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# Halal Criteria in Supply Chain Operations Reference (SCOR) for Performance Measurement: A case Study

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**Abstract.** Halal SCM is developed to meet the demands of Muslim consumers who want to make sure that what is consumed has a halal guarantee. Halal is not only from material but the whole process involved in production. One part of the halal SCM model is performance measurement. SCM performance measurements with important Islamic value indicators are considered to achieve a balance in halal SCM.

This study is the implementation of company performance measurement with the involvement of halal indicator. The object of this research is at a food processing company. This research was conducted to answer the question how is the performance of the company measured using SCOR method approach with the halal indicators? SCOR is used because it is a good model as reference because SCOR can map every process in the supply chain. A total of 18 KPIs were identified which 14 of them were modified containing Islamic values. Some of these halal indicators are: halal certification, provision of halal raw materials, the accuracy of payment, satisfaction of consumer orders, and handling complain.

Weighting is done at every level of SCOR metric using Analytical Hierarchy Process (AHP). Structured questionnaires and scheduled interviews are used to collect the important data. The measurement results show that the company's performance is at "good" level with Score 77%. Even so, there are 4 KPIs where the achievement is still low, that is halal certification, sale price determination, inclusion period and customer complain rate. This is recorded by the company as an input to improve their performance in order to compete in halal food business.

## 1. Introduction

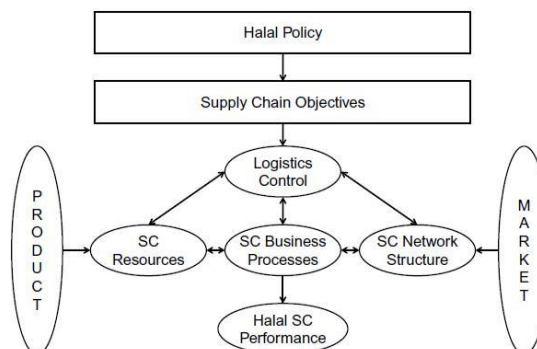
Supply Chain Management (SCM) is a process to integrate, coordinate, and control the movement of raw materials into finished products from suppliers to deliver to consumers [1]. In other definitions, SCM can also be interpreted as setting material, money, people, and information in and across the supply chain to maximize customer satisfaction and to gain an edge over competitors. In the 1950s and 1960s, most manufacturers focused on mass production to minimize production costs per unit of product as an operating strategy. In the 1970s, Material Requirement Planning (MRP) was developed because the company was aware of the impact of both raw materials inventory and Work in Process



WIP. The global competition of the 1980s forced industrial organizations to compete to sell cheap but high quality products with high design flexibility [2]. The evolution of SCM continued into the 1990s, organizations were required to manage the company's resources by incorporating strategic suppliers and logistics functions. In this era many manufacturers and distributors embraced the SCM concept to improve the efficiency and effectiveness of the entire supply chain (Jain et al 2010). Since the 1990s until now the discussion of supply chain has grown very wide. Researchers have developed the concept of supply chain from various perspectives and issues including economics [3], [4], [5], service [6], [7], [8], and performance [9], [10], [11].

Halal Supply Chain Management is a new perspective that began to grow in the 2000s. This is motivated by the desire of many companies in meeting the demands of consumers of the Muslim community who want to ensure that what is consumed is guaranteed halal not only from the status of the material but the whole process involved in the production of the product [12]. Not many researchers have focused on this perspective, the existing research is more likely to be oriented towards tourist objects and processed products. Tieman, et.al (2012) has presented a Halal SCM model

[13]. This model introduces a new framework for optimizing the design of halal SCM. He proposed halal model of SCM is as follows:



**Figure 1.** Model Halal SCM Tieman, et.al (2012)

This framework was introduced in 2012. During that time, there have been many studies that discuss Halal SCM from various perspective based on the framework. Tieman himself developed the framework by formulating the concept of halal purchasing in 2013 [14]. From that model we can see that one part of halal SCM is performance measurement. Performance measurement is important to know whether the company is running well in accordance with the standards. Modifying the existing SCM performance measurement models such as Balance Score Card, PRISM, IMPS, SCOR and so on by involving important Islamic value indicators is considered to realize the halal balance of SCM.

