

# DESIGNING SYSTEM MONITORING OF HALAL SUPPLY CHAIN PERFORMANCE IN FOOD PROCUREMENT AND DISTRIBUTION USING ANALYTICAL HIERARCHY PROCESS (AHP) METHOD: A MIXED BETWEEN INDONESIAN COUNCIL OF RELIGIOUS (MUI) AND SUPPLY CHAIN OPERATIONS REFERENCE (SCOR)

Rangga Fauzian Ramadhan<sup>1\*</sup>, Ari Yanuar Ridwan<sup>2</sup>, Budi Santosa<sup>3</sup>

<sup>1</sup> School of Industrial and System Engineering Telkom University

<sup>2</sup> School of Industrial and System Engineering Telkom University

<sup>3</sup> School of Industrial and System Engineering Telkom University

**Abstract.** Brownies is one of the products from the food industry that has a soft and dense texture, with cakes that have a blackish brown color and have a distinctive chocolate flavor. Vannisa Brownies is a company in the food industry and is included in the company scale. Small and Medium Enterprises by producing food products are brownies. The process of procurement of raw materials and product distribution is a crucial process. Although this process is important, in the procurement and distribution process there are no performance measurements and also halal measurements on its part. This process needs to be done to ensure that the process is carried out properly in accordance with the rules and also as a supporter in improving the company. In this study, it will be proposed for halal procurement and distribution systems. The Supply Chain Performance Measurement System is designed based on the model of Supply Chain Operation Reference (SCOR), LPPOM MUI and Analytical Hierarchy Process (AHP). The result of this SCOR model is the Key Performance Indicator (KPI). This system is designed in the form of a web-based application. In this study there were 21 metrics and 5 halal metrics for procurement, 9 metrics and 3 halal metrics in the distribution section of the company divided into 4 attributes. The most important performance is the Responsive attribute with the weight of the AHP obtained 0.484. In this system, it can also be completed. Also the conditions of the process carried out in the company.

**Keywords:** Halal Supply Chain, Performance Measurement System, SCOR, AHP, Monitoring System.

## 1. INTRODUCTION

The food industry is a business that manages raw materials or semi-finished goods that have added value to the goods to be marketed to consumers with the aim of making a profit. nowadays the developing food industry is the halal industry market, the world market industry continues to develop at a rate of 1.1 trillion US dollars and reached 1.6 trillion US dollars in the year 2018 (Perindustrian, 2018).

The food industry needs to be supported by halal supply chain management (Halal Supply Chain Management / HSCM). HSCM is a development of conventional supply chain management that guarantees halal security starting from raw materials to purchases by consumers so that the product is still in a halal condition and safe for consumption (Tieman, 2011). Therefore it is necessary to hold a bureaucracy that is strict enough to make halal-approved food or beverages

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\* Corresponding Author, Email: [ranggafauzianra@student.telkomuniversity.ac.id](mailto:ranggafauzianra@student.telkomuniversity.ac.id)

with food and beverage approval for those who can issue halal certificates in Indonesia. In Indonesia, the issuing party to issue a certificate is the Indonesian Ulema Council or often abbreviated as MUI. The high growth of the food industry in Indonesia also makes entrepreneurs or builders of industrial elements in the food and beverage sector compete to increase customer satisfaction by registering their products to the MUI to increase customer trust. From the data obtained from the Indonesian Ulema Council (MUI) the list of certificates that were successfully registered with LPPOM continued to increase from 2012 to 2017 as many as 3296.

In this study, the focus is on the procurement and distribution process in the company, in this study will also help companies in making halal KPIs in the halal food industry or commonly called the Key Performance Indicators using the SCOR (Supply Chain Reference) model the reason using SCOR model because it can measure the performance of the supply chain by mapping the activities that exist in the company. key performance indicators are scale and quantitative measures. KPI is also used to determine measurable objectives, see trends, and support decision making.

