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Supply Chain Performance Measurement Using Supply Chain Operation Reference (SCOR) 12.0 Model : A Case Study in A Leather SME in Indonesia

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Abstract. The leather industry is one of the basic ingredients in fashion and textile/apparel that has good development potential. This can be used to take advantage of the opportunity for the leather industry which is still importing 60-70%. Supply chain measurement is needed to determine production capability and moreover to benchmark for its company, government, and academics. Measurement of supply chain performance is carried out using the newest-SCOR 12.0 method with a performance and processes approach. The study was conducted on XYZ SME and limited to bag product which is one of the largest leather industries in the Bantul area, Special Region of Yogyakarta. The value of supply chain performance is 54.29, which based on performance indicators. This value included in the average category. It can be inferred as the benchmark for the leather industry around areas to improve supply chain performance.

1. Introduction

The leather industry is one of the basic ingredients in fashion and textile/apparel that has good development potential. Indonesia still imports the fashion and textile apparel between 60-70%, which is also an opportunity for the local leather industry and challenges to fulfill the market potential. Then, the leather industry has challenges to keep growing and developing because of the scale of production and the high-rate of import. Other challenges are customer behavior by consuming branded, international products, and also the production level of local leather industries.

Supply Chain defined as entire activities, materials or processes to make products from raw material (by supplier's supplier) to the end product (by customer). Another definition from supply chain means from the upstream to the downstream. The supply chain also means entire processes from the purchasing, source, production, and distribution with the material and information flow [1]. Based on the definition and implementation, supply chain management are important activities for a company that can increase the value of production level in order to deliver products to the customer by managing and controlling entire the activities.

Supply chain can be measured by many methods. One of the most famous and general method is Supply Chain Operation Reference (SCOR) Model. SCOR Model measurement established by The Association for Operations Management (APICS) which deliver SCOR to measure by business process



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and performance. Both process and performance itself have their own metrics to defined by, such as process is defined from plan, source, make, deliver, return, and enable activities and performance by company reliability, responsiveness, agility, cost, and asset management level [2].

The purpose of this research is to measure the performance of supply chain from one of the Small-Medium Enterprise (SME) XYZ as the leather manufacture industry in Bantul, Special Region of Yogyakarta Province by using newest-SCOR Model; SCOR 12.0 version. The measurement is done by the SME process and performance including metrics. The XYZ SME is one of the largest leather industry in Bantul. Hopefully, the research not only measures the process and performance for its own company but also benchmarking with other companies, so the government can concern with the development and its impact to economics.

It has been never done before to measure leather industry supply chain and by using SCOR in previous research. The previous research with the SME in Indonesia is the research agro-industry [3], and with the mushrooms products [4]. Although, it is an opportunity to measure the supply chain management for an SME to help the production level, manage the material and information flow [5]. There are literature review about how to implement SCOR in manufactur industry [6]. Last, it is an opportunity to use the newest version of SCOR as the SCOR 12.0 version by APICS especially how it implemented in SME to gain information and development of that method for future research. By this research, the purpose is also to define the supply chain score or level in Leather Industry SME. So, the government, the owner, and the academics can give benefits to local and country economics, develop strategies, increase production level, and take the export opportunity.

2. Literature Review

2.1. Supply Chain Management

Supply Chain is related to all activities, tools and materials, or steps needed by a product from raw materials to finished products or semi-finished products to costumers, known as upstream to downstream. Related to the procurement of raw materials, suppliers, the distribution of raw materials, purchasing, production, production targets, to distribution is a discussion of the supply chain. Therefore, supply chain management is a critical activity that needs to be carried out by a company. Supply chain management is an activity that includes managing and managing the entire process of the flow of goods and business processes of a company from upstream to downstream [7]. It can be measured based on the merging of such a qualitative and quantitative approach to an *expert* or a specialist in a particular field [8].

Supply Chain Management has a role to determine the quality of performance owned by the company, and also has other roles in reducing cost, effectiveness and efficiency of resources. Specifically, it understands the quality of business process performance that applies in a related company [1].