## 2. Research Question

Question to be solved in this research is how is performance of the company if measured using SCOR method approach by involving the halal indicator. SCOR is used because it is a good model as reference with many reasons: (1) It is able to map business performance along the supply chain part, ("Plan", "Source", "Make", "Deliver", and "Return"), (2) Each business process has their own Key

Performance Indicators, and (3) there are best practices to be implemented to measure the performance [15]. This research is limited only in measurement of company performance using SCOR metrics.

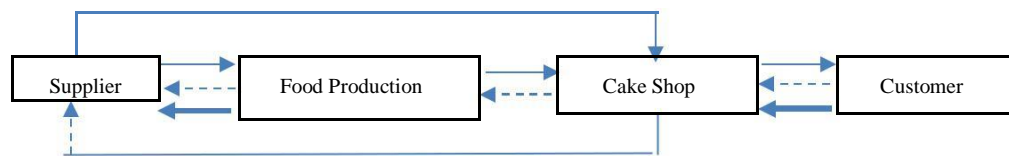
### 3. Method

#### 3.1. Research Object

This study was conducted in one food industry that produces various types of bread, cake, and tart. It is located in Yogyakarta, Indonesia.

#### 3.2. Supply Chain Activity

Supply chain flow in the company can be described by this following picture:



**Figure 2.** Supply Chain Activity in Research Object

The solid line indicates a product flow and the bold line means financial flow while the dashed line indicates the flow of information between chains.

#### 3.3. Metrics SCOR

Performance measurement is started with hierarchy based on the basic function of the supply chain: plan, source, deliver, make, and return, with the main attributes of reliability, responsiveness, cost, and asset. The hierarchy is derived into several performance indicators called Key Performance Indicators (KPI). This KPI is used to measure performance. In this research, there are 18 KPI which has been mapped based on the type of process level. All KPI used to measure the performance of the company's supply chain is presented in the following table:

**Table 1.** Key Performance Indicators

Process (Level 1)	Attribute (Level 2)	Key Performance Indicator (Level 3)	Description
Plan	Reliability	Suitability of Tag Price	Comparison between price tag and price on receipt
	Responsiveness	Halal Certification Label	Clarity Halal Label on Product
	Cost	Pricing	Margin determination
	Asset	Cash to cash cycle time	Inventory days of supply + average days of account receivable - average days of account payable
Source	Reliability	Halal Raw Material	Number of Raw Material with Halal Label
		Lead time	Time to order until material received
	Responsiveness	Conformity of raw materials	Percentage material from supplier fit with order
		Accuracy of payment to suppliers	Accuracy of payment to supplier as due date

Process (Level 1)	Attribute (Level 2)	Key Performance Indicator (Level 3)	Description
Make	Asset	Accuracy of employee salary payments	Accuracy payroll
		Inventory days of supply	Average of Inventory
	Reliability	Order Compliance	Percentage of order fit with demands
	Responsiveness	Expired date Labelling	Customer satisfaction of Expired Label on Product
		Price Labeling	Customer Satisfaction of Price Label on Product
	Asset	Equipment Life Time	Time period from Purchase to out of order
Deliver	Reliability	Customer Compliance	Order Percentage of correct product delivery (type and number)
	Responsiveness	Delivery Accuracy	Percentage of correct delivery time
Return	Reliability	Complain rate	Number of complain
	Responsiveness	Time to product replacement	Time to replace the wrong item

#### 4. Result and Discussion

To measure supply chain performance, we need to weight the level of importance between the aspects used. Weighting is calculated using Analytical Hierarchy Process method. AHP is a decision support developed by Thomas L. Saaty [16]. This method is used because it accommodates the need to compare weight of each criteria without alternatives. This weighting level is done at levels 1 and 2. Steps using AHP follows these procedure:

a. Identified the hierarchy of the problem.

The resolved problem is decomposed into its elements: criteria, sub criteria and alternatives, then it is compiled into a hierarchical. In this research we did the pairwise only for criteria and sub criteria. So the structure oh hierarchy such as this following figure:

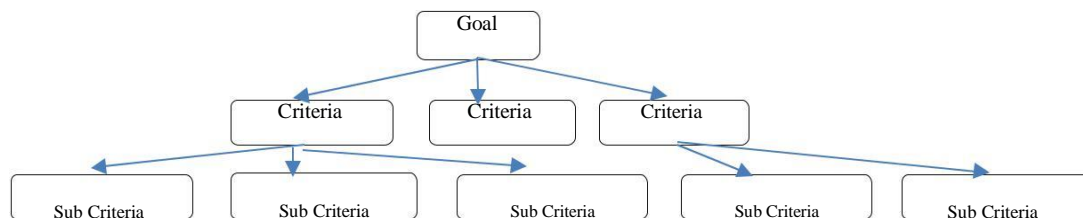


Fig 3. AHP Hierarchy Structure

b. Determine pairwise comparisons between criteria.

