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AN APPLICATION OF SUPPLY CHAIN OPERATION REFERENCE (SCOR) AND ANALYTICAL HIERARCHY PROCESS (AHP) MODELS IN A SUPERMARKET

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ABSTRACT

In Indonesia, retail businesses have been growing up vastly in these few years which is indicated by a number of competition among retailers. A retailer must then perform well to be able to compete with its competitors. In order to perform well, a retailer should first measure its performance. This paper proposes an application of supply chain operation reference (SCOR) model to measure a retailer's performance taking into account its role as a member of a supply chain. We also propose an Analytical Hierarchy Process (AHP) to measure the importance of processes in this supermarket. The application of SCOR and AHP models shows that a number of improvements can be made by the supermarket to better design its operations.

Keywords: supply chain operation reference, analytical hierarchy process, measurement, improvements

1. INTRODUCTION

In a supply chain, retailing is considered as near-end activities which basically consist of selling and distributing goods and services directly to end consumers (Kotler, 2008). In the past decade, Indonesia sees a growing number of new retailers which means more competition in the business. Seeing the competition closely, it can be concluded that retailers must focus on product delivery with good quality, low pricing, and good services such as speed and easiness to order.

In order to gain a competitive advantage (see also Indrajit, 2005), a company may want to collaborate or work together with other parties. A supply chain can be defined as integrated relationships among parties where raw materials are procured, and transformed into finished goods and then delivered to customers through distribution and retailing (Beamon, 1999). Managing elements of the chain in order to fulfill customers demand is called supply chain management. A supply chain management ensures that each party in the chain operates efficiently and effectively filling the market demand.

This research is conducted in a specific environment where Supermarket X operates in the area of Bandung. Supermarket X opens daily including Sunday and Holidays from 8am to 10 pm. It sells basic consumer needs such as, meats, vegetables, fruits, milks, and many automotive equipments. Preliminary observation shows that suppliers cannot fulfill Supermarket X's demand, in particular demand of vegetables, fruits and meats. A 75% service level was previously acceptable. Furthermore, suppliers have been changing item prices without notice which in turn

discourage the Supermarket to place orders. In the mean time, items were out of stock. Suppliers' deliveries were also coming later than the agreed dates. The forementioned problems have been occurring rather frequently and they affect directly to the availability of the product in the supermarket. We also interviewed the manager of Supermarket X and came into conclusion that consumers were frequently leaving the Supermarket without buying because fresh products were not available in the shelf.

To this day, Supermarket X measures its own performance based only on monthly sales. A single criteria used for performance measurement will only jeopardize the survival of the company because it ignores other long terms objectives. Our observation shows that measurement should also include components in the supply side. It is thus necessary to conduct this research to determine measures taking into account strategic objectives, in particular in term of supply chains. The objective of the research is to measure the performance of Supermarket X based on the supply chain operation reference model. Subsequently, operation improvements can then be made to be better design its operations.

2. LITERATURE STUDY

Chopra (2010) defined a supply chain as a system where all parties, directly or indirectly, involved in fulfilling customers demand. Besides manufacturers and suppliers, a supply chain may consist with transportation, warehousing, retailer and even the customers. Kotler (2008) stated that supply chain management exists even before physical distribution occurs. Supply chain management concerns with input selection (raw material, components, and capital equipments), and transforming it efficiently into finished goods and then deliver them to customers. A supply chain is normally dynamic and involving constant flows of information, products and money between stages in the chain. Every stage in a supply chain is connected through a set of product and money flows. According to Chopra (2010), a typical supply chain may consist of key players, such as: Suppliers, Manufacturers, Distributors, Retailers, and Customers. Figure 1 shows a typical supply chain.

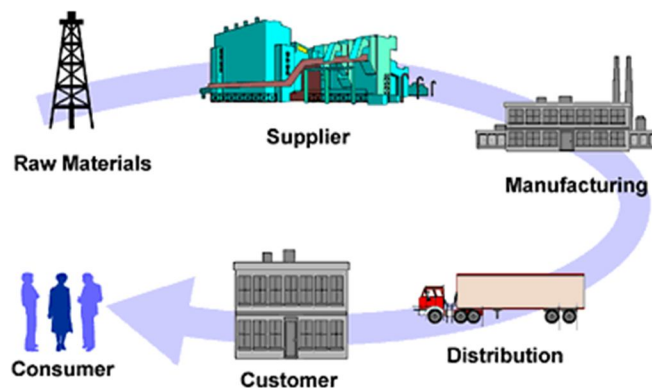


Figure 1. A typical supply chain

A Supply Chain Operation Reference (SCOR) model provides a framework to measure and to analyze the performance of a supply chain and to create a basis for improvements. The model was originally developed by Supply Chain Council (SCC) a non-profit independent organization (Supply Chain Council, 2010). Today, the council joins with APICS becoming APICS-Supply Chain Council. The model is a reference process model helping improving strategies, determining structures of problems, controlling the process as well as measuring the

supply chain performance. The model can be seen as a tool in solving supply chain problems in order to gain (1) excellent customer service, cost control, risk planning and management, partners relationship management, and talent and capability.

The model decomposes the supply chain processes into five main classifications: Plan, Source, Make, Deliver, and Return. **Plan** describes all activities to identify customers need, and resources, balancing resource needs and availability, and identifying actions to close the gap between available capacity and resource needs. **Source** involves with all activities to procure goods and services, such as: order placement, delivery schedule, receiving, validating, and verifying suppliers invoices. **Make** considers all activities transforming raw materials into finished products, such as: production scheduling, manufacturing, assembling, maintenance, recycling, rework, and inspections. **Deliver** consists with activities maintain and fulfilling customer demands, such as: order processing, delivery, packaging, and invoicing. Return describes all activities with product return from customers, including identifying causes, return and re-deliver scheduling, and receiving product return.

In the SCOR model, there are five attributes to measure performance of a supply chain, i.e. Reliability, Responsiveness, Agility, Cost and Assets. For all processes in the supply chain, a hierarchical metrics systems is introduced. The first level describes the performance of the whole supply chain, also known as strategic metrics or key performance indicators (KPI). The second level metrics present process categories where the company chooses to implement its operation strategies. The third level consists of decomposition processes from the second level. There are also performance metrics suggested by Aramyan (2006) for Food Industry and Gunasekaran (2006), Handfield (1999), Kulkarni (2005) for more generic frameworks.

3. APPLICATION OF SCOR AND AHP MODELS

In this section, we apply the concepts of SCOR using data flow diagrams to describe business process in the Supermarket. Business processes in Supermarket X is modeled using a decomposition technique in information systems, presented as graphical data flow diagrams (DFDs). Main processes in Supermarket X can be categorized into:

1. Procurement
2. Handling (Receiving and Displaying)
3. Promotion
4. Selling

As an example the context diagram of handling processes can be seen in Figure 2, which basically consists of two main activities, i.e. receiving and displaying. The handling processes can be detailed into main activities, such as: receiving goods from the warehouse, packing fresh foods, renewing item prices, printing price tags, adding price tags into goods, checking for empty shelves and displaying the items.

