kinerja Perusahaan Berbasis Kerangka Agri-Food Supply Chain. *Jurnal INTECH Teknik Industri Universitas Serang Raya*, *6*, 123–131. https://doi.org/10.30656/intech.v6i2.2405

Setiyadi, A., & Dwi Agustia, R. (2018). Penerapan Metode AHP dalam Memilih Marketplace E-Commerce Berdasarkan Software Quality And Evaluation ISO/IEC 9126-4 untuk UMKM. *Jurnal IKRA-ITH Informatika*, 2(3), 61-70.

Sirajuddin, dan Harjanto .(2018). Pengaruh Ukuran Adsorben dan Waktu Adsorpsi Terhadap Penurunan Kadar COD pada Limbah Cair Tahu Menggunakan Arang Aktif Tempurung Kelapa, *Prosiding (SNP2M), ISBN : 978-602-607766-4-9, Politeknik Negeri Samarinda*

Suhairin, S., Muanah, M., & Dewi, E. (2020). Pengolahan Limbah Cair Tahu Menjadi Pupuk Organik Cair di Lombok Tengah NTB. *SELAPARANG Jurnal Pengabdian Masyarakat Berkemajuan*, *4*, 374. https://doi.org/10.31764/jpmb.v4i1.3144