

MEASUREMENT SUPPLY CHAIN PERFORMANCE USING METRIC OF SCOR MODEL (Case Study : Automotive Component Manufacturing)

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ABSTRACT

This study is proposed to implement the supply chain operations reference (SCOR) model for measurement supply chain performance. The case study conduct to one of manufacturing automotive component whose supply the automotive industry in West Java. Based on perspective realibility, responsiveness, flexibility, supply chain cost and assets are developed 10 metrics of performance measurement. In case study shown the achievement of performance supply chain reach best in class on reliability, 6 metric on position advantage and 2 metric on medium. Needed imediately to improve supply chain performance so that the performance of reaching the position better.

Keywords : *Supply chain operations reference model, performance, measurement, metric*

1. INTRODUCTION

Supply Chain Management (SCM) has become a significant focus of competitive advantage for many businees over the past decade. Although various supply chain models have been proposed, its required the performance measuring system that adaptive to apply in certain industry. Measuring supply chain performance can facilitate a better understanding of the supply chain, and its can conduct improving its overall performance. In order to achieve supply chain goals, it demands that effective performance measurements be established and therefore, a system for measuring performance is required. Gunasekaran et al. (2001) developed a framework for measuring the performance according to strategic, tactical and operational levels in supply chain. This framework deals with supplier,delivery, customer service, inventory and logistic costs.

A supply chain is a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system. To achieve integrated supply chain management, a number of researchers and practitioners have devoted their efforts in developing models to describe the elements and

activities of a supply chain (Huang et.al, 2005)

The Supply Chain Council, was introduced in 1996 the Supply Chain Operations Reference (SCOR) model. The SCOR model is a process reference model. Specifically, it is a model that links process elements, metrics, best practice and the features associated with the execution of a supply chain in a unique format. There are includes 5 basic process including plan,source, make, deliver, and return. The advantages of SCOR model has been widely publicized by Supply Chain Council with illustrative case histories. The condensed generalized achievements of SCOR implementation in wide range of industries worldwide can be cited as follows (Bolstorff and Rosenbaum, 2003).

The primary focus of this paper is to purpose developing performance metric which are associated to the SCOR model. Validation of metric for measurement supply chain conduct to small enterprise, especially automotive component as the one of supporting automotive industry. Emerging growth on automotive industry at Indonesia has challenge the component manufacturing to improve their supply chain performance.

2. THEORETICAL BACKGROUND

The Supply Chain Operations Reference (SCOR) model concern at five management process, there are plan, source, deliver and return. The Plan process consists of processes that balance aggregated demand and supply to develop a course of action which best meets the business goals. The Source process contains processes that procure goods and services to meet planned or actual demand. Sourcing/material acquisition includes the jobs of obtaining, receiving, inspecting, holding, and issuing material. The Make process includes functions that transform goods to a finished state to meet planned or actual demand. Make is the core process of the system in which actual production execution takes place. The Deliver process consists of processes that provide finished goods and services to meet planned or actual demand. This typically includes the functions of order management, transportation management, and distribution management. Return is the latest addition to SCOR model. It deals with managing reverse flow of material and information related to defective, surplus of product. The framework of SCOR Model as shown at Figure 1. (Huang et al, 2005; Chopra et.al 2004)

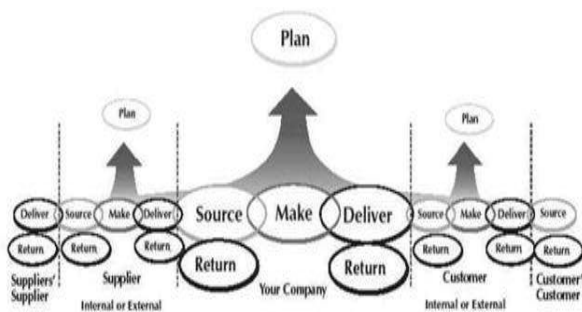


Figure 1 : The SCOR Model framework

The SCOR model contains three levels of process detail. Level 1 is the top level that deals with process types. Level 2 is the configuration level and deals with process categories. Level 3 is the process element level and is the lowest level in the scope of the SCOR model. Implementation levels that are below Level 3, in which we decompose process elements into tasks and further activities. This model is a process reference model. Specifically, it is a model that links

process elements, metrics, best practice and the features associated with the execution of a supply chain in a unique format.

