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DESIGNING OF HALAL SUPPLY CHAIN MONITORING SYSTEM ON FOOD PRODUCTION: AN INTEGRATION BETWEEN HALAL METRICS OF INDONESIAN ULEMA COUNCIL (MUI) AND SUPPLY CHAIN OPERATIONS REFERENCE (SCOR)

Renata Ganiswara[1*], Ari Yanuar Ridwan[2], Budi Santosa[3]

[1] Telkom University
[2] Telkom University
[3] Telkom University

Abstract. The halal products are dominated the demand of Moslem customers, for example in Indonesia. This preference leads to the development of halal-food industry in Indonesia to produce the well-compete products among other countries that also put concern on halal-food. The urge to achieve the goal is supported by the government through the released of halal products regulations. The Halal Product Guarantee (JPH) is defined as the halal standards that obliged to be fulfilled by halal-industry executants. On the whole, the demand of halal certification to Indonesian Council of Religious Scholars (MUI) has raised up in recent years. This also goes along with the micro industries (UKM) that widely started to involve in obeying the government's halal regulations. However, according to the company, there is still an absence in the reference clarity that boldly state whether a manufacturing mechanism can be labelled as halal. Therefore, the designed monitoring system is urgently needed to measure the company's supply chain. This research used AHP method to weight the conventional metric that obtained from the SCOR model. The conventional metric is integrated from the halal metric that fit to the standards from Indonesian Council of Religious Scholars (MUI). The weighting process is done after the conventional metric is approved by the company which in accordance to its business process, while the halal metric is not weighed. Furthermore, the weighed metric is normalized to obtain a uniform metric value. Later, the measurement of manufacturing works are translated into a monitoring system with a web based display. The working mechanism measurement system designed by Vannisa Brownies Bandung resulted to 15 conventional metrics that distributed into 4 work attributes which are Reliability, Responsiveness, Cost, dan Asset Management. Meanwhile, the 5 halal metrics are divided into halal production and halal packaging metrics. The monitoring system can reveal the whole result of company's performance, historical data, and the achievements done by the company in production and packaging aspects.

Keywords: AHP, certificate halal, monitoring system, MUI, supply chain, performance measurement system

* Corresponding Author, Email: renataganiswara@student.telkomuniversity.ac.id

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1. INTRODUCTION

The halal industry has begun to be developed by Indonesia, along with the large demand for halal products by consumers. According to the Ministry of Industry, Indonesia has a great opportunity to develop a halal industrial zone because currently demand for halal products has begun to increase, especially for food and beverages and cosmetics (Waharini & Purwantini, 2018). 2019 5 th International Conference on Rural Development and Entrepreneurship ICORE 2019 Along with the development of the halal industry for local products, halal is related to the guarantee of halal indicated by the existence of halal certification from Indonesian Ulema Council (MUI). With halal certification, in addition to good food security, the provision of halal guarantees will increase the competitiveness of local food products for imported products that do not receive halal certification. Halal certification activities aim to provide certainty of halal status in food products, drugs - cosmetics, etc., so that consumers feel safe in consuming these products. For Muslim consumers, safe food is not only free from the dangers of physical, chemical, or microbiology, but also there is a very essential element, which is safe from the dangers of goods that are forbidden and doubtful. Food safety hazards, including the dangerous category "which is unclean and / or doubtful" the effect that is caused are the implications for the peace of the soul of Muslim consumers and once polluted, the ineffectiveness of the financial and consumer confidence in the product is inevitable. The importance of the legal aspects of drug and food labelling is related to the increasing demands of consumers, especially regarding aspects of halal, and the existence of legal protection by the government . Vannisa Brownies is one of the Small and Medium Industries (IKM) which has ensured that the halal procedures established by LPPOM MUI are well implemented in their production processes. Nevertheless the company does not have a reference that can be used as a reference in determining value results of supervision in the halal production process. Thus, a monitoring system design is needed that can provide the results of supervision related to halal supply chain integration, so that each production process can be measured and controlled. Because the production process carried out by the company still has the chance of contamination of products with unclean or unclean ingredients that have an impact on the production section which cannot be categorized as halal (Ridwan & Syafrijal, 2017). In the operation of production and product packaging, performance measurements that can measure the processes of production and packaging activities need to be done, with the existence of a performance measurement system, the capability of a process in the company to obtain the value of the results in accordance with planned and measurable. In addition, the performance measurement system can track and examine the failure of a company's effectiveness and efficiency process which can be additional information in decision making. In its development, one method that can be used to design a performance measurement system is design using the Analytical Hierarchy Process (AHP) method based on the model of the Supply Chain Operations Reference (SCOR) (APICS Supply Chain Council, 2014). AHP method which is a hierarchical multi-criteria decision making method can be used to prioritize metrics in the supply chain performance measurement system (Ilhamizar,

