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Application of the Supply Chain Operation Reference (SCOR) Method: Batik SMEs in Indonesia

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***ABSTRACT* - Supply Chain Operations Reference (SCOR) is a process reference model that can be used in measuring supply chain management performance. Based on the literature, only a few studies have proposed methods for measuring and predicting supply chain management performance in manufacturing, particularly in Batik industries in Indonesia. The purpose of this paper is to find out the results of performance measurement of supply chain management with the Supply Chain Operation Reference (SCOR) approach in Batik Small Medium Enterprise (SMEs) in Indonesia. The steps taken are making variables in SCOR such as; Plan, Source, Make, Delivery, and Return. From these variables are derived into dimensions, namely, Reliability, Responsiveness, Flexibility, Cost, and Assets. Benchmarks in measurements by identifying Key Performance Indicator (KPI) of 24 items. The next step is to normalize Snorm De Boer which functions to equalize the KPI value. Analytical Hierarchy Process (AHP) is carried out next to assist in determining the priority of existing criteria. The measurement results of supply chain management performance produces the highest performance value in the Make process of 30.74, Source 24.68, Plan 22.78, Deliver 10.88, the lowest value is Return of 6.33. Meanwhile, the company's SCM performance value is 95.42. This value indicates that the company's SCM performance achievement is classified as Excellent.**

Keywords- *Key Performance Indicator, Analytical Hierarchy Process, Supply Chain Management, and Supply Chain Operation Reference*

1. Introduction

Increasingly intense industrial competition forces companies to integrate their activities in producing goods or services ranging from suppliers, companies (internal), distribution companies, and customers. The activities of these stakeholders must synergize with each other, so companies should do management engineering by applying the concept of Supply Chain Management (SCM). The rapid rate of change in the global market has forced manufacturing companies to be more responsive to customers by changing higher needs and requirements for value-added products and services [1]. The concept of supply chain management (Supply Chain Management or SCM) must be able to integrate the management of various existing management functions to build an inter-organizational relationship in order to create an integrated system and support each other. The key to effective SCM is to make suppliers as "partners" in the company's strategy to meet the ever-changing market [2].

Batik SMEs in Indonesia has implemented SCM, the company is a company that produces Indonesia typical batik from making batik, stamp and printing or screen printing. Batik SMEs in Indonesia its business requires a variety of suppliers of batik raw material supplies (mori), equipment for batik, and medicines to make batik, which is almost entirely separated by the supply chain system. Whether or not a successful SCM is implemented needs to be measured by the SCM's performance.

Tools used to measure the success of SCM performance, one of which is the Model Supply Chain Operations Reference (SCOR). The SCOR model is one of the supply chain operations models, a model based on a process that integrates three main elements, namely Business Process Reengineering (BPR), Benchmarking and Best Practice Analysis (BPA) into the supply chain cross-functional framework [3].

The SCOR model is a method that can represent the existing situation in Batik SMEs in Indonesia because SCOR can evaluate supply chains through the concept of explaining the core processes of plan, source, make, deliver, and return that are configured with the company's actual business [4]. From the SCOR measurement, problems can be formulated such as; What is the structure of the supply chain of Batik SMEs in Indonesia? How do you measure performance against supply chain management in Batik SMEs in Indonesia? How to determine the solution of supply chain problems after measuring supply chain management performance in Batik SMEs in Indonesia?2. Literature Review (Theory Basis)

2.1. Supply Chain Management (SCM)

Supply chain is a network of companies that jointly work to create and deliver a product to the end user. These companies usually include suppliers, factories, distributors, stores, or retailers, as well as supporting companies such as logistics service companies [5].Supply chain management (SCM) can also be interpreted the integration of vision, culture, process and strategy to organize an optimal flow of high-quality, value-for-money raw materials, or components from reliable and innovative suppliers and ultimately providing customers with high quality products they designed and manufactured at competitive prices [1]. If the supply chain is a physical network, ie companies that are involved in supplying raw materials, auxiliary materials and other inputs, producing goods, or sending to end

users, then Supply Chain Management (SCM) is the method, tool, or approach to management [1].

The main activities of SCM are: designing new products (product development), obtaining raw materials (procurement, purchasing, or supply), planning production and inventory (planning and control), planning production (production), making delivery / distribution (distribution) , and managing product / goods development (return). The purpose of supply chain management is to increase efficiency and minimize costs for the entire system. The system in question is all activities and components ranging from transportation to distribution and raw goods to finished goods.

