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SUPPLY CHAIN MEASURING PERFORMANCE WITH SCOR MODEL BUSINESS PROCESS MAPPING

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Abstract

In general, this study aims to provide a general framework for measuring general supply chain performance. This research uses business process mapping with the Supply Chain Operations Reference (SCOR) 11.0 model. PT Semen Bosowa Maros faces increasingly fierce competition conditions with other cement industry companies. PT Semen Bosowa must be able to increase the company's competitiveness by increasing the effectiveness and efficiency of its productivity, producing high-quality products, on time and providing good service for consumers. To achieve this, companies must have a good supply chain system. Based on observations, the supply chain problems faced by PT Semen Bosowa Maros are related to the source process, namely the fulfillment of material supplies that have an impact on the production process The hampering of the production process has an impact on the company's inability to meet customer demand. (make). This will certainly reduce the company's competitiveness in the midst of increasingly fierce competition in the cement industry. The findings of this study show that the business processes of PT Semen Bosowa Maros have been implemented well. Of the 12 performance measurement metrics used, there are 8 metrics with details, namely: internal meeting, planning cycle time, source defect rate, source fill rate, failure in process, orders ready to pick by customer, customer complaint, and return rate has been in a very good position (excellent). Three other metrics have been in good position: source lead time, machine efficiency, and delivery fill rate. Only the forecast accuracy metric is in a marginal position.

Keywords: Supply Chain Management; Supply Chain; Supply Chain Measuring Performance; Supply Chain Operations Reference (SCOR).

INTRODUCTION

The development of the business world in Indonesia is currently experiencing very rapid progress, so the competition faced by companies is getting tighter. In this condition, companies are required to increase effectiveness and efficiency, as well as improve the quality of products and services in order to affect customer satisfaction and support the company's long-term survival. In addition, to increase competitiveness, companies must be able to integrate the management of various management functions to form a good supply chain system through the concept of supply chain management. Supply chain management is concerning and managing the business from the procurement of raw material to manufacturing to distribution, customer service and finally reprocessing and disposal of products (Samudrala et al., 2022). Pujawan & Er, (2017) reveal that the supply chain is a network of companies that work together to create and deliver a product to the hands of end users. Jacobs & Chase,(2015), reveal that the supply chain is a process that moves information and raw materials from and to the company's manufacturing and service processes. Good supply chain implementation can improve the company's performance and competitiveness capabilities through increasing the effectiveness and efficiency of company operations. To provide low cost, good quality products, supply

chain management is a key determinant of the company's competitive advantage (Wahyuniardi et al., 2017). This will maximize the company's performance and competitive advantage.

Performance measurement and evaluation of supply chain performance in the company are needed to provide information on the quality of the company's supply chain performance in order to make continuous improvements. According to Maestrini et al.,(2017) to achieve this objective, it is of the most importance to measure the performance of large spectrum of tasks (e.g logisticks, inventory management and warehosing, deman forecasting, and supplier and costumer relationship management) In supply chain, performance measurement the main purpose is to get information for top management's needs, but also several kinds of SC measures are needed at every management and operational level (Sillanpää, 2015). One of the most widely used methods in measuring supply chain performance is the SCOR (Supply Chain Operation Reference) model. This model is widely used because it is able to in detail present the entire supply chain process from upstream to downstream by dividing supply chain processes into five core processes, namely plan, source, make, deliver and return. Using the SCOR method, companies are able to evaluate overall supply chain performance to monitor and control, communicate organizational objectives to functions in the supply chain and determine where an organization stands relative to competitors, and determine the direction of improvement for the creation of competitive advantage (Pradabwong et al., 2017).

PT Semen Bosowa Maros is one of the manufacturing companies engaged in the cement industry in Indonesia. PT Semen Bosowa has its own factory with a production capacity of up to two million tons per year. The type of production is Portland Composite Cement (PCC) and Ordinary Portland Cement (OPC) which are marketed to various regions in Indonesia such as Sulawesi, Kalimantan, West Nusa Tenggara, and East Nusa Tenggara

The Company faces increasingly fierce competition conditions with other cement industry companies such as PT Semen Tonasa, PT Semen Gresik, and PT Semen Padang which have merged into group companies under the auspices of PT Semen Indonesia tbk.