This study will also integrate data, performance calculations and visualization of each key performance indicator of the company, especially in the procurement and distribution section, in this system it is useful to help companies in the supply chain halal monitoring system so that in the future it can be seen whether ongoing activities are in accordance with planning and procedures predetermined or agreed upon, where the system is capable of monitoring each metric that was successfully designed in the form of web-based, with this monitoring can display metrics in the supply chain performance measurement system in graphical form (Novar, 2018). The existence of a halal procurement and distribution monitoring system helps companies evaluate and achieve business targets for the process of procuring halal materials and halal distribution so that they are in accordance with the regulations set by the government through the Indonesian Ulema Council or the Indonesian Ulema Council.

## **2. LITERATURE REVIEW**

### ***2.1 Supply Chain Management***

*Supply Chain Management or commonly said SCM is a supply chain consisting of all stages that are mutually involved, either directly or indirectly to meet customer demand. The supply chain also includes not only producers and suppliers, but also transporters, warehouses, retailers, and customers themselves (Chopra, 2003).*

### ***2.2. Halal Supply Chain Management***

*Halal SCM can be defined as halal network management which has a goal to extend the halal integrity of the source to the point of consumer purchase. To ensure that the product received is a product that has proven its legal truth, it is also important to determine what principles exist in existing halal supply chain management (Willison, 2012).*

### ***2.3. Supply Chain Operation Reference (SCOR)***

*The Supply Chain Operation Reference, also known as SCOR, is a model designed by the Supply Chain Council (SCC). SCOR itself has several versions of SCOR where SCC has now issued a model from SCOR, version 12.0. The SCOR model has also been developed to describe related business activities with all phases in satisfying customer demand. The main components of SCOR are plan, source, make, deliver and return. Part of SCOR's performance itself consists of two types of elements, namely Performance Attributes and Metrics. SCOR level 1 metrics are strategic, high-level actions that cross several levels of SCOR. Lower level metrics are related to a narrower subset of processes. For example, the delivery performance is calculated as the total number of*

products sent in a timely manner and in accordance with a predetermined agreement (Council, 2012).

#### 2.4. Normalization of Snorm De Boer

This normalization has a very important role because in order to achieve a final value of a performance measurement and this process is carried out by normalization called the normalization of Snorm De Boer (Sumiati, 2006). The following formula for De Boer normalization in measuring each indicator weight is converted into an interval at a certain value, namely 0-100:

$$S_{nom} (skor) = \frac{(S_i - S_{min})}{(S_{max} - S_{min})} \times 100$$

Or

$$\frac{(S_i - S_{min})}{(S_{max} - S_{min})} = \frac{skor - 0}{100 - 0}$$

Description :

- $S_i$  = The actual indicator value that was successfully achieved
- $S_{min}$  = The worst performance achievement indicator
- $S_{max}$  = The best value for performance achievement indicators

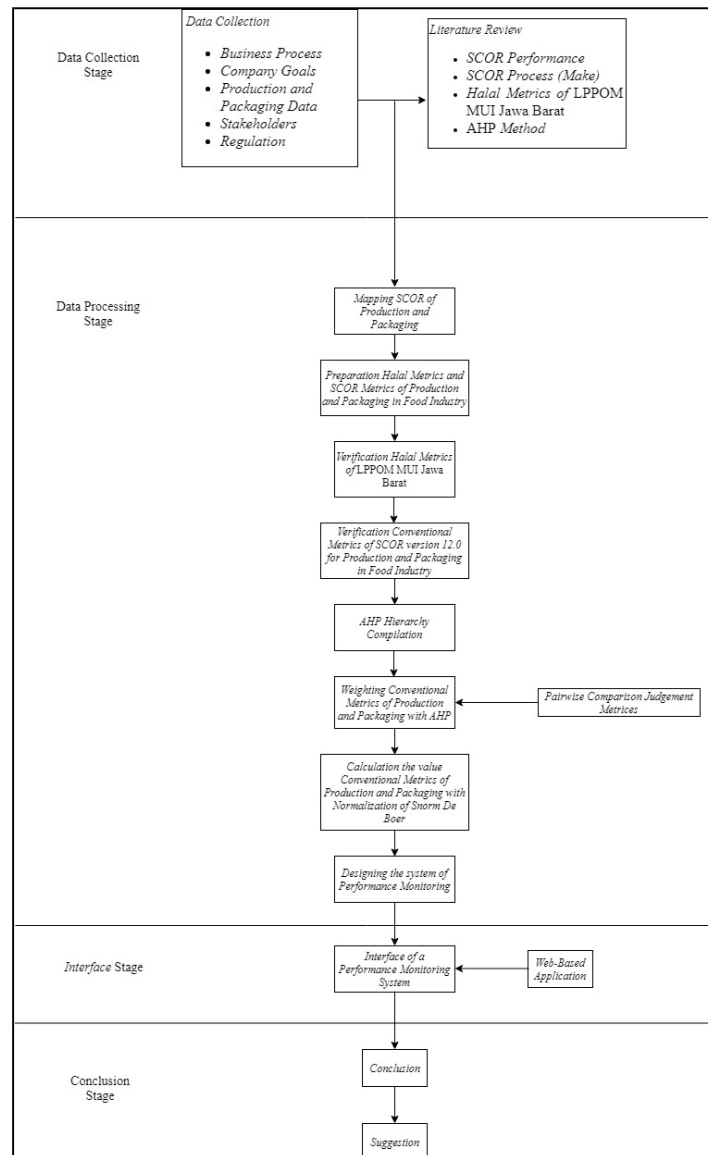
#### 2.5. Analytical Hierarchy Process (AHP)