2.2. Supply Chain Operation Reference (SCOR)

Performance measurement is needed as an approach in order to optimize the supply chain network and to determine the extent of optimization of marketing activities carried out by supply chain members [6], [7]. The Supply Chain Operations Reference (SCOR) Model is a well-*established* process reference model which is supported by the APICS Supply Chain Council [8]. SCOR is endorsed by the Supply Chain Council as the cross-industry de facto standard diagnostic tool for supply chain management. SCOR enables users to address, improve, and communicate supply chain practise within and between all interested parties in an extended entreprise [9]. Many models can be used to measure supply chain performance. One way to measure supply chain performance is to use the SCOR (Supply Chain Operation Reference) method. SCOR is used to provide standard business process definitions, terminology, metrics in supply chain management. It and enables companies to benchmark themselves against others and influence future application development to improve business processes in five distinct functional areas: plan, source, make, delivery, and return [10], [11], [12], [5]. Based on the APICS Supply Chain Council, the SCOR model can be illustrated in Figure 1.

There are several models for measuring SCM performance. This article aims to discuss the research gap so far by proposing a SCOR method for evaluating SCM performance.

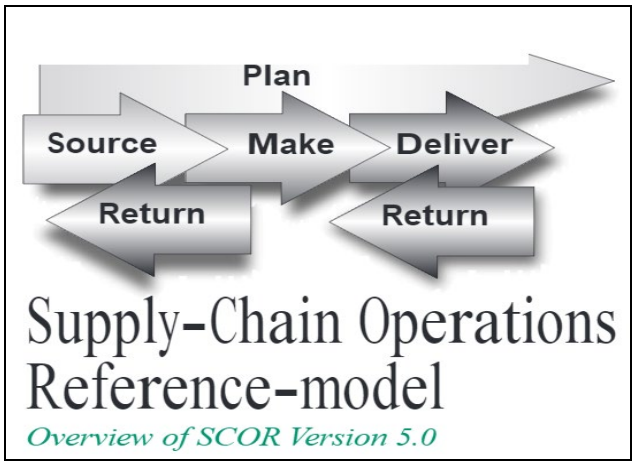

Figure 1. SCOR Model

2.2.1 Key Performance Indicator (KPI)

Measurement of supply chain performance needs some performance indicators called Key Performance Indicators (KPIs)[13]. Key Performance Indicator (KPI) is a benchmark used by companies to measure performance and compare performance with one another, so that by carrying out KPI measurements, it is known that the company's performance capability has reached the target set and is expected to be able to provide evaluations and improve performance [14].

2.2.2 Normalization Process

There are various ways of measuring performance that has ever been carried out by a company. The level of performance fulfillment is defined by the normalization of the performance indicators [15]. Each indicator has a different weight with a different size scale as well. Therefore, the parameter equalization process is needed namely by means of the normalization. Here normalization plays an important role in achieving the final value of performance measurement. The normalization process is carried out with the Snorm De Boer normalization formula, which are:

$$Snorm\ (score) = \frac{(Si - Smin)}{(Smax - Smin)} x\ 100 \ldots\ldots\ldots\ldots\ldots 1$$

Where :

Si = The value of the actual indicator that was achieved

Smin = The value of the worst performance achievement of a performance indicator

Smax = The value of the best performance achievement of performance indicators.

In measuring the steps, it is as follows; each indicator weight is converted into a specified value interval of 0 to 100. Zero (0) is interpreted as the worst value and one hundred (100) is interpreted as the best value. This is so that the parameters of each indicator have the same unit size, after that we get a result that can be analyzed. According to performance indicators are divided into 5 conditions, as can be seen in Table 1. this bellow [16].

Table 1. Key Performance Indicator Conditions

Performance Indicator Value	Performance Indicator Conditions
< 40	*Poor Performance*
40-50	*Marginal Performance*
50-70	*Average Performance*
70-90	*Good Performance*
> 90	*Exellent Performance*

The table above it is clear the value of each indicator of performance indicators, so that it is easy to just see the results of the indicator value of what the value is and immediately know the condition of the performance indicator.

2.2.3 Analytical Hierarchy Process (AHP)

AHP is a multi-criteria decision making (MCDM) method helping decision-maker facing a complex problem with multiple conflicting and subjective criteria (e.g.

location or investment selection, projects ranking, etc) [17]. Developed a strong and helpful tool for managing qualitative and quantitative multi-criteria elements involving in decision-making behavior. This model is called Analytical Hierarchy Process (AHP) and is based on a hierarchical structure [18].