Criteria and alternatives are assessed through pairwise comparisons. According to Saaty [15], for every case, a scale of 1 to 9 is the best scale to expressing opinions.

c. Calculate the consistency ratio

Consistency index (CI) in AHP is measure with formula  $CI = (\lambda - n)/(n - 1)$  where  $\lambda_{max}$  is the largest eigenvalue of A and A is n dimensional of AHP pairwise matrix. The degree of C.I measure by the formula  $CR = CI/RI$ . Where RI is a random index consistency from Saaty table. Consistency ratio  $\leq 0.1$  means consistency of expert judgement.

d. Calculate priority weight

This step is processed to calculate the weight of every criteria and sub criteria

Weighted level 1 is designed to compare Plan, Source, Make, Deliver, and Return matrices. The owner of the company filled the pairwise questionnaire as an expert. Based on the calculation using AHP, with the value of inconsistency ratio of 0.09. We get weight on each criteria. That is: Plan: 0.21, Source: 0.44, Make: 0,19, Deliver: 0,10, and Return: 0,07. With the same way, for level 2 the following results are obtained:

**Table 2.** Consistency Ration and Weight of Sub Criteria

Level	CR	Result
<b>Plan</b>	0.07	Reliability: 0,25, Responsiveness: 0,50, Cost: 0,15 and Asset: 0,10
<b>Source</b>	0.04	Reliability: 0,26, Responsiveness: 0,63, Asset: 0,11
<b>Make</b>	0.06	Reliability: 0,64, Responsiveness: 0,28, Asset: 0,07
<b>Deliver</b>	0	Reliability: 0,80, Responsiveness: 0,20
<b>Return</b>	0	Reliability: 0,75, Responsiveness: 0,25

#### 4.1. Plan

##### 4.1.1. Suitability of Tag Price

This KPI is used to find out how the reliability of the company in providing price information to consumers. That the price on the receipt is same with the price on the shelf. Based on the results of satisfaction survey to 44 respondents about satisfaction to price labeling with receipt obtained 28 people fill the score 3 and 16 people fill the score 4 so that the value of this KPI is:

$$\% \text{ conformity} = \frac{\text{Total Score}}{\text{Highest Scale} \times \text{number of respondent}} \times 100\% = \frac{148}{4 \times 44} 100\% = 84.09\%$$

##### 4.1.2. Halal Certification

The Responsiveness aspect is used to see how companies are responsible for providing halal products to consumers. Performance of this indicator can be seen by calculate the number of food product with Halal label from MUI. Until now the company does not have halal certification for products sold for this KPI is 0%.

##### 4.1.3. Pricing

Cost is used to know the comparison between production cost and selling price. Halal performance of this indicator is calculated from how the company set the margin. The average margin applied for a product is 20-40%. The value for this KPI is calculated as follows:

$$\text{Score} = \frac{30-20}{40-20} \times 100 = 50\%$$

##### 4.1.4. Cash to Cash Cycle Time

Assets are used to find out how a company can convert raw material inventory into value for money and retain assets such as machinery, raw materials, and products of the company. This indicator is measured by Cash to cash cycle time. The shorter the time it takes, the better for the supply chain. From data collection it was known that *Inventory days of supply* is 7 days, *average days of account receivable* is 9 days and *average days of account payable* is 14 days. So, the score of this KPI is calculated as follow:

$$\text{Cash to cash cycle time} = \text{Inventory days of supply} + \text{average days of account receivable} - \text{average days of account payable} = 7 + 9 - 14 = 2$$

The score for *cash to cash cycle time* is 100%, because 2 days can be classified into the fast category.