Competition is increasingly tightened with more and more foreign companies entering Indonesia such as Panasia Haohan Cement, Cement Hippo, and PT Conch Cement Indonesia. With a very tight level of competition, PT Semen Bosowa must be able to increase the company's competitiveness by increasing the effectiveness and efficiency of its productivity, producing high-quality products, on time and providing good service for consumers. To achieve this, companies must have a good supply chain system. Supply chain management has become the key management focus and the source of competitive advantage for many firms (Anand & Grover, 2015).

Based on observations, the supply chain problems faced by PT Semen Bosowa Maros are related to the source process, namely the fulfillment of material supplies that have an impact on the production process (make). In its production process, PT Semen Bosowa uses various types of material components supplied from within and outside the country. In meeting material needs, companies sometimes face problems of delays in supplying materials, such as coal supplied from Kalimantan. This usually happens because of the delay in suppliers sending coal, the shipping process by sea takes a long time, and the distance of material distribution from the port to the factory is quite far.

Delays in coal supply have hampered the production process. This is because in the cement production process, coal functions as fuel in the combustion process of various mixtures of raw materials to form clinker (semi-finished cement) for further processing to become ready-to-sell cement. The hampering of the production process has an impact on the company's inability to meet customer demand.

This resulted in the factory ceasing operations and impacted the company's inability to fulfill customer orders. The total orders that cannot be fulfilled are quite large between March

and July, where the percentage of customer orders that cannot be fulfilled reaches thousands of tons of total customer orders each month.

A company's inability to fulfill customer orders can affect customer confidence and satisfaction levels and make the company lose potential revenue. This will certainly reduce the company's competitiveness in the midst of increasingly fierce competition in the cement industry. Therefore, the company must take corrective action against these conditions.

RESEARCH METHOD

The supply chain process starts from obtaining raw materials from suppliers, the production, until it is used by the end user based on the spirit of collaboration for customer satisfaction (Sholeh et al., 2020). Nurafifah et al., (2022) explain that performance measurement is the process of measuring success in implementing given goals. The achievement of the given objectives shows the level of effectiveness, the higher the level of goal achievement, the higher the effectiveness (Imran et al., 2015). Data analysis in this study uses the Supply Chain Operation Reference (SCOR) model version 11.0 as a reference in mapping the company's business processes to design supply chain performance measurements. According to (Prasetyo et al., 2021) SCOR is a process reference model that combines concepts in business process reengineering, benchmarking, and process measurement. Performance measurement using SCOR is able to measure the company from upstream to downstream (Chotimah et al., 2018). Supply Chain Management is an activity ranging from coordination, scheduling and controlling the procurement, inventory and delivery of products or services to customers, SCM is an activity that combines all parties involved in the process of turning raw materials into products (Pujawan & Er, 2017). The company's five core processes are plan, source, make, deliver and return. Five Core company's busniness processes will measuring with several metrics. using metrics and communicating results allows members of a supply chain to compete at a higher level and attract customers than other supply chains that coordinate inter firm activity to a lesser degree (Cirtita & Glaser-Segura, 2012). Purnomo et al., (2022) the company's business process measurement metrics are as follows:

1. Plan
   a) Forecast Inaccurancy: The percentage difference between forecast demand and actual demand. Forecast Inaccurancy can be calculated by the following formula:

$$FI = \frac{[\text{Demand Forecast} - \text{Actual Demand}]}{\text{Actual Demand}} x\ 100\%$$

   b) Internal Meeting: The number of meetings between departments within the company.
   c) Planning Cycle Time: The time needed to draw up a production schedule.
2. Source
   a. Defect rate: the percentage of comparison of defective raw materials and auxiliary materials with the number of shipments of raw materials and auxiliary materials from each supplier. The defect rate can be calculated using the following formula:

$$DR = \frac{\text{Number of Defective Units}}{\text{Number of Units Delivered}} x\ 100\%$$

   b. Source fill rate: The percentage of the number of requests each supplier can fulfill.
   c. Source Lead Time: the time it takes to order materials until the receipt of goods.
3. Make
   a. Failure in process: The percentage of failures that occur in the production process.
   b. Machine Efficiency: The percentage of machine efficiency in the production process.