AHP or Analytical Hierarchy Process is a decision support model for describing complex multi-factor problems into a hierarchy but also builds a relative scale that can be derived and makes paired comparisons using judgments of absolute number scales (Saaty, 2008). AHP is determined which alternative is the best or which is concerned with the company from the existing criteria. Some steps in carrying out the AHP method are as follows:

1. Determine the criteria used
2. Arrange criteria in the form of paired metrics
 
$$a_{ij} = \frac{w_i}{w_j} \quad \text{untuk } i, j = 1, 2, 3, \dots, n \dots\dots\dots (1)$$
3. Normalization of metrics
 
$$a_{ij} = \frac{a_{ij}}{\sum a_{ij}} \dots\dots\dots (2)$$
4. Total number of each first column
 
$$a_{ij} = \sum_i a_{ij} \dots\dots\dots (3)$$
5. Determine the priority weight (eigen vector) of each of the first criteria
 
$$Wt = \frac{a_i}{n} \dots\dots\dots (4)$$
6. Calculate the eigenvalue value
 
$$\lambda_{maks} = \frac{\sum a}{n} \dots\dots\dots (5)$$
7. Calculate consistenct index (CI)
 
$$CI = \frac{(\lambda_{maks} - n)}{(n-1)} \dots\dots\dots (6)$$
8. Calculating the consistency of the ratio (CR)
 
$$CR = \frac{CI}{RI} \dots\dots\dots (7)$$

### 3. METHODOLOGY

Systematics of problem solving is an explanation of the steps to solve or solve a problem in this study. The systematic problem solving in this study can be done through four parts of Figure 1, namely [1] Data Collection, [2] Data Processing, [3] Stage of Implementation and Analysis and [4] Conclusion



**Fig. 1. Methodology**

Weighting is done using the AHP method. In obtaining existing data use the Pai-wise Comparison Judgment Metrics (PCJM) method. This comparison method is carried out to get the weighting results to be analyzed using the AHP method, if the respondent is more than one, Geoman must be calculated first. The results of analyzing using PCJM and AHP methods are local weights or global weight or global weight. After the next weighting test is to do a consistency test to test whether the data is valid or not. The metrics that have the next weight are normalized because

each metric is still in different units, so the need to normalize SnormDeboer is intended to give the value of each metric to a scale of 0-100%.

At the implementation stage, the performance measurement system that has been compiled is designed into the application. The design of this system is also based on the results of the design of the monitoring system in the previous stage and from the results of designing use case diagrams and use case scenarios and also seeing the results of the halal KPI in the procurement section and also distribution based on LPPOM MUI. The monitoring system that has been created is then tested by inputting data from the company in the procurement and distribution section and the requirements for halal in that section.

#### 4. DISCUSSION AND CONCLUSIONS

##### 4.1 Data Collection

Data collection is done by interviewing top management directly. The results of this interview produced ten stakeholders including admin, production department, raw material warehouse, raw material parts, suppliers, quality control, packaging parts, warehouse finish goods, shipping and outlets. In addition, for business processes, companies are also mapped in the form of cross-functional diagrams. After that is the determination of company objectives that are mapped into SCOR as shown in Table 1. The literature study on SCOR was also carried out in this process and also collected regulations related to the processes carried out by the company.