The SCOR model endorses 13 performance metrics. A company cannot be best in all 13 of the metrics, so it should wisely target its strength in several, those by which it differentiates itself in the market, while ensuring that it stays competitive in the others. In practice most companies typically choose among four to six of the 13 performance metrics to focus on. Those chosen tend to fall into five defining categories: supply chain reliability, supply chain responsiveness, supply chain flexibility, supply chain costs, and efficiency in managing assets (working and fixed capital) in the supply chain (Huang et.al, 2005). A brief description of these metrics is given as follows:

- Delivery performance. Percentage of orders delivered on time with respect to the total number of orders delivered.
- Fill rate. Fill rate is percentage of ship-from-stock orders shipped within 24 hour of order receipt.
- Order fulfillment lead time. The average actual lead time consistently achieved from customer authorization of purchase order to final installation/order completion at customer end.
- Perfect order fulfillment. The percentage of orders meeting deliver performance and with complete and accurate documentation with no shipping damage. Components of perfect order fulfillment include all items and quantities delivered on-time and documentation for packing slips, bills of lading, and invoices. It is calculated as: $[\text{total orders shipped on time and in full-orders without faulty documentation orders with shipping damage}]/[\text{total orders}]$.
- Supply chain response time. The time it takes the integrated supply chain to respond to abnormal change in demand. It is calculated as $[\text{order fulfillment lead time} + \text{source cycle time}]$
- Production flexibility. Production flexibility can be seen in two parts, upside flexibility and downside flexibility. Upside flexibility is number of days required to achieve an

unplanned sustainable 20% increase in production. Downside flexibility is percentage order reduction sustainable at 30 days prior to delivery with no inventory or cost penalties.

- Total logistics management cost. The sum of supply chain related costs for order management, material acquisition, inventory carrying, finance and planning, and MIS costs. It is calculated as sum of the costs.
- Cost of goods sold. The cost associated with buying raw materials and producing finished goods. This cost includes direct cost (labor, material) and indirect cost (overhead)
- Value added productivity. It is calculated as: $[\text{Total Product Revenue} - \text{Total Material Purchases}] / \text{Total Employment (in full time equivalents)}$.
- Warranty cost or returns processing cost. It includes materials, labor, and problem diagnosis for product defects.
- Cash-to-Cash cycle time. Cash-to-Cash cycle time is a measure of the time required in days to convert cash paid to suppliers into cash received from customers, including the inventory required. It is calculated as $[\text{Inventory days of supply} + \text{days sales outstanding} - \text{days of payables}]$.
- Inventory days of supply. Total gross value of inventory at standard cost before reserves for excess and obsolescence.
- Asset turns. Total turns of capital employed. It impacts inventory, accounts payable, accounts receivable, and fixed assets on the balance sheet. It is calculated as total gross product revenue divided by total net assets..

3. RESEARCH METHOD

This study purpose to apply metric of SCOR Model, and how to measure supply chain performance whose conduct as a case study at small - medium enterprise. The case study conduct to PT XYZ that produce various automotive component that supply automotive industry in West Java.

The first stage is gathering data to measure performance based on decision of

management. The framework measurement based on metric of SCOR model. Based on result of focus group discussion with management, and the availability data record the performance metric decided into 5 perspective. Data collected in this study were drawn from company's data from 2010 to 2011. The balance sheet and other production recording are use as main source to calculate many variable in data processing.

4. RESULT AND DISCUSSION

4.1. Enterprise Supply Chain

The PT XYZ is the manufacturing company that produce various automotive component. The management of this company focuses on continuous improvement of planning processes and supply and operations of supply and delivery products. One of important component type is the bush arm as shown in Figure 2. Bush arm is the main and important part that produce through curring process through injection machine.



Figure 2. The bush arm

The business process as supply chain sight in PT XYZ focus on one stage downstream (supplier) and one stage upstream as shown Figure 3. Its comprises procurement, movement and manufacturing of materials, including raw materials for manufacturing. Then these manufacturers further distribute finished goods to costumer (automotive industry).

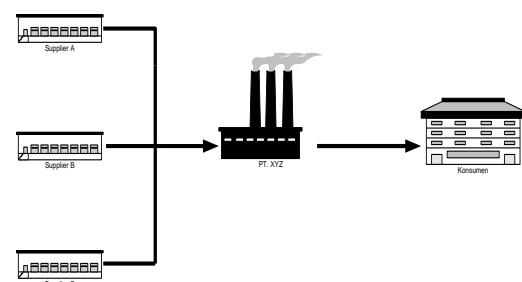


Figure 3. The Supply Chain PT. XYZ

4.2. Performance Measurement

Performance of supply chain metric categorised into five perspective, there are ; realibility, responsiveness, flexibility, supply chian cost and assets. Referred to these perspective, further the collection data processed into metric of SCOR model. This next discussion are result of data processed.

Realibility

This perspective is a measure performance on delivery time with regard to costumer order. There are two metrics to measure delivery on time.

- Delivery performance

This is a measurement as percentage of orders delivered on time with respect to the total number of orders delivered. By using this formulate, the calculation are :

Actual in 2010 : $(34/55) \times 100\% = 61.8$

Actual in 2011 : $(43/60) \times 100\% = 71.6$

Achievement : $(61.8/71.6) \times 100\% = 86.2$

The components of delivery performance include total number of orders received, number of orders scheduled to customer's request date, total number of orders delivered, percentage of orders delivered on time (to request date), number of orders delivered on-time to commit date, and percentage of orders delivered on-time to customer commit date.