2.2. Supply Chain Performance Measurement

Supply chain in a company can be measured by a tool or method. Activities in measuring supply chain performance is called supply chain performance measurement or assessment. Quite number of practitioners and academics are also focused on developing supply chain performance measurement theories. This is due to the complexity of the process and material contained in the supply chain, starting from procurement to distribution to customers [9]. There are several things that are expected in a supply chain measurement [10], including: (1)Identify goals or companies key performance indicator; (2) Identify the customer or target market needs; (3) Help an organization or company to understand the business process, and analyze the elements within; (4) Finding critical points in business process carried, to identify waste, bottlenecks, and the other; (5) Improve production level or business process based on data , and (6) Find out the impact of the improvement.

2.3. SCOR Model

There are several methods or approaches that can be used to measure the performance of a supply chain in an industry. SCOR, which is an acronym for the Supply Chain Operations Reference, is a model or method of approach begun in 1996 which was initiated by the Supply Chain Council called APICS (The Association for Operations Management). This SCOR Model is a framework that is used to help measure the performance of supply chains in an industry, help in terms of management, business processes, and how a company performs with market demand. SCOR Model also changes in the variable and attributes it had before, this is due to adjustments to the industrial reality or conditions. The latest SCOR Model is SCOR 12.0 which has several changes compared to the previous version [2]. The SCOR Model includes the business processes of a company that consists of (Fig.1):

- Plan, which is the main activity in a supply chain. Regarding production planning, material needed, finance, scheduling, distribution plan, along with planning to provide value to the customer.
- Source, related to the activity of procuring raw materials and materials needed for business processes. Therefore it will be very related to suppliers.
- Make, is the core stage in providing added value processes to products that will be offered to customers. This stage includes the production process, work-in-process, until becomes semi-finished or finished goods.
- Deliver, related to the stages of distributing both products and services to customers. This stage also plays an important role in supply chain performance measurement due to its relationship with the customer which is the core or main point of the product made or offered.
- Return, is the process of returning the product, either in a condition rejected by the customer or in an effort to improve the product. This condition occurs in a certain moment, for example mismatch with market demand or with other conditions.
- Enable, is a process related to the establishment, maintenance and monitoring of information, relationships, resources, assets, business rules, suitability, and contracts needed to carry out from processes in supply chain. This process related to High-Level Management, Finance, HR, IT, Facility Management, Product Management, Sales Processes and Support.

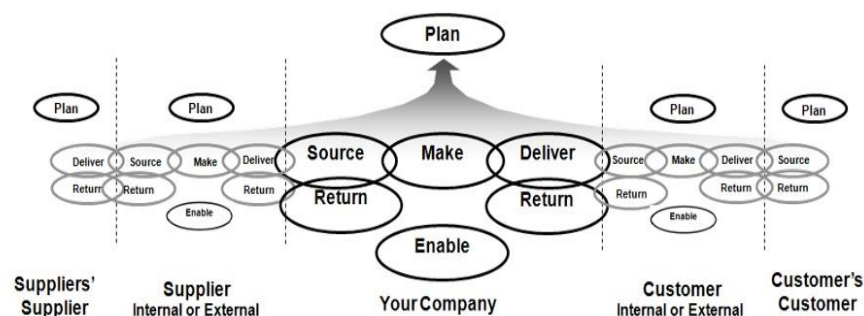


Figure 1. SCOR Model Framework

Source : The Association for Operations Management (APICS)

2.4. SCOR Model 12.0

In measuring supply chain performance using the SCOR 12.0 model has metrics that are used as the basis for performance assessment. These metrics are arranged at several levels which have an impact on the assessment of the supply chain performance. The metric level in question are level 1 (one), level 2 (two), and level 3 (three). Level 1 or also commonly called the Key Performance Indicator (KPI), describes the key activities contained in the company's business processes. Level 2 is the assessment criteria used for level 1 metrics. Level 2 can be used to diagnose performance from the performance found at level 1. Level 3 includes metrics that are also used to diagnose the performance of metrics at level 2.