#### 4.2. Source

Source is assessed to know how the process of procurement of raw materials and the level of performance of suppliers. It is also seen how company's performance in the accuracy of payments to suppliers and employees. The scope of the Source includes the following three attributes:

##### 4.2.1. Halal Row Material

It is used to know how the supplier reliability in providing halal material. This indicator is measured by calculating percentage of raw material from supplier with halal label from MUI. From the record known that there are 31 of 43 raw materials that have halal label MUI so that percentage can be calculated with this following formula:

$$\% \text{ Halal Material} = \frac{\text{Material with LPPOM MUI label}}{\text{Total raw material}} \times 100\% = \frac{31}{43} \times 100\% = 72.09\%$$

##### 4.2.2. Lead time

Besides the provision of halal raw materials, reliability is also measured by lead time. Lead time is calculated from the company order to the supplier until the supplier sends the raw materials. Based on company data, the absolute value of raw material lead time is 2 days. This is because suppliers located outside the region take time to deliver raw materials. Thus, it is assumed the best value of 1 day and the worst value of 7 days. So, the normalization values are as follows:

$$\text{Score} = \frac{(2-1)}{(7-1)} \times 100\% = 83.33\%$$

##### 4.2.3. Conformity of raw materials

This KPI measures supplier conformity in meeting the demand of raw materials of the company. From the data for 2 months found that there are 11 out of 15 requests that successfully met by supplier, so the value of this KPI is:

$$\% \text{Material Conformity} = \frac{\text{Number of material fit to order}}{\text{Total o}} \times 100\% = \frac{11}{15} \times 100\% = 73.33\%$$

##### 4.2.4. Accurate payment to supplier

From 32 transactions purchased by the company to suppliers, only 28 transactions were successfully paid on time. So the value of this KPI is equal to 87.25%.

#### 4.2.5. *Appropriate in paying salaries*

Based on interviews on 12 employees, it is found that the salary payments are always paid on time by the company, so the score of this KPI is 100%.

#### 4.2.6 *Inventory days of supply*

Supply chain performance is good when rotating assets quickly. Thus, the shorter the Inventory days of supply, the better the asset performance of a SCM. Based on the data, the absolute value of inventory days of supply is 7 days, this is because the company can still store raw materials. Thus, the scale of the best value matrix is 7 and the worst value is 4 days. So normalization is as follows:

$$\text{Score} = \frac{(7-4)}{(7-4)} \times 100\% = 100\%$$

### 4.3. Make

#### 4.3.1 *Order Compliance*

This KPI is used to determine the reliability of companies handling orders that vary in accordance with the demand. This is measured from the level of suitability of orders both on the type and number of orders. The score for this KPI is 100% because the company can meet all customer order with correct specification.

#### 4.3.2. *Expired date Label*

This print is very important to be included in the product to be sold. Expiration date is the limit of producer or company guarantee to the security of the product it produces. The inclusion must be clear and easy to be read by the consumer. From the questionnaires to 44 customers, it is found that 14 people gave a value of 2, 26 people gave a value of 3, and only 4 people who answered 4 for the satisfaction of the expiry date. So the value of this KPI is:

$$\% \text{ Expired Date} = \frac{\text{Total Score}}{\text{Highest Scale} \times \text{Number of Respondent}} \times 100\% = \frac{176}{4 \times 44} \times 100\% = 69.31$$

#### 4.3.3. *Price Labelling*

Price inclusion is a matter of concern to the company, so that consumers who will buy the product can know the price of the product, and consumers are not confused in choosing the product. From the questionnaires to 44 customers, it is obtained that 1 person gives a value of 2, 13 people gave a value of 3, and only 30 people who answered 4 for price labeling satisfaction. So the score of this KPI is:

$$\text{Price Labeling} = \frac{161}{4 \times 44} \times 100\% = 91.47\%$$

#### 4.3.4.. *Equipment Life Time*

The asset aspect is represented by the life time life of production machine. Production machine is the equipment used to process raw materials into finished products. Based on the observation, the maximum value of the life time of production equipment is 2.5 years. Thus, it is assumed the best value is 3 years and the worst value is 1 year. So normalization is as follows:

$$\text{Score} = \frac{(2,5-1)}{(3-1)} \times 100\% = 75\%$$



#### 4.4 Deliver

##### 4.4.1 Customer Order Compliance

This KPI is used to know how the company's reliability in handling customer order both in number and type of demand. From the ordering data, it is known that all customer demand both in type and number of products can always be met with precisely so that the value of this KPI is 100%.