- Fill rate

The fill rate affects is calculated as: $[\text{number of orders filled from stock shipped within 24 h of order receipt}]/[\text{total number of stock orders}]$. The calculation is :

Actual in 2010 : $(765/37) \times 100\% = 20.7 \%$

Actual in 2011 : $(743/32) \times 100\% = 23.2 \%$

Achievement : $(61.8/71.6) \times 100\% = 89.1\%$

Responsiveness

This perspective is a measurement to measure the response time or lead time required to provide product on costumer hand based on their order. The calculate is as order fullfilment are shown below ;

- Order fullfilment lead times

It is calculated as: $[\text{sum of lead time required for each order fullfilment from purchase}$

$\text{order authorization to final installation}]/[\text{total number of orders}]$.

Based on lead time data record at 2012, as a plan lead time is 1 - 3 days, and actual as average the order fullfilment lead time is 2 days.

Flexibility

There are two metrics to measure the flexibility of enterprise in order to respon market change and maintain or increase profit.

- Supply chain response time

Its a measurement the day required to complete the whole supply chain business process. In PT XYZ process business includes delivery from supplier, storage, production, delivery finish good to customer. Planning all of these process need 16 days. The production system is make to stock, the order planning arrange every month. In actual as average total day to accomplish all process is 18 days

- Production flexibility

This metric in this study is measurement of upside flexibility is number of days required to achieve an unplanned sustainable 20% increase in production. In this case study the average day required 3 days (50%) whereas 2-6 days planned.

Supply Chain Cost

In this study have measure supply chain cost into cost of good sold and total supply chain management cost. There are the calculation of cost below ;

- Cost of good sold

The cost associated with buying raw materials and producing finished goods. This cost includes direct cost (labor, material) and indirect cost (overhead)

Based on comparison of plan and actual or realization in 2011 obtained the achievement as percentage 57.2%.

- Total SCM cost

In this case study the total SCM cost is sum of supply chain related costs for order management, material acquisition, inventory carrying, finance and planning. Calculation Comparison between planning and actual

cost in 2011 calculated as percentage, the achievement as 64.3%.

Asset management

- Cash to cash management

It is calculated as [Inventory days of supply + days sales outstanding - days of payables] Based on record from PT XYZ balance sheet in 2011, comparison between plan as 48 days and realization as 55 days, it means the achievement of cash to cash management increase as 62.7 % (7 days).

- Inventory of supply

This metric is total gross value of inventory at standard cost before reserves for excess and obsolescence. Its calculated 4 days in planning and the actual reach 7 days. It means the inventory cost decreased in actual.

- Assets Turn

It is calculated as total gross product revenue divided by total net assets. In PT XYZ the planning total gross revenue as Rp 3.5 billion and total asset as Rp 4.8 billion, whereas the actual revenue as Rp 4.7 billion and total asset as Rp 4.8 billion. By calculated achievement of asset turn as comparison of planning and actual as 74%.

It is necessary to obtain a score for overall metrics so that the effect of supply chain performance can conduct the improvement strategy. Therefore, the achievement and position of all metrics are categorized based on focus group discussion with management. Regard to discussion result, all of achievement of supply chain performance while grouped into scoring. The scoring of position developed using likert scale, it is value are :

- 80 -100 % : best in class
- 60 - 80 % : advantage
- 40 - 60 % : medium
- 20 - 40 % : disadvantage
- 0 - 20% : major opportunity

All of achievement based on measurement using metric SCOR are classified as presented Table 1.

Table 1. The Supply Chain Performance

Metrics	Achievement (%)	Position
Realibility		
• Delivery performance	86.2	Best in class
• Fill rate	89.1	Best in class
Responsiveness		
• Order fullfilment	75.2	Advantage
Flexibility		
• SC Response Time	62.5	Advantage
• Production Flexibility	50.0	Medium
SC Cost		
• Cost of good sold	57.2	Advantage
• Total SCM cost	64.3	Advantage
Asset		
• Cash to cash	62.7	Advantage
• Inventory of supply	60.3	Medium
• Assets turn	74.0	Advantage

Refer to achievement, PT XYZ as average have advantage position at supply chain performance. Especially in reliability that measured on delivery performance and fill rate the performance reach position best in class. The other metric, production flexibility at medium position. The production flexibility is dependent upon internal manufacturing capacity, direct labor and material availability. Inventory of supply at medium position, its means needed effort to maintain continuity and sustainability relationship with supplier so that the supply status are guaranteed at necessary level. The most metric are position in at advantage. Effort are required to increase this position, actually management must do the best practice on supply chain management. Some of strategy is suggest are simplified processes, maintain and enlarge networks, centralized managed inventories. Finally the impact of supply chain performance impact to the whole of organization performance. significantly as shown on balance sheet.

5. CONCLUSION

This study aims to help managers in supply chain to measure the supply chain performance and help to consider for decision making improvement . The SCOR model work done in this field case study to supply chain performance measurement. In this study the achievement are categorized in 5 class. This will help to guide the decision making in order improvement operational of supply chain management.

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