Analytical Hierarchy Process is one of the most inclusive system is considered to make decisions with multiple criteria because this method gives to formulate the problem as a hierarchical and believe a mixture of quantitative and qua[19]litative criteria as well. The first step is to create a hierarchy of the problem. The second step is to give a nominal value to each level of the hierarchy and create a matrix of pairwise comparison judgment.

Since its introduction, AHP has been widely used, for example in banks [20] , operators evaluation [21], strategy selection [22], supplier selection [23], [24], [25]. Analytical Hierarchy Process (AHP) is used after the data is weighted against the hierarchy of Key Performance Indicators (KPI). After that, the KPI is weighted using the AHP to get the main priorities and criteria used as alternatives (Nurus Shubuhi Maulidiya, 2015).

3. RESEARCH METHOD

3.1. Batik SMEs in Indonesia.

Batik industry in Indonesia in general is a Small and Medium Enteprise (SMEs) which become the livelihood of some people. Before the monetary crisis in 1997 the industry This small and medium enterprises had experienced progress rapid. Some batik entrepreneurs had a chance experiencing a glory period. Especially in years 1980s batik is a formal dress must be worn at every state event or other official events. So that it can introduce and enhance the image of batik in international world at that time.

The batik industry in Indonesia is spread across several regions in Java later became the name of these types of batik like Pekalongan batik, Surakarta batik, batik Yogya, Lasem batik, Cirebon batik, batik Sragen. Every batik from the area have specific motive characteristics. Batik type there are three manufactured namely batik, batik stamp and batik printing. Industrial development batik in Indonesia is very much related to the development of batik that began since hundreds of years ago. SCM activities in the company are carried out by several related parties, namely owners and employees. Researchers conducted interviews with company owners regarding the SCM system and with employees related to the production process.

3.2. Determination of The Number of Samples

The population is the whole unit or individual within the scope of study. The population of interest is the study's target population that it intends to study. In research studies, it is often not appropriate or feasible to recruit the entire population of interest. Instead, investigators will recruit a sample from the population of interest to include in their study.If the population is less than 100 it would be better taken all, so that the research is population research [26]. The number of samples to be used in the weighting questionnaire are 100 respondent.

3.3. SCM Performance Analysis based on the SCOR approach

The steps that can be taken to measure SCM performance are as follows:

a. Identifying the matrix for each level
   The design of performance measurement is based on the SCOR model by identifying the level 1 matrix which is in the form of the SCM process in SCOR. These processes include plan (planning process), source (the process of procuring raw materials), make (production process), deliver (delivery process), and return (return process). Metric at level 2 is the dimension for measuring SCM performance. These processes include plan (planning process), source (the process of procuring raw materials), make (production process), deliver (delivery process), and return (return process). Metric at level 2 is the dimension for measuring SCM performance. These processes include plan (planning process), source (the process of procuring raw materials), make (production process), deliver (delivery process), and return (return process).
   Metric at level 2 is the dimension for measuring SCM performance. These processes include plan (planning process), source (the process of procuring raw materials), make (production process), deliver (delivery process), and return (return process). Metric at level 2 is the dimension for measuring SCM performance. These processes include plan (planning process), source (the process of procuring raw materials), make (production process), deliver (delivery process), and return (return process). Metric at level 2 is the dimension for measuring SCM performance. Dimensions used include Reliability, Responsiveness, Flexibility, Cost and Asset. At level 3 the authors identify t he indicators that influence each process and the SCM dimensions of the company. From these three levels, a hierarchy of SCM performance indicator selection is made in the company based on interviews and filling in an indicator questionnaire by the company owner. Information on each level can be shown in table 2.
b. Verification of Key Performance Indicator (KPI)
   Done to find out whether the SCM performance indicators that have been designed are correct and in accordance with company needs by checking which indicators have not been included or do not need to be included because of the possibility of similarities with other indicators.
c. Calculate the normalized value (score) for each metric using the Snorm De Boer normalization process. The value scale equation used is Snorm De Boer normalization. The weights of the indicators are converted into certain value conversions between 0 and 100. Normalization value calculation is obtained from the actual value compared to the expected maximum value. Each Key Performance Indicator

(questionnaire question) obtained actual data obtained then determined the expected maximum value. From this value we can know the weight of the KPI value.

d. Weighting with Analytical Hierarchy Process (AHP)
The stages of weighting the KPI by using the Analytical Hierarchy Process (AHP). Done to determine the level of importance of each level and KPI.

e. The total value of SCM performance
The calculation can be calculated by multiplying the normalization score value for each metric with the value of metric weights obtained from the weighting results using AHP.

f. Conclusions and Suggestions
The conclusion contains the results of the discussion of the analysis of the calculation of SCM performance in Batik SMEs in Indonesia classified as good or bad and which indicators have the lowest weight so that they need improvement. Suggestions are given as a follow up to the indicator.