##### 4.4.2 Delivery Accuracy

KPI is used to find out how the company can respond to consumers by sending orders on time. From the data of 32 customer orders only 25 orders were successfully sent on time so for this KPI the score is:

$$\% \text{Delivery Accuracy} = \frac{\text{On time delivery Order}}{\text{Number of Order}} \times 100\% = \frac{25}{32} \times 100\% = 78.12\%$$

#### 4.5. Return

##### 4.5.1 Complain Rate

KPI is used to find out how the company in handling complaints from consumers. Based on the data, the highest value for customer complaints is 3. This is because there are 3 complaints from consumers to the company. Thus, assuming the best value is 0, its worst value is assumed to be 6. So its normalization is as follows:

$$\text{Score} = \frac{(3-0)}{(6-0)} \times 100\% = 50\%$$

##### 4.5.2. Time to product replacement

This KPI is used to find out the time required for the company to replace the product in the complaint by the customer. Based on the data, the longest time to replace the non-conforming product is 1 day. This is because the company returns the product on the day the customer complains. Thus, it is assumed the best value of 1 day and its worst value is 3 days. So normalization is as follows:

$$\text{Score} = \frac{(1-3)}{(1-3)} \times 100\% = 100\%$$

From all analysis above, it can be calculated the performance score of the company as shown in the following table:

**Table 3.** KPI Calculation

Table 5: AHP Calculation							
KPI	Attribute	Proses Inti	KPI Score	Weight Level 3	Weight Level 2	Weight level 1	Score
Suitability of Tag Price	Reliability	Plan	84.09	1	0.25	0.21	4.41
Halal Certification Label	Responsiveness		0	1	0.5	0.21	0.00
Pricing	Cost		50	1	0.15	0.21	1.58
Cash to cash cyle time	Asset	Source	100	1	0.1	0.21	2.10
Halal Row Material	Reliability		72.09	0.5	0.26	0.44	4.12
Lead time	Responsiveness		83.33	0.5	0.26	0.44	4.77
Conformity of raw materials			73.33	0.33	0.63	0.44	6.71
Accuracy of payment to			87.25	0.33	0.63	0.44	7.98

suppliers							
Accuracy of employee salary payments			100	0.33	0.63	0.44	9.15
Inventory days of supply	Asset		100	1	0.11	0.44	4.84
Order Compliance	Reliability		100	1	0.64	0.19	12.16
Expired date Label	Responsiveness	Make	69.31	0.5	0.28	0.19	1.84
Price Labelling			91.47	0.5	0.28	0.19	2.43
Equipment Life Time	Asset		75	1	0.07	0.19	1.00
Customer Order Compliance	Reliability	Deliver	100	1	0.8	0.1	8.00
Delivery Accuracy	Responsiveness		78.12	1	0.2	0.1	1.56
Complain rate	Reliability	Return	50	1	0.75	0.07	2.63
Time to product replacement	Responsiveness		100	1	0.25	0.07	1.75
Total Score			77.03				

Based on the performance monitoring system, 77% indicates that the company's performance is at a good level. However, there are four KPIs with low achievement, they are halal certification, price labelling, expired date labelling and customer complain rate. Like most other food industry, halal certification is not a company priority. This is usually due to the cost of management and convoluted procedures, whereas the assurance that the food consumed have halal certification has become special attention for consumers. Companies should start to concentrate on that. Increased consumer confidence will impact on increased sales. Registering products to obtain halal licenses gradually can be a solution to this. Determination of the selling price, although included into the low KPI, but this is not a problem from the perspective of Islam. The selling price determination depends essentially on the policies of each company by looking at market demand and supply. In Islam the company is free to determine the percentage of profit. In other words, it is not restricted to take profit but is not allowed to take the maximum profit and harm the buyer. There are two principles that must be known in Islam is the principle of likes and do not harm others. The KPI scores for the expired date labels in the company are still low because physically the labels used are not clearly listed. It only manually written the date and item code, making it difficult for customers to know the expiration date of their products. Therefore, this indicator needs to be improved by designing the new expired date label by stating the exact date, month, and year so the customer can read the expiry period clearly. The last is KPI complain. Improvements need to be made to reduce number of complaints. This can be done by checking the product before it is purchased by the consumer, anticipating delays in delivery such as accurately estimating delivery times, and always maintaining the quality of its products and services.

## 5. Conclusion

From the description above can be concluded that the modification of SCOR metric can be done by implementing Islamic values in the determination of KPI. This modification model can be validated

through application in real cases. In the future, it is needed to validate the Islamic indicators used as KPIs. It opens up opportunities for further research.

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