**Table 1 Performance Attributes Based on the Purpose of Procurement and Distribution of the Company**

Objective	Performance Attributes
Meet the target of material and distribution procurement in terms of both quality and quantity	Reliability
Meet the procurement and distribution targets within the time set by the company	Responsiveness
Meet the procurement and distribution targets in a cost efficient manner	Cost
Meet the procurement and distribution targets with efficient assets	Aset Management

##### 4.2. Data Processing

###### 4.2.1. Mapping SCOR

SCOR mapping is the stage of adjustment or mapping between activities that exist in the business process of a company with a SCOR model. This stage aims to identify process activities at SCOR that are related to the processes in the procurement and distribution of raw materials and products from the Vannisa Brownies Bandung company.

###### 4.2.2. Preparation of Halal and Conventional Metrics

Halal metrics are the provisions needed to assist in the examination and testing of the halal nature of a product and are sourced from LPPOM MUI as an organization entitled to making halal certification. In the procurement and distribution section, of course there are several points that must be fulfilled to declare halalness in that section. Besides halal metrics, it is also necessary to develop conventional metrics that refer to SCOR and need to be verified by the company.

4.2.3. Preparation of the AHP Hierarchy and Weighting of Metrics

In the preparation of the AHP hierarchy, weighting is used using AHP, so after the verification metrics are made in the form of hierarchies. The AHP hierarchy for metrics in the Vannisa Brownies Bandung company has three levels. After the AHP preparation is then weighted using AHP.

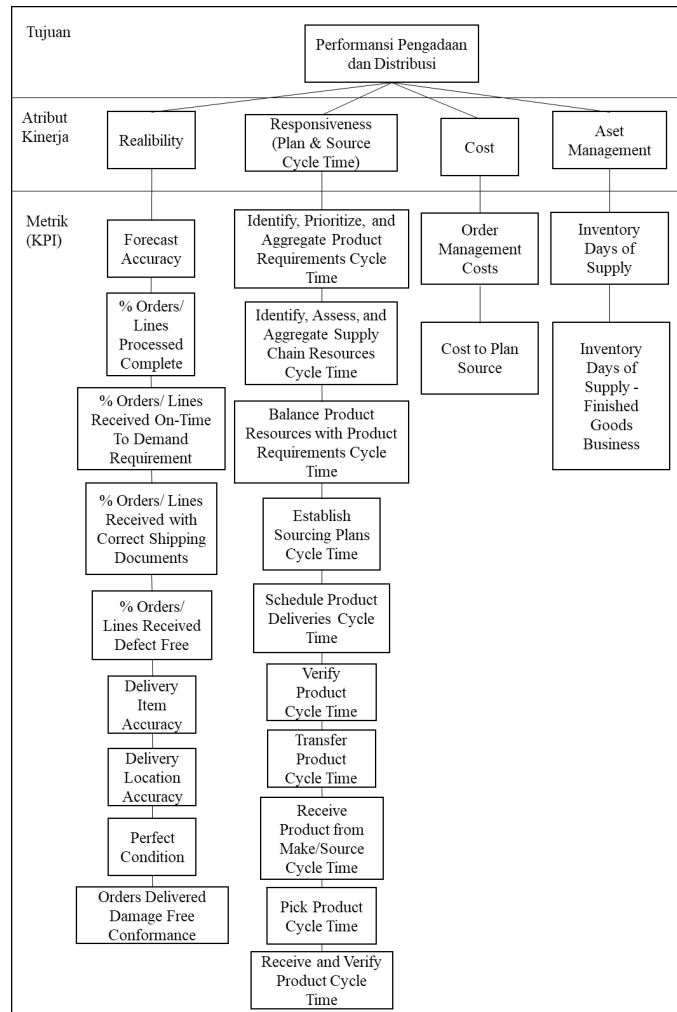


Fig. 2. Metric Hierarchy Model

4.3. Local And Final Score of Metrics

Table 2 Calculation of Transaction Performance Last part of Procurement

Atribut Kinerja	Metrik	LW	GW	Si	Smin	Smax	SNORM	Global Score (SNORM x GW)
Reliability	Delivery Item Accuracy	0,070	0,034	98%	95%	100%	60,000	2,024
	Delivery Location Accuracy	0,512	0,248	98%	95%	100%	60,000	14,873
	Perfect Condition	0,137	0,066	95%	90%	100%	50,000	3,309
	Orders Delivered Damage Free Conformance	0,282	0,136	97%	95%	100%	40,000	5,458