Table 2. Matrix for each level in SCM Performance

Process Core (level 1)	Dimensi (level 2)	*Key Performance Indicator* (level 3)	*Si*	*Smax*	*Score*	*Monitoring*
Plan	*Reliability*	Meeting with customers (PR-1)	1	2	50	Average
		Time identifies employee performance (PR-2)	10 mont	20 mont	50	Average
	Responsiveness	Period of production scheduling (Pre-1)	15	25	60	Average
		Time period identifies new product specifications (PR-2)	1 mont	2 months	50	Average
	Asset	Cash to cash cycle time (PA)	1 months	2 months	50	Average
Source	*Reliability*	Raw material defects (SR-1)	1 months	1 months	100	Excellent
		Fulfillment of raw materials (SR-2)	1 months	2 months	50	Average
		Reliability in shipping (SR-3)	1 day	1 day	100	Excellent
	Responsiveness	Lead time of raw material (SRe)	1 months	1 months	100	Excellent
	Flexibility	Supplier availability (SF)	5	10	50	Average
	Cost	Order costs to suppliers (SC)	100 millon	100 millon	100	Excellent
	Asset	Daily supplies (SA)	4500 pieces	4500 pieces	100	Excellent
Make	*Reliability*	Error in packing (MR-1)	70 pieces	70 pieces	100	Excellent
		Number of defective products (MR-2)	200 pieces	200 pieces	100	Excellent
	Responsiveness	Product manufacturing time (MRe-1)	8 days	10 days	80	Good
		The responsiveness of producing varied consumer orders (MRe-2)	10 days	20 days	50	Average
	Flexibility	Flexibility in manufacturing products (MF)	2 days	4 days	50	Average
	Cost	Production cost (MC)	80 millon	1 millon	100	Excellent
	Asset	The type batik molding tool	5 months	10 months	50	Average
Deliver	*Reliability*	The level of fulfillment of finished product (DR-1)	1 weeks	3 weeks	25	Poor
		Out of rate of product (DR-2)	1 weeks	1 weeks	100	Excellent
	Responsiveness	Lead Time of finished products (DRe)	1 weeks	1 weeks	100	Excellent
Return	*Reliability*	The level of customer complaints (RR)	1 months	1 months	100	Excellent
	Responsiveness	Time to replace damaged products (RRe)	1 day	2 days	50	Average

Source: [27]

4. ANALYSIS

From the interview data collection and filling out the questionnaire by sources in the company, SCM will be measured by SCOR performance. Calculations are carried out starting from level 1 to level 4 with the following steps:

4.1. Measurement of SCM Performance with SCOR

4.1.1 Normalization Value Calculation

Each indicator has a different weight with a different size scale as well. Therefore, the parameter equalization process is needed, namely by means of the normalization. Here the normalization plays an important role in achieving the final value of performance measurement.

This normalization process is carried out with the Snorm De Boer normalization formula.

4.1.2 Weighting with AHP (Analytical Hierarchy Process)

From the Snorm de Boer normalization results obtained KPI scores. The next step is to provide weighting for each level from level 1, level 2 and level 3. The initial stage carried out in weighting with AHP is to make a pairwise comparison questionnaire (pairwise comparison) filled out by each respondent concerned. Data obtained from the results of the questionnaire, then performed calculations with the Analytical Hierarchy Process (AHP).

4.1.2 Calculation of the KPI final value

The calculation of the KPI final value aims to find the final value of the existing KPI in the process so that the dimension value is obtained. KPI score values are obtained from calculations with formula.1 (normalization of Snorm de Boer) and KPI weight values are obtained from calculations using AHP. Calculation results can be seen in table 3.