4. Deliver
   a) Fill rate: The percentage of the number of items available when requested by the customer.
   b) Ready to pick orders by customer: % of the order frequency ready to be picked up by the customer divided by the total order frequency.
5. Return
   a. Customer Complaint: The number of customer complaints to the company.
      Return Rate: % return of products that the company provides to customers.

RESULT AND DISCUSSION

Business processes in the supply chain of PT Semen Bosowa Maros consist of plan, source, make, deliver and return processes. The business process and calculation of the company's process metrics are as follows:

1) Plan

The planning carried out includes sales planning, production planning, material procurement planning, distribution planning, product quality development planning, and market expansion planning. The planning process starts from the internal meeting of each department to discuss the departmental planning that will be submitted to the company planning meeting. Furthermore, the results of the planning meeting by each department will be submitted by representatives of each department to the company planning meeting for further discussion and integration with the overall company planning. The results of the planning implementation will be evaluated monthly in monthly evaluation meetings.

To measure the performance of the planning process, it uses several measurement metrics, namely forecast inaccurancy metrics, internal meeting metrics and planning cycle time metrics. The results of the calculation of the three metriks are as follows:

a. Forecast Inaccurancy

Table 1 Measurement of Forecast Inaccurancy of PT Semen Bosowa Maros

Month	Demand Forecast (Ton)	Actual Demand (Ton)	FI (%)
January	150.600	141.200	7%
February	105.400	122.000	-14%
March	135.600	125.285	8%
April	120.500	138.195	-13%
May	90.400	153.330	-41%
June	105.400	96.485	9%
July	165.700	151.454	9%
August	180.800	147.000	23%
September	203.400	121.200	68%
October	203.400	148.700	37%
November	188.300	139.400	35%
December	158.200	146.400	8%
	Average		11%

Forecast innacurancy (FI) is used to determine the percentage of error in forecasting customer demand, based on the difference between forecast demand and actual demand. Based

on table 1, the error rate of forecasting customer demand fluctuates monthly by an average of 11%. This value has not reached the minimum forecasting error desired by the company, which is 5%. The forecasting error values in February, April, and May were negative, meaning that customer demand exceeded forecasts. The biggest forecasting error occurred in September at 68%, meaning that the actual demand value was very far below the value of demand predicted by the company.

b. Internal Meeting

Table 2 Internal Meeting Measurement of PT Semen Bosowa Maros

Month	Internal Meeting (Times)
January	4
February	4
March	2
April	3
May	4
June	3
July	4
August	3
September	1
October	2
November	1
December	4
Average	3

Internal meeting metrics are used to measure the intensity of meetings between departments within the company to discuss planning, evaluation, and issues that occur each month. Based on the table above, the most interdepartmental meetings are four times a month, and the least is once a month. This is in line with the expectations of companies that schedule interdepartmental meetings once a month to discuss routine issues within the company.

c. Planning Cycle Time

Table 3 Planning Cycle Time Measurement of PT Semen Bosowa Maros

Month	PCT
January	2
February	2
March	2
April	2
May	2
June	2
July	2
August	2
September	2
October	2

November	2
December	2
Average	2

This metric is used to measure the length of time it takes a company to draw up a production plan. Based on table 3, the average time needed to compile a monthly production schedule is in accordance with the company's expectations, which is two days. That is, the company is able to have been able to compile a monthly production schedule in a timely manner.

d. Procurement (Source)

Source is the procurement of production needs in the form of raw materials and auxiliary materials. This process includes scheduling shipments from suppliers, receiving materials, checking materials, selecting suppliers, evaluating supplier performance, and other matters related to procurement of production needs. The production process uses limestone as the main raw material and uses various types of auxiliary materials to produce cement. Various types of auxiliary materials such as gypsum, coal, silica sand, etc. are supplied from various suppliers in different regions. Therefore, companies must be able to carry out good cooperation and coordination with suppliers so that production needs can be met.