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Ridwan, Deni, & Math, 2018). In addition to the supply chain performance measurement system, a performance monitoring system capable of monitoring performance (metrics) of each process of procurement of rice is also needed so that the company can quickly and accurately make decisions because there is a system that is able to provide a better understanding of the company's condition (Ridwan et al, 2015).

2. LITERATURE REVIEW

2.1. Supply Chain Performance Measurement

Supply Chain Performance Measurement System is a set of metrics used to measure the effectiveness and efficiency of processes and supply chain relationships that can cover many functions / departments and many companies so as to allow supply chain order to occur. The purpose of the performance measurement is to support the application of supply chain strategies and fulfilment of supply chain objectives. In its application, to reduce the complexity of SCPMS and considering that many companies only monitor a portion of the entire supply chain, measuring supply chain performance is divided into two components, namely internal SCPMS and external SCPMS. Thus, measuring supply chain performance can be focused on one part of the supply chain itself (Novar, Ridwan, & Santosa, 2017). Measurement of supply chain performance is important to implement, with the existence of a performance measurement system, the capability of a process in a company to get the results that are planned as planned can be measured and known. In addition, the performance measurement system can track and examine the failure of a process in effectiveness and efficiency which can be additional information in decision making.

2.2 Halal Assurance System (HAS)

Halal Assurance System (HAS) is an arranged, applied, and maintained system by halal certified company to maintain sustainability of halal production process according to the rule of LPPOM MUI. HAS has to describe function of each division in company with person in charge and its distribution. For some function such as training, socialization, SOP, work instruction, form etc, its implementation may be integrated with other quality system(s) (Hosen, 2007).

2.3. Supply Chain Operation Reference (SCOR)

The Supply Chain Operations Reference (SCOR) model is a reference model developed by the Supply Chain Council (SCC). The model was developed based on business needs to meet customer

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demand. SCOR models can be done to analyze supply chains in many process levels. This model focuses on the top three levels which can be applied to various industries. This model does not provide provisions on how a business should be carried out. In addition, this model focuses on the process in the company, in other words, this model focuses on the activities carried out, not to the person or part that does it. The SCOR model is a model that combines Process, Performance, Best Practice, and People in a framework arranged in key managerial processes such as Plan, Source, Make, Deliver, and Return. As a reference model, the SCOR model aims to provide an overview of how the processes work and how the process works (APICS Supply Chain Council, 2014).

2.4.Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a measurement method through pairwise comparisons and depends on expert judgment in generating priority scales. This AHP method is a method that is able to measure and unify various factors from a complex selection process in a hierarchical form. In addition, according to this hierarchical method can be used to prioritize metrics in the supply chain measurement system. This method can also be used to quantify factors that can be assessed qualitatively. AHP method can be applied to a group, but there are things that need to be considered in applying AHP in a group, namely to determine the aggregate assessment of each individual in the group. To determine the aggregate assessment of more than one individual can use the Geometric Mean. In this case the final assessment is obtained from each individual without changing the judgment of each individual (Saaty, 2008).

2.5. Monitoring System

Monitoring system is used to monitor each process and performance in graphical form. The monitoring system is able to briefly describe the condition of the company that allows the company to make decisions quickly and accurately. This supervisory activity needs to be carried out by a company for every operation activity in its daily life to be able to get the expected performance (Waaly, Ridwan, & Akbar, 2018).