Table 3. Calculation of KPI Final Value

Variabel	Score	Weight	Variabel Total	Dimensi	Score	Weight	Dimention Total	KPI	Score	Weight	Total KPI
Plan	47.46	0.48	22.78	Reliability	47.00	0.61	28.67	PR-1	50	0.34	47.00
								PR-2	50	0.60	
				Responsiveness	72.6	0.20	14.52	PRe-1	60	0.56	72.60
								PRe-2	50	0.78	
				Asset	7.00	0.61	4.27	PA	50	0.14	7.00
Source	47.47	0.52	24.68	Reliability	76.50	0.17	13.01	SR-1	100	0.17	76.50
								SR-2	50	0.43	
								SR-3	100	0.38	
				Responsiveness	31.00	0.43	14.52	SRe	100	0.31	31.00
				Flexibility	12.50	0.56		SF	50	0.25	12.50
				Cost	29.00	0.27	4.27	SC	100	0.29	29.00
				Asset	18.00	0.35	14.52	SA	100	0.18	18.00
Make	47.29	0.65	30.74	Reliability	68.00	0.10	6.80	MR-1	100	0.25	68.00
								MR-2	100	0.43	
				Responsiveness	41.90	0.26	10.89	MRe-1	80	0.28	41.90
								MRe-2	50	0.39	
				Flexibility	14.00	0.43	6.02	MF	50	0.28	14.00
				Cost	65.00	0.29	18.85	MC	100	0.65	65.00
				Asset	11.00	0.43	4.73	MA	50	0.22	11.00
Deliver	17.28	0,63	10.88	Reliability	41.75	0.34	14.20	DR-1	25	0.27	41.75
								DR-2	100	0.35	
				Responsiveness	28.00	0.11	3.08	DRe	100	0.28	28.00
Return	10.56	0.60	6.34	Reliability	17.00	0.37	6.29	RR	100	0.17	17.00
				Responsiveness	7.00	0.61	4.27	RRe	50	0.14	7.00

Source: Primari data processed, 2019

4.1.2 Calculation of final dimension value

This calculation aims to find the final value of the dimensions that exist in the process. The score is obtained from the calculation of the total KPI score in each dimension and the weight is obtained from the calculation by AHP. This calculation

4.1.3 Calculation of Total Value of SCM Performance

This calculation aims to find the final value of SCM performance. The score is obtained from the calculation of the total dimension score in each process and the weight is obtained from the calculation with AHP. This calculation can be seen in

Tabel 4. Final Total Value of SCM

Variabel	Score	Weight	Total Value
Plan	47.46	0.48	22.78
Source	47.47	0.52	24.68
Make	47.29	0.65	30.74
Deliver	17.28	0.63	10.88
Return	10.56	0.60	6.88
Total Performance			95.42

5. Discussion

Each indicator has different weights and different units of measure, so the normalization process is carried out to equalize the parameters of each indicator. The normalization process is carried out using the Snorm de Boer formula at each level from level 1 to level 3 (performance metrics).

From the normalization score, weighting of importance level will be carried out at each level 1 (variable), level 2 (dimension) and level 3 (indicator). Weighting is done by using AHP from data from the spread of pairwise comparison model questionnaires (pairwise comparison).

The calculation results note that the highest weight for the process at level one is the make process 0.65. Then the second priority is the delivery process of 0.63. The next

priority is the process of return, source, and plan. The make attribute has the highest value so it has a big effect. Because it has a large influence, these attributes need to be mai ntained. While other attributes whose priorities are below it is necessary to have a proposed strategy to increase the value of these attributes.

6. CONCLUSIONS

From the results of the discussion in the previous chapters a conclusion can be drawn as follows (1). The The measurement results of supply chain management performance produce the highest performance value in the Make 30.74 process. Therefore the company needs to maintain the make variable down to the dimensions and key performance indicators. (2). The result of data processing shows that the company's SCM performance value is 95.42. This value indicates that the company's SCM performance achievement is classified as Excellent. This is due to the fact that the average in Batik SMEs in Indonesia has been established for a very long time and has experience in implementing supply chain management..(3). Weighting with Analytical Hierarchy Process (AHP). This weighting shows that the biggest weight for pairwise comparisons between processes is a Make of 0.65. In addition to weighting between processes, it is necessary to weight the dimensions and KPIs of each process because the results of these weights are reused to obtain SCM performance values. (4). The difference from the measurement results of supply chain management performance produces the lowest performance value is Return of 6.74. This requires companies to try to improve the return variable by improving the key performance indicators that exist in the return variable

While the suggestions that can be submitted are as follows; (1). Management should pay attention to the presentation of the weight of performance values under Make, such as Deliver, Return, Source and Plan. This is intended to increase the value of the variable weights. If the repair has been done it turns out that it cannot increase the value of the weight, the variable means it does not match, so it needs to be removed. (2). Improvements in the value of performance on Deliver variables, Return variables, Source variables and Plan variables are carried out by paying attention to each of the dimensions of the variables and indicators of each dimension or a list of questions asked to respondents. If it turns out that the questionnaire or questionnaire cannot increase the presentation of the weight value, then it needs to be eliminated, because it is likely the list of questions is not appropriate. Calculation of total value of SCM performance can be see at tabel 4.

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