The supply of raw material needs can always be met because the location of raw material mining is integrated with the factory, besides that the supply of raw materials is also supported by cooperation with PT Bosowa Mining. The obstacle faced is in meeting the needs of auxiliary materials originating from third parties. The usual obstacle is that suppliers cannot meet requests and the auxiliary materials sent are defective or not in accordance with the desired specifications. To overcome the possibility that suppliers cannot meet the demand for materials, the company establishes a primary supplier and a reserve supplier for each type of material.

To measure the procurement performance of PT Semen Bosowa Maros, several measurement metrics are used, namely defect rate metrics, source fill rate metrics, and source lead time metrics. The measurement results of the three metrics are as follows

a. Defect Rate

Table 4 Defect Rate Measurement of PT Semen Bosowa Maros

Month	Delivered (Ton)	Defective Units (Ton)	Delivered (Sheet)	Defective Units (Sheet)	DR (Ton)	DR (Sheet)
January	104.606	40.000	2.077.000	-	38,24%	0,00%
February	81.355	-	1.650.000	-	0,00%	0,00%
March	55.510	-	1.285.000	-	0,00%	0,00%
April	93.952	-	1.811.000	-	0,00%	0,00%
May	92.685	-	1.767.000	-	0,00%	0,00%
June	87.740	-	1.301.000	-	0,00%	0,00%
July	105.586	-	2.081.000	-	0,00%	0,00%
August	116.094	-	2.007.000	-	0,00%	0,00%
September	124.814	-	1.552.000	-	0,00%	0,00%
October	123.212	-	1.873.000	-	0,00%	0,00%

November	96.694	-	2.068.000	-	0,00%	0,00%
December	90.283	-	2.257.000	-	0,00%	0,00%
Amount/Average	1.172.531	40.000	21.729.000	-	3,19%	0,00%

Defect rate (DR) is a metric to measure the percentage ratio of defective raw materials/auxiliary materials to the total shipments of raw materials/auxiliary materials from suppliers. Based on the table above, the average defect rate is 3.19%. Defective raw materials existed only in January, amounting to 40,000 tons.

b. Source Fill Rate

Table 5 Source Fill Rate Measurement of PT Semen Bosowa Maros

Month	Material Request (Ton)	Delivered (Ton)	Material Request (Sheet)	Delivered (Ton)	SFR (Ton)	SFR (Sheet)
January	104.606	104.606	2.077.000	2.077.000	100%	100%
February	81.355	81.355	1.650.000	1.650.000	100%	100%
March	55.510	55.510	1.285.000	1.285.000	100%	100%
April	93.952	93.952	1.811.000	1.811.000	100%	100%
May	92.685	92.685	1.767.000	1.767.000	100%	100%
June	87.740	87.740	1.301.000	1.301.000	100%	100%
July	105.586	105.586	2.081.000	2.081.000	100%	100%
August	116.094	116.094	2.007.000	2.007.000	100%	100%
September	124.814	124.814	1.552.000	1.552.000	100%	100%
October	123.212	123.212	1.873.000	1.873.000	100%	100%
November	96.694	96.694	2.068.000	2.068.000	100%	100%
December	90.283	90.283	2.257.000	2.257.000	100%	100%
Amount	1.172.531	1.172.531	21.729.000	21.729.000	100%	100%

This metric is used to measure the percentage of the amount of material demand that each supplier can fulfill. Based on table 5, the source fill rate is 100%, meaning that all quantities of raw material and auxiliary material requests requested can be met by suppliers.