Based on the levels above, the SCOR model evaluates based on several attributes, including reliability, responsiveness, agility, assets, and costs. Reliability is the ability to complete or work to implement in accordance with expectations and criteria that have been previously set. Responsiveness is the speed in carrying out work that is and distributes in accordance with the customer's expectations. Agility is the ability to adapt to changes in the external environment that occur, such as fluctuations in demand that occur in the market. Assets or commonly called assets management efficiency which is the ability to manage assets or manage expenses with income. Costs are components of costs owned by the company, such as material costs, transportation, and others.

Normalized Score (Snorm). Having measurement attributes in both performance and process, the data obtained in the study has unit variants that can be normalized. Data that has been obtained based on each attribute measurement according to each metric used is normalized using the Snorm de Boer method. This is done so that all data with various units owned can be used for further calculations. The use of the Snorm de Boer method can be done using the following formula [11]:

$$Snorm = \frac{(Si - Smin)}{(Smax - Smin)} \times 100 \quad (1)$$

Snorm = Normalized Score

Si = Valued Actual Indicator

Smin = Lowest Valued Actual Indicator

Smax = Highest Valued Actual Indicator

2.5. Key Performance Indicator

Key Performance Indicators is indicators that determine the value or quality of an industrial, business, and performance process of an organization. KPI values can be obtained through various discussions, some complete, qualitative and quantitative, subjective information that provides an assessment based on individual experience or expertise. In this study the calculations carried out using SCOR 12.0 will be adjusted to the standard performance indicators, based on the following table:

Table 1. Performance Indicator

System Indicator	Performance Indicator
<40	Poor
40-50	Marginal
50-70	Average
70-90	Good
>90	Excellent

3. Methodology

K-Chart is designed to understand the framework in implementing supply chain performance measurement for the research. It is the stage of the method used in the study. Started based on the type of product industry as an object of research, namely the textile and fashion apparel industry. Then, the production system used is MTO (Make To Order). Classification based on economic measurements, to the method used along with the approach. The method used is SCOR (Supply Chain Operation Reference) with an approach to Process and Performance. Supply Chain Assessment using SCOR Model in this study was carried out with several steps as follows :

- Design a business scope diagram, as an initial step for mapping business processes run by a company
- Mapping business processes based on processes, starting from the plan to enable
- Design a business thread diagram
- Set up of metrics along with performance measurement attributes
- Performance calculation of supply chain performance
- Weighting attributes and process

Figure K-Chart is the stage of the method used in the study. Started based on the type of product industry as an object of research, namely the textile and fashion apparel industry. Then, the production system used is MTO (Make To Order). Classification based on economic measurements, to the method used along with the approach. The method used is SCOR (Supply Chain Operation Reference) with an approach to Process and Performance.

4. Result and Discussion

4.1. Business Scope Diagram

The Business Scope Diagram describes in general the business processes that take place at the XYZ SME. The intended business process starts from the procurement of raw materials from suppliers, the production process, to arrive at customers who are divided into private and retail, as distributors (Fig.2).

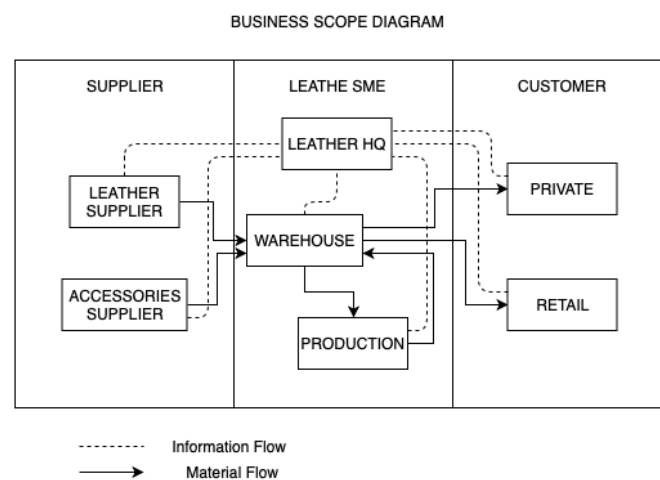


Figure 2. Business Scope Diagram for XYZ SME

4.2. Business Thread Diagram

Business Thread Diagram is a development of business scope diagrams and every stage of business processes, starting from plan, source, make, deliver, return, and enable. Figure 3 shows the following activities from second level :