Atribut Kinerja	Metrik	LW	GW	Si	Smin	Smax	SNORM	Global Score (SNORM x GW)
<b>Reliability Score</b>								25,663
Responsiveness	Receive Product from Make/Source Cycle Time	0,152	0,029	20	30	10	50,000	1,472
	Pick Product Cycle Time	0,560	0,109	50	60	15	22,222	2,415
	Receive and Verify Product Cycle Time	0,288	0,056	10	30	10	100,000	5,579
<b>Responsiveness Score</b>								9,467
Sourcing Cost	Order Management Costs	1,000	0,165	Rp4.000.000	Rp2.000.000	Rp5.000.000	66,667	11,025
<b>Sourcing Cost Score</b>								11,025
Asset Management	Inventory Days of Supply - Finished Goods Business	1,000	0,156	2	7	1	83,333	13,039
<b>Asset Management Score</b>								13,039
<b>Total</b>								59,194

**Table 3 Calculation of the Last Transaction Performance in the Distribution section**

Atribut Kinerja	Metrik	LW	GW	Si	Smin	Smax	SNORM	Global Score (SNORM x GW)
Reliability	Forecast Accuracy	0,059	0,029	85%	75%	100%	40,000	1,146
	% Orders/ Lines Processed Complete	0,366	0,177	93%	85%	100%	53,333	9,459
	% Orders/ Lines Received On-Time To Demand Requirement	0,120	0,058	92%	90%	100%	20,000	1,165
	% Orders/ Lines Received with Correct Shipping Documents	0,203	0,098	95%	90%	100%	50,000	4,914
	% Orders/ Lines Received Defect Free	0,251	0,122	99%	95%	100%	80,000	9,734
<b>Reliability Score</b>								26,418
Responsiveness	Identify, Prioritize, and Aggregate Product Requirements Cycle Time	0,329	0,064	2	7	1	83,333	5,309
	Identify, Assess, and Aggregate Supply Chain Resources Cycle Time	0,036	0,007	2	5	1	75,000	0,528
	Balance Product Resources with Product Requirements Cycle Time	0,218	0,042	2	4	1	66,667	2,820
	Establish Sourcing Plans Cycle Time	0,324	0,063	1	5	1	100,000	6,286

Atribut Kinerja	Metrik	LW	GW	Si	Smin	Smax	SNORM	Global Score (SNORM x GW)
	Schedule Product Deliveries Cycle Time	0,093	0,018	65	150	30	70,833	1,275
	Verify Product Cycle Time	0,098	0,019	30	60	30	100,000	1,902
	Transfer Product Cycle Time	0,070	0,013	20	60	15	88,889	1,200
<b>Responsiveness Score</b>								19,321
Sourcing Cost	Cost to Plan Source	1,000	0,165	Rp500.000.000	Rp600.000.000	Rp400.000.000	50,000	8,269
<b>Sourcing Cost Score</b>								8,269
Asset Management	Inventory Days of Supply	1,000	0,156	2	7	1	83,333	13,039
<b>Asset Management Score</b>								13,039
<b>Total</b>								67,047

#### 4.4. Stage of Implementation and Analysis

The halal monitoring system created for the company is explained in the use case and as in the picture below, the monitoring system designed consists of two actors or actors in the implementation, namely the Admin and the procurement of raw materials for brownies as well as distribution. This section can see the system dashboard to see the supply chain performance.



Fig. 3. Use Case Diagram Monitoring System

After the analysis of the weighting of company activities and also weighting the selected metrics so that priority vectort is obtained and then get the value of the company from the procurement section and also distribution then a system is created to help top management in decision making later, this system is a system Halal monitoring in the procurement and distribution section at this stage will be displayed visually from company data so that it can display the performance of the company.