3. METHODOLOGY

Systematic problem solving is a description and explanation of the steps that will be carried out in this study. The systematic problem solving in this study is divided into four parts, namely (1) Data Collection Stage, (2) Data Processing Stage, (3) Interface Stage, (4) Conclusion Stage. Figure 2 below is a systematic problem solving in this study.

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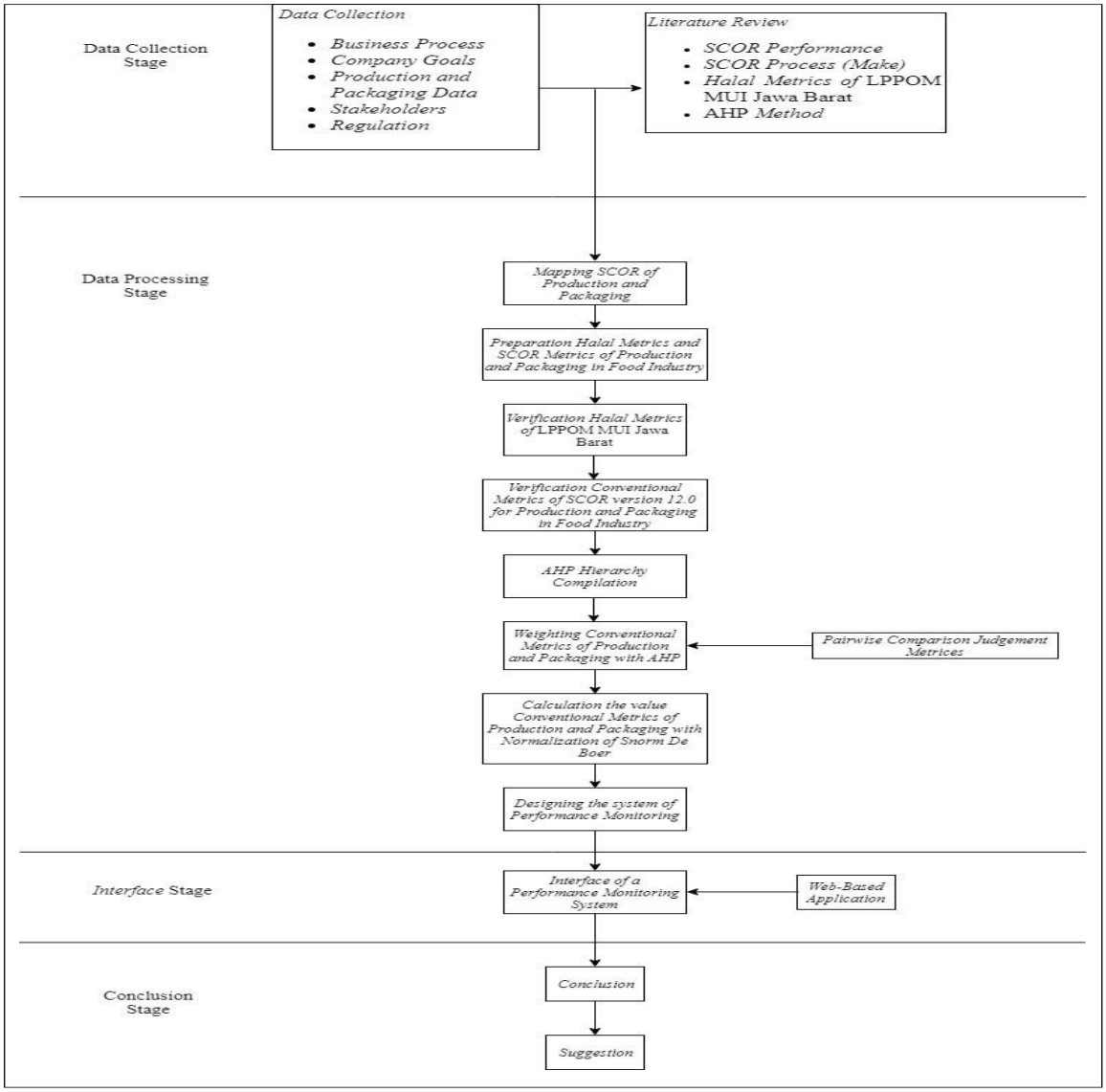