1. P2 (Plan to Source), P3 (Plan to Make), P4 (Plan to Deliver), and P5 (Plan to Return)
2. S2 (Source Make-to-Order)
3. M2 (Make-to-Order)
4. D2 (Deliver Make-to-Order)
5. SR1 (Source Return) and DR1 (Product Return)

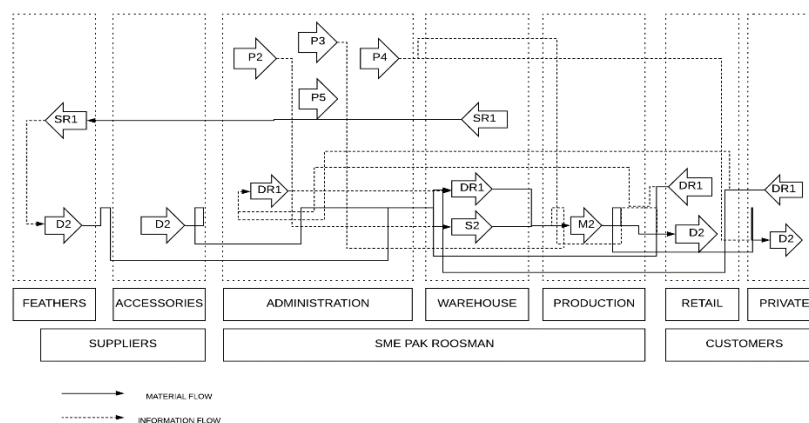


Figure 3. Business Thread Diagram for XYZ SME

Table 2. Metrics for Supply Chain Assessment

NO	SCOR LEVEL 1	METRICS	ATRIBUTES
1	PLAN	RL. 3.37 Forecast Accuracy	Reliability
2		RS. 3.29 Establish Sourcing Plans Cycle Time	Responsiveness
3		RS. 3.28 Establish Production Plans Cycle Time	
4		RS.3.27 Establish Delivery Plans Cycle Time	
5		RS. 3.26 Establish and Communicate Return Plans Cycle Time	
6	SOURCE	RL. 3.27 % Schedules Changed within Supplier's Lead Time	Reliability
7		RL. 3.18 % Orders/ Lines Processed Complete	
8		RL. 3.20 % Order/ Lines Received On-Time to Demand Requirements	
9		RL 3.23 % Orders/ Lines Received with Correct Shipping Documents	
10		RL. 3.19 % Orders/ Lines Received Defect Free	
11		RL. 3.21 % Orders/ Lines received with correct content	
12		RL. 3.24 % Orders/ Lines received damage free	
13		RL. 3.25 % Product Transferred On-Time to Demand Requirement	Responsiveness
14		RL. 3.26 % Product Transferred without Transaction Errors	
15		RS. 3.10 Average Days per Schedule Change	
16		RS 3.113 Receiving Product Cycle Time	
17		RS. 3.8 Authorize Supplier Payment Cycle Time	Asset Management
18		AM. 3.28 Percentage Defective Inventory	
19		AM. 3.37 Percentage Excess Inventory	
20	MAKE	RL.3.49 Schedule Achievement	Reliability
21		RL.3.58 Yield	
22		RL.3.31 Compliance Documentation Accuracy	
23		RL. 3.56 Warranty Cost	
24		RS.3.123 Schedule Production Activities Cycle Time	Responsiveness
25		RS.3.101 Produce and Test Cycle Time	
26		RS.3.142 Package Cycle Time	
27		CO. 3.11 Direct Material Cost	Cost
28		CO. 3.12 Indirect Cost Related to Production	
29		CO. 3.13 Direct Labor Cost	
30	Deliver	RL. 3.33 Delivery Item Accuracy	Reliability
31		RL. 3.34 Delivery Location Accuracy	
32		RL. 3.35 Delivery Quantity Accuracy	
33		RL. 3.32 Customer Commit Date Achievement Time Customer	
34		RL. 3.50 Shipping Documentation Accuracy	
35		RL. 3.41 Orders Delivered Damage Free Conformance	Responsiveness
36		RL. 3.42 Orders Delivered Defect Free	
37		RS. 3.117 Route Shipments Cycle Time	
38		RS. 3.126 Ship Product Cycle Time	Agility
39		AG.3.1 % of labor used in logistics, not used in direct activity	
40		CO. 2.4 Cost to Deliver	Cost
41	RETURN	RS.3.5 Authorized Defective Return Cycle Time	Responsiveness
42		RS.3.104 Receive Defective Product Cycle Time	
43		RS.3.136 Transfer Defective Product Cycle Time	
44		CO.2.5 Cost to Return	Cost
45	ENABLE	AM. 3.26 Return Rate	Asset Management
46		RS. 3.78 Manage Production Performance Cycle Time	Responsiveness
47		CO.3.13 Direct Labor Cost	Cost
48		AM.3.9 Capacity Utilization	Asset Management