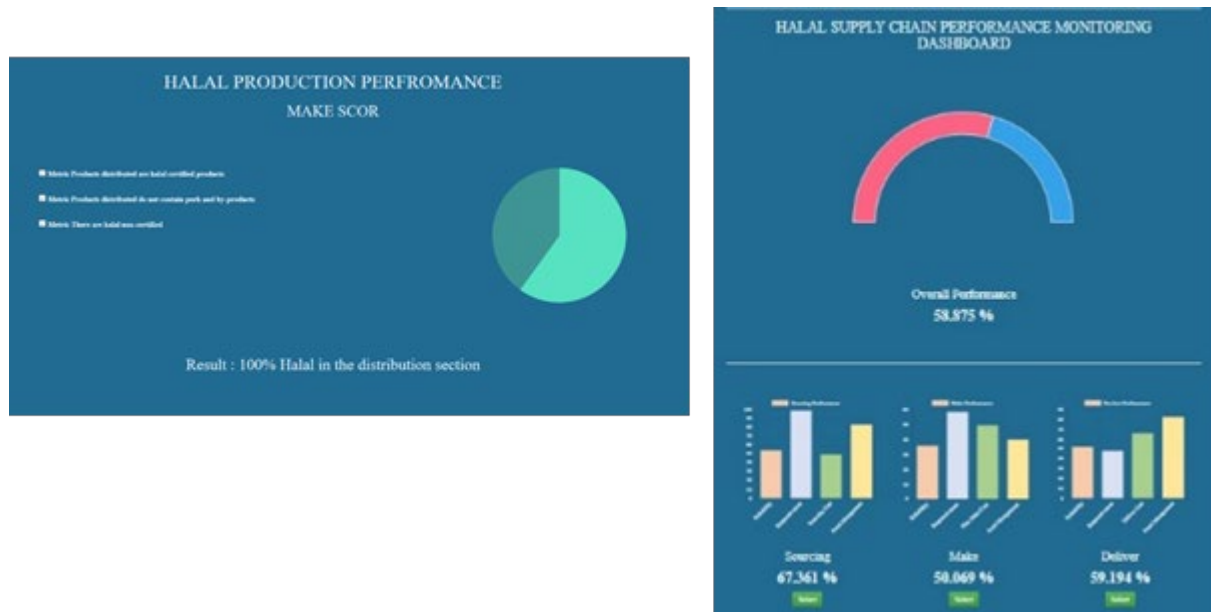


Figure 4 Halal Monitoring System Dashboard

## 5. CONCLUSION

Monitoring systems for procurement and distribution are also made by producing company performance output as the performance of the company and can see halal performance in the procurement and distribution sectors. The design of the food industry halal supply chain performance monitoring system in the procurement and distribution section using the SCOR model and LPPOM MUI standard provisions with the AHP method produces 37 metrics, including 23 metrics that are in line with the company's business process performance, 5 halal metrics in the procurement section in accordance with LPPOM provisions MUI and 3 halal metrics in the distribution section in accordance with the provisions of LPPOM MUI. For conventional metrics each has an assessment weight obtained from weighting using the AHP method. The performance attribute that has the highest weight is Reliability and the AHP weight is 0.484. Normalization is carried out at the analysis stage to give an assessment of each conventional metric in order to have the same value, namely in the scale range 0-100% by taking into account the best achievement (Smax) and worst achievement (Smin). There is no weighting for halal metrics because in each halal metric in the procurement and distribution section the same value is 0% if it is not met and 100%.

The design of the supply chain halal performance monitoring system in the Brownies Vannisa Bandung company besides being able to display the performance of the procurement department and also distribution in this monitoring system, there are also production and packaging parts so that they are able to see the performance and packaging. So that in the procurement and distribution section can be integrated with the production and packaging parts because in the company's process the product flow is the procurement of production and distribution. The monitoring system in the production and packaging section is also able to show halal performance to the company in the relevant section.

The monitoring system designed in this study was the result of designing a supply chain halal performance monitoring system in the procurement and distribution of brownies in the Vannisa

Brownies Bandung, a monitoring system designed to be applied in a web-based application interface cluster. So that all the processes that have been designed can display the performance metrics of the procurement and distribution section in the form of graphs that describe the data displayed.

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