Figure 1. Systematic Problem Solving

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At the data collection stage, everything related to the implementation of this research was collected. Data collection of company business processes, company objectives, identification of stakeholders, and data on product procurement is done by means of semi-structured interviews and direct observation to Vannisa Brownies. In addition, at this stage a literature study on Conventional Metrics and Halal Metrics is also conducted which refers to SCOR and the Indonesian Ulema Council (MUI).

At the data processing stage, things that have been obtained at the data collection stage begin processing to solve the problem. The first step is to map business processes and company objectives into the SCOR model. The results of the mapping can be used in the preparation of metrics. The proposed metrics that have been obtained are then verified by Vannisa Brownies, specifically the production and packaging department. The verified metrics are then hierarchically arranged for later use when weighting AHP.

Weighting is done by the AHP method, to get paired comparisons can be done using the Pair-wise Comparison Judgment Method (PCJM) method. Comparison using this method can be done for more than one respondent, for respondents with more than one number, it is necessary to calculate Geomean. The results of the work process using the AHP method will produce two types of weights, namely LW (local weight) and GW (global weight). In carrying out the weighting, a consistency test is also carried out to check whether the weighting is valid or not obtained from this AHP method. The metrics that have these weights are normalized by using the Snorm DeBoer technique. Normalization aims to create values in each metric that has a variety of units and the range of values is uniform, that is, to a value scale of 0-100%. In this study there are two types of scores to be used, namely local scores and global scores. A local score is a value that describes the performance of a metric in a performance attribute, while a global score is a score that describes the performance of a metric in overall product production and packaging performance. Local scores can be obtained by multiplying the local weight of a metric with the results of normalization, while global scores can be obtained by multiplying global weights with the results of normalization. By obtaining local scores and global scores, the performance measurement system has been designed. The next stage is designing a design proposal for a performance monitoring system to be created. The proposed design is made by forming a use case diagram and a use case narrative related to the monitoring system. The use case diagram and use case narrative are formed by analyzing the needs of the monitoring system and also the expected workings of the system.

In the implementation stage, the performance measurement system that has been obtained at the data processing stage will be translated into the application form by referring to the use case diagram and the use case narrative that has been prepared so that the monitoring system for the

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production and packaging process performance can be designed. As for this stage the application was developed into a web-based application. At this stage the display of the application interface is also designed so that the application can function in accordance with the purpose of the application, which is to be a monitoring system for the production and packaging process of the product.

After the system design has been completed, then the next application is tested. Testing of the application is done by entering production and packaging data into the application and trying to display the data that has been entered. Then, at the conclusion stage, the results of the research that have been conducted are concluded according to the purpose of this study. In addition, at this stage the advice taken from the results of the research conclusions is given.

4. DATA PROCESSING

4.1 Data Collection

Data collection is done by semi-structured interviews and direct observation. From this data collection stakeholders can be identified. In addition, the company's business processes are also mapped in the form of cross - functional diagrams. As well as company objectives were identified and mapped into the SCOR model shown in Table 1. In addition, literature studies related to

Conventional Metrics and Halal Metrics that refer to SCOR and the Indonesian Ulema Council (MUI) were carried out at this stage. Similarly, related regulations are collected at this stage.

Table 1. Performance Attributes Based on Company Procurement Objectives

Purpose	Performance Attributes
Fulfill the company's production targets per day, both in terms of quality and quantity	*Reliability* (RL)
Fulfill customer requests within a predetermined period of time	*Responsiveness* (RS)

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Fulfill production targets by maintaining the same raw material and cost-efficient	*Cost* (CO)
Utilizing company assets efficiently	*Asset Management* (AM)

4.1.1 Compilation of Halal Metric

The preparation of halal metrics was obtained by observing LPPOM MUI West Java. Observations were made by conducting interviews with the LPPOM MUI section on halal certification. The purpose of this observation is to obtain halal metrics which are used as parameters in the halal monitoring system in the production and packaging section. The halal metrics obtained are shown in Table 2 and Table 3.