4.3. Metrics Set Up According to SCOR 12.0

Based on business scope and business thread diagram measurement attributes can be arranged along with supply chain metrics in accordance with SCOR 12.0 guidelines. Determination of metrics and attributes of measuring supply chain performance will be carried out based on the process and performance in table 2.

So that measurements are made based on process and performance approaches. There are 48 metrics from the results of business processes in the leather industry for bag product. The metrics, in general, are found in the leather industry, so not all metrics will have a value on the measurement results in XYZ SME.

4.4. Supply Chain Performance Measurement

The calculation of supply chain performance based on historical data of XYZ SME that has normalized data using SNORM. From the data, the total score of each process and the measurement metric of SCOR 12.0 have been determined. The next step is to determine the total score of each process by giving weight to the performance attributes. The weighting of performance is given equally towards all attributes, therefore each attribute, namely reliability, responsiveness, agility, cost, and asset management has the same weight, which is equal to 0.2. Likewise for weighting the process is given the same value, which is equal to 0.17 for plan, source, make, deliver, return, and enable. So that the calculation of the total score of XYZ SME can be seen in table 3.

Table 3. Final Score XYZ SME based on Process Approach

NO	SCOR	ATTRIBUTES	Score	Bobot	Score x Bobot	Scor Level 1	Bobot Level1	Final Score
	LEVEL 1							
1	PLAN	Reliability	0,00	0,50	0,00	50,00	0,17	8,33
2		Responsiveness	100,00	0,50	50,00			
3	SOURCE	Reliability	86,67	0,33	28,89	71,08	0,17	11,85
4		Responsiveness	26,56	0,33	8,85			
5		Asset Management	100,00	0,33	33,33			
6	MAKE	Reliability	62,25	0,33	20,75	57,48	0,17	9,58
7		Responsiveness	56,67	0,33	18,89			
8		Cost	53,54	0,33	17,85			
9	DELIVER	Reliability	100,00	0,25	25,00	55,05	0,17	9,18
10		Responsiveness	83,33	0,25	20,83			
11		Agility	9,09	0,25	2,27			
12		Cost	27,78	0,25	6,94			
13	RETURN	Responsiveness	33,33	0,33	11,11	64,44	0,17	10,74
14		Cost	80,00	0,33	26,67			
15		Asset Management	80,00	0,33	26,67			
16	ENABLE	Responsiveness	0,00	0,33	0,00	27,71	0,17	4,62
17		Cost	23,13	0,33	7,71			
18		Asset Management	60,00	0,33	20,00			
TOTAL SCORE								54,29

The measurement of the XYZ SME supply chain performance based on the process approach is **54.29**. It includes the average category. Then, the value of supply chain performance measurement based on performance can be known by calculation in table 4. A low value from the measurement results can be defined as the following explanation. “Plan”, SME doesn’t have any forecasting method yet which can improve “plan supply chain”, “plan source”, “plan make”, “plan deliver”, and “plan return” activities. “Source”, delayed material sourcing can effect the production process which has below 40 scores compared to performance indicator. “Make”, managing the cost was the biggest impact for low-make value, knowing that XYZ SME still doesn’t have any warranty cost and other problem from the production schedule and time. “Deliver”, the biggest problem came from the managing labor to ship requirements, XYZ SME should manage it efficiently. “Return”, a problem came from return authorized and deal with customer withdrawal for return activities. “Enable”, XYZ SME still not have

any specific and systematic supply chain performances, therefore the enable activities needs covered by the owner.

From the final score result, it can be seen that the highest score is asset performance. Higher score of asset performance indicates that the utilization of production facilities and the turnover of inventory is quite good. This is in line with research from [12] that asset management strengthens the performance especially for small-medium enterprises and inventory level of the company could increase asset performance.

Table 4. Final Score XYZ SME based on Performance

NO	ATTRIBUTES	SCORE	PROCESS	FINAL SCORE
1	Reliability	248,92	4	62,23
2	Responsiveness	299,90	6	49,98
3	Agility	9,09	1	9,09
4	Cost	184,44	4	46,11
5	Asset Management	240,00	3	80,00

On the other hand, the lowest attribute in performance score is agility. This indicates a lack of good ability to respond to market changes or changes in production capacity. The low level of agility can be seen from the lack of flexibility in the use of labor that cannot be transferred during overload work. Agility is one of key success to compete, especially companies that produce innovative product [13;14]. The fashion industry requires strategic flexibility and manufacturing flexibility [15] because it can affect agility supply chain performance. Flexible strategies affect directly and significantly while manufacturing flexibility does not. Examples of applying agile and responsive models are quick response, describe shorter, more flexible, demand driven, and based on process integration and networking [16]. In addition, supplier innovation is also needed through information sharing so that it can facilitate collaboration in the supply chain [17].

Reliability, responsiveness, and cost are a performance that have average scor. Responsiveness in manufacturing companies can be upgraded by considering fundamental element that are spread into 4 paths, namely (i) Drivers, (ii) Enablers, (iii) Measures, and (iv) Impacts [18]. It is very important for manufacturing companies to have all elements of responsive in order to survive. Reliability is the ability to perform tasks as expected. Reliability focuses on the predictability of the outcome of a process [2]. Based on the study of 218 manufacturing SME in Texas [12], it can conclude that reliability strengthens the performance. Reliability in this research is measured using metric forecast accuracy, on-time, the right quantity, and the right quality. The value of reliability is in the average category. This shows that the accuracy of manufacturing in planning, procurement, and delivery needs to be improved.

Costs in performance measurement are all costs incurred to operate the supply chain [2]. In this study, the low-cost performance shows that the cost of manufacturing is not yet efficient. The costs in the supply chain, especially those related to logistics for delivery and return, must consider the relationship of cost of transportation with the selection of shipping modes and the relationship between cost and distance and the time of delivery. Where all these indicators are linearly related as examined [19]. The company needs to consider this model to improve costs, especially the logistics costs of this company.

The crucial subjects in SCOR are process modeling and performance measurement [20] that different from many companies to gain competitive advantages. Therefore, this research was conducted by making a supply chain model and then measuring supply chain performance. So, XYZ SME can improve their performance based on their low performance and benchmark with other companies to enhance performance in accordance with the company that has the best performance.

5. Conclusions and Recommendations

Based on the measurement or supply chain assessment using the SCOR 12.0 method, some conclusions are obtained as follows. It define the value of each XYZ SME process in a based on plan; source; make;

deliver; return; and enable; are 50; 71,08; 57,58; 55.05; 64.44; 27,71. This value indicates that the best process that is owned is “source” and the lowest is “agility”. Value for the overall supply chain performance and process of XYZ SME is 54.29. Based on all performance attributes possessed, the best value is asset management by 80, and the lowest value is agility with a value of 9.09. Based on the table of performance indicators, the performance value of the XYZ SME supply chain is included in the "Average" category. It still needs improvement in many sectors. Some of them are making forecasting on the production process, making collaborate with suppliers, managing by reducing production costs, logistic cost, clarity in product returns, and managing supply chain performance systematically covered by the owner. Moreover, XYZ SME Supply Chain Score can be made for another leather manufacture industry as a benchmark to improve supply chain performance.

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