c. Source Lead Time

Table 6 Source Lead Time Measurement of PT Semen Bosowa Maros

Month	Clay (Day)	Limestone (Day)	Fly ash (Day)	Gypsum (Day)	Silica (Day)	Coal (Day)	Bag Mks (Day)	Bag Grs (Day)	Amount (Day)
January	2	1	2	22	1	8	1	7	44
February	1	1	1	19	2	15	1	6	46
March	2	1	2	17	1	24	1	6	54
April	2	1	1		2	21	1	8	36
May	1	1	1		1	27	1	6	38

June	1	1	1		1	28	1	7	40
July	1	1	1		1	26	1	6	37
August	1	1	1		1	8	1	6	19
September	1	1	1	16	1	7	1	6	34
October	1	1	1	16	1	7	1	6	34
November	2	1	1	17	2	7	1	6	37
December	2	1	2		2	7	1	7	22
Average	1	1	1	18	1	15	1	6	37

Source lead time is used to measure the length of time it takes to order materials until receiving materials at the factory. Based on table 4.6, the source lead time for each raw material and auxiliary material varies, depending on the distance between the supplier and the factory. The average source lead time of each material has been in line with expectations except for the supply of gypsum and coal. These two types of materials have experienced supply delays several times. The average source lead time for gypsum is 18 days while the company's expectation is 14 days. The average coal source lead time is 15 days, while the company's expectation is 7 days.

2) Production (Make)

Make is a process to process material components into ready-to-sell cement. Production is the most important process in the supply chain process because this process determines the company's ability to meet customer demands in accordance with the desired quality, quantity, and time.

Production process performance is measured by several measurement metrics, namely failure in process metrics and machine efficiency metrics. The calculation results of the three metrics are as follows

a) Failure in Process (FiP)

Table 7 Measurement of Failure in Process PT Semen Bosowa Maros

Month	FiP
January	0%
February	0%
March	0%
April	0%
May	0%
June	0%
July	0%
August	0%
September	0%
October	0%
November	0%
December	0%

The measurement of the above metric is used to measure the percentage of failures that occur in the production process. Based on table 4.7, the percentage of failures that occur in the production process is zero percent, meaning that there has never been a production failure.

b) Machine Efficiency

Table 8 Machine Efficiency Measurement of PT Semen Bosowa Maros

Month	Production Capacity (Ton)	Actual Production (Ton)	MME
January	166.667	136.900	82,14%
February	166.667	133.200	79,92%
March	166.667	87.300	52,38%
April	166.667	138.700	83,22%
May	166.667	126.800	76,08%
June	166.667	115.700	69,42%
July	166.667	132.000	79,20%
August	166.667	145.400	87,24%
September	166.667	104.700	62,82%
October	166.667	152.200	91,32%
November	166.667	133.000	79,80%
December	166.667	157.200	94,32%
	Average		78,16%

In the table above, the average efficiency of using the machine is 78.16%. This value has not met the company's expectations, which is 90.39%. The worst engine efficiency values occur in March, June, and September, where the percentage of engine efficiency is below 70%. This means that the company is still unable to maximize the capacity of the machine owned, this will have an impact on the value of return on investment of fixed assets.

3) Deliver

Deliver is the process of delivering products to meet customer demand. The finished product is then distributed to distributors/customers. To measure the delivery performance of PT Semen Bosowa Maros, fill rate metrics and orders ready to pick by customer metrics are used. The results of the metric measurement are as follows:

a) Fill Rate

Table 9 Fill Rate Measurement

Month	Available Inventory (Ton)	Customer Demand (Ton)	FR
January	219.900	141.200	155,74%
February	209.200	122.000	171,48%
March	176.200	105.900	166,38%

April	207.400	130.700	158,68%
May	233.000	137.700	169,21%
June	158.100	91.300	173,17%
July	207.900	147.700	140,76%
August	229.500	147.000	156,12%
September	173.700	121.200	143,32%
October	222.400	148.700	149,56%
November	193.600	139.400	138,88%
December	219.200	146.400	149,73%
	Average		156,13%