Table 2. Halal Metrics of Production Process

Atribut Kinerja	Metrik	Deskripsi	Karakteristik
Reliability (RL)	(LPPOM-MUI) *Products are certified halal*	Produk sudah memiliki sertifikasi halal	Terpenuhi
	(LPPOM-MUI) *Chance of the contamination unclean ingredients*	Peluang terkontaminasiny a dengan bahan haram/najis	Terpenuhi
	(LPPOM-MUI) *Raw Materials are certified halal*	Bahan baku sudah tersertifikasi halal	Terpenuhi
	(LPPOM-MUI) *Expiration date validation check*	Pemeriksaan tanggal kadaluarsa	Terpenuhi

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Table 3. Halal Metrics of Packaging Process

Atribut Kinerja	Metrik	Deskripsi	Karakteristik
Reliability (RL)	*The products on display have owned halal certification*	Produk yang dipajang untuk dijual sudah memiliki sertifikat halal	Terpenuhi

4.1.2 Conventional Metric Preparation and Verification

After identifying each performance and activity attribute of the SCOR model that is used, the metrics that need to be used can be followed based on the suggested metrics provided by the SCOR model, but before the metrics are used, it is necessary to verify the metrics first by Vannisa Brownies to ensure that the metrics in accordance with the goals and needs of the company.

4.1.3 Preparation of Conventional Hierarchy and Weighting Metrics

After a list of verified metrics is obtained, the AHP hierarchy that describes the hierarchical model of the metric needs to be compiled. The design of the hierarchical metric model can be seen in Figure 4. After the model is compiled, the weighting process using AHP is done to give weight to each metric used. The results of weighting metrics can be seen in Table 4.

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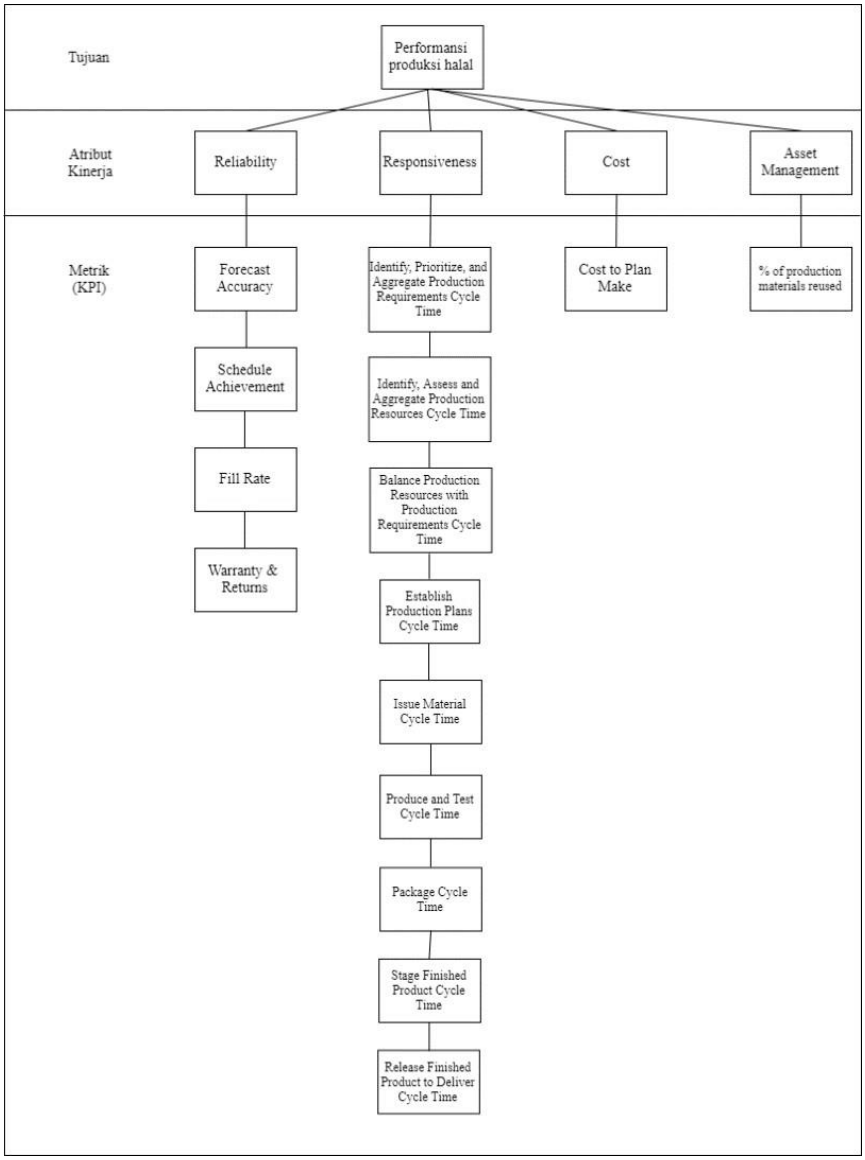

Figure 2. Conventional Metrics Hierarchy

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4.1.4 Calculation Value of Conventional Metrics with Normalization of Snorm DeBoer

By compiling metrics that already have assessment weights, the assessment process can already be done. However, considering each metric has a different unit, it is necessary to do a normalization process so that the value of each metric has the same scale, in this case a scale of 0-100%. By doing this calculation, the supply chain performance measurement system has been designed. The calculation example for the last transaction can be seen in Table 5.

In conducting the assessment, the normalization that can be used is the normalization of Snorm DeBoer. The normalization formulation can be seen in equation 1 below.

$$Snorm = \frac{(S_i - S_{min})}{(S_{max} - S_{min})} \times 100\%$$

Information:
Si = Actual indicator value achieved.
Smin = Value of achieving minimum performance from a performance indicator dataset.
Smax = Value of achieving maximum performance from a performance indicator dataset.

Table 5. Results of Calculation of Every Metric Score

Metrik	Aktivitas Proses Bisnis	LW	GW	Si	Smin	Smax	SNORM	Local Score (SNORM x LW)	Global Score (SNORM x GW)	UoM
RL.3.37 *Forecast Accuracy*	Peramalan pengadaan bahan baku	0,226	0,044	85%	75%	100%	40,000	9,027	1,750	%
RL.3.49 *Schedule Achievement*	Memeriksa waktu produksi	0,274	0,053	78%	56%	100%	50,495	13,850	2,686	%
RL.3.36 *Fill Rate*	Memeriksa pemenuhan kapasitas produksi	0,438	0,085	600%	500%	1000%	20,000	8,762	1,699	%
RL.3.55 *Warranty and Return*	Produk dijadikan sample	0,062	0,012	0,02%	0,07%	0%	71,429	4,425	0,858	%
Reliability Score								**36,064**	**6,993**	
RS.3.42 *Identify, Prioritize, and Aggregate Production Requirements Cycle Time*	Penjadwalan kebutuhan produksi Identifikasi kebutuhan produksi	0,098	0,048	180	210	120	33	3	2	Minutes
RS.3.36 *Identify, Assess and Aggregate Production Resources Cycle Time*	Identifikasi dan penjadwalan sumber daya produksi	0,142	0,069	180	210	120	33	5	2	Minutes
RS.3.13 *Balance Production Resources with Production Requirements Cycle Time*	Penyesuaian sumber daya dan kebutuhan produksi	0,164	0,079	360	420	240	33	5	3	Minutes
RS.3.28 *Establish Production Plans Cycle Time*	Menetapkan perencanaan produksi	0,216	0,105	60	120	60	100	22	10,467	Minutes