Fill rate presents the percentage of the quantity of goods available when requested by the customer. Based on the table above, the average fill rate is 156.13%. This value is above the standard set by the company which is 135%, meaning that the company sets a margin of safety for inventory of only 30% every month. The highest fill rate occurred in June at 173.17% and the lowest occurred in July at 140.76%. This means that there is a buildup of merchandise inventory.

b) Orders Ready to Pick by Customer

Table 10 Measurement of Ready to Pick by Customer Orders

Month	Total Order (Times)	Ready Order (Times)	ORP
January	5.230	5.230	100,00%
February	4.519	4.519	100,00%
March	4.640	3.922	84,53%
April	5.118	4.841	94,58%
May	5.679	5.085	89,55%
June	3.574	3.381	94,63%
July	5.609	5.470	97,52%
August	5.444	5.444	100,00%
September	4.489	4.489	100,00%
October	5.507	5.507	100,00%
November	5.163	5.163	100,00%
December	5.422	5.422	100,00%
	Average		96,73%

The orders ready to pick by customer metric is used to measure the percentage of customer request frequency that is ready to be taken with the total frequency of customer requests as a whole. Based on table 10 above, the average value of orders ready to pick by customer is 96.73%. The metric value does not reach 100% because from March to July there is a shortage of inventory at the time the order is received. However, the percentage of achievement of this metric has been very good because

every month the percentage of order frequency ready to be taken by customers is above 80%.

4) Return

Return is the process of returning or accepting product returns from customers due to defective or damaged products. Cement that has been sent to distributors sometimes experiences damage or is not in accordance with the desired product quality standards. This results in a claim from the distributor to the company to compensate for losses due to the damage or nonconformity. Measurement of return performance uses several metrics, namely customer complaint metrics and return rate metrics. The measurement results of these metrics are presented as follows:

a) Customer Complaint

Table 11 Measurement of Customer Complaint PT Semen Bosowa Maros

Month	Customer Complaint (Times)
January	0
February	0
March	0
April	0
May	0
June	0
July	0
August	0
September	0
October	0
November	0
December	1

The customer complaint metric is used to measure the number of customer complaints to the company because the quality of products or services is not in accordance with customer expectations. The table above shows that there was only one customer complaint in December. This indicates that the quality of production and service of PT Semen Bosowa Maros has been very good, because there were almost no complaints of damaged products from customers during the year.

b) Return Rate

Table 12 Return Rate Measurement of PT Semen Bosowa Maros

Month	Deliver (Ton)	Return (Ton)	RR
January	130.340	0	0,000%
February	103.400	0	0,000%
March	58.817	0	0,000%
April	138.700	0	0,000%
May	113.400	0	0,000%
June	56.925	0	0,000%
July	94.700	0	0,000%
August	147.000	0	0,000%
September	121.200	0	0,000%

October	148.700	0	0,000%
November	139.400	0	0,000%
December	146.400	5	0,003%
	Average		0,0003%

The return rate metric measures the percentage of product returns that a company has delivered to customers. Based on table 4.12 the rate of return of cement from customers is 0.003, meaning that the rate of return of goods that have been sold to customers is very low. Product returns only occurred in December amounting to 5 tons out of a total of 146,400 tons of sales in that month. This indicates that the quality of the product is very good, because the return value of the product is very small compared to the total sales.

CONCLUSION

The results of business process measurement based on the SCOR model show that PT Semen Bosowa Maros' business processes have been implemented well. Of the 12 performance measurement metrics used, eight metrics, namely internal meeting, planning cycle time, source defect rate, source fill rate, failure in process, orders ready to pick by customer, customer complaint , and return rate have been in a very good position (excellent). Three other metrics have been in good position, namely source lead time, machine efficiency, and delivery fill rate. Only the forecast accuracy metric is in a medium (marginal) position. Therefore, improvements in customer demand forecasting performance and source lead time performance must be done because it affects sales performance and overall company performance. Improving customer demand forecasting performance can be done by involving distributors in conducting market analysis. Improving source lead time performance by conducting supplier evaluations, periodic safety stock reviews and improving the scheduling and refreshing of material purchases.

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