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RS.3.49 *Issue Material Cycle Time*	Menerima bahan baku untuk proses produksi	0,103	0,050	90	120	60	50	5,133	2,486	Minutes
RS.3.101 *Produce and Test Cycle Time*	Melakukan inspeksi	0,064	0,031	60	30	60	100	6,438	3,117	Minutes
RS.3.142 *Package Cycle Time*	Melakukan *packaging*	0,038	0,018	90	120	60	50	1,885	0,913	Minutes
RS.3.128 *Stage Finished Product Cycle Time*	Proses *cooling* setelah dikemas	0,107	0,052	90	120	60	50	5,362	2,596	Minutes
RS.3.114 *Release Finished Product to Deliver Cycle Time*	Proses penyimpanan *finish goods* untuk didistribusikan	0,067	0,032	50	20	60	75	5,027	2,434	Minutes
Responsiveness Score								**58,954**	**28,548**	
CO.3.3 Cost to Plan Make	Memeriksa pemenuhan kapasitas produksi dan biaya yang dikeluarkan	1	0,165	Rp 500.000.000,00	Rp600.000.000,00	Rp 400.000.000,00	50	50	8,269	Rp
Plan Make Cost Score								**50**	**8,269**	
AM.3.5 % of production materials reused	Pemeriksaan jumlah bahan baku	1	0,156	25%	35%	10%	40	40	6,259	%
Asset Management Score								**40**	**6,259**	
							Total Score		**50,069**	

5. INTERFACE

At this stage, the performance measurement system that has been designed is translated into a monitoring system. The design of the monitoring system is designed in the form of web-based. Use case diagrams are used as a guide in forming a performance monitoring system. Use case diagram

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can be seen in Figure 5. The use case diagram explains the interaction that must be met between the monitoring system and the user.

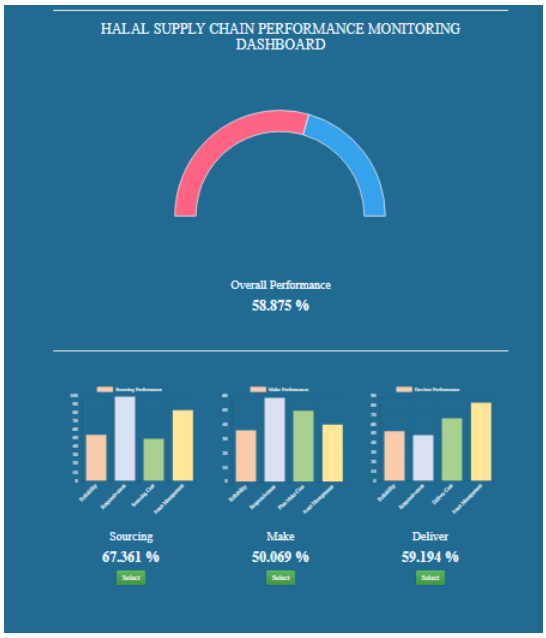

Figure 3. Conventional Metrics Hierarchy

6. CONCLUSION

The design of a halal supply chain performance measurement system in the production and packaging section based on the integration of the SCOR model that complies with MUI standards using the AHP method produces a halal supply chain performance measurement system with 15 conventional metrics, namely metrics derived from the SCOR model while for metrics Halal is a metric that is obtained based on the MUI standard of five metrics which is divided into two parts, namely four halal metrics in the production section and one halal metric in the packaging section. Weighting metrics are not weighted because halal metrics must be fulfilled (100%) because they

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can be said to be halal if the entire metric has been fulfilled without being missed. For conventional metrics fifteen metrics are distributed into four performance attributes, namely four metrics distributed into Reliability attributes, nine metrics distributed into the Responsiveness attribute, one metric distributed into each attribute Cost and Asset Management. Each performance attribute and each metric have an assessment weight obtained from AHP weighting. The most important performance attribute that has the highest weight is the Responsiveness performance attribute with the AHP weight of 0.484. Normalization is done to give the same level of unit leveling that is on a scale of 0-100%, by calculating some values as limits, such as Si or the actual achievement value, Smin the worst achievement value, and Smax the best achievement value. In this case, each process in the measurement system that has been processed is displayed in the form of a web interface. The display in the monitoring system is designed to display the performance of halal metrics for the production and packaging of brownies in the form of graphic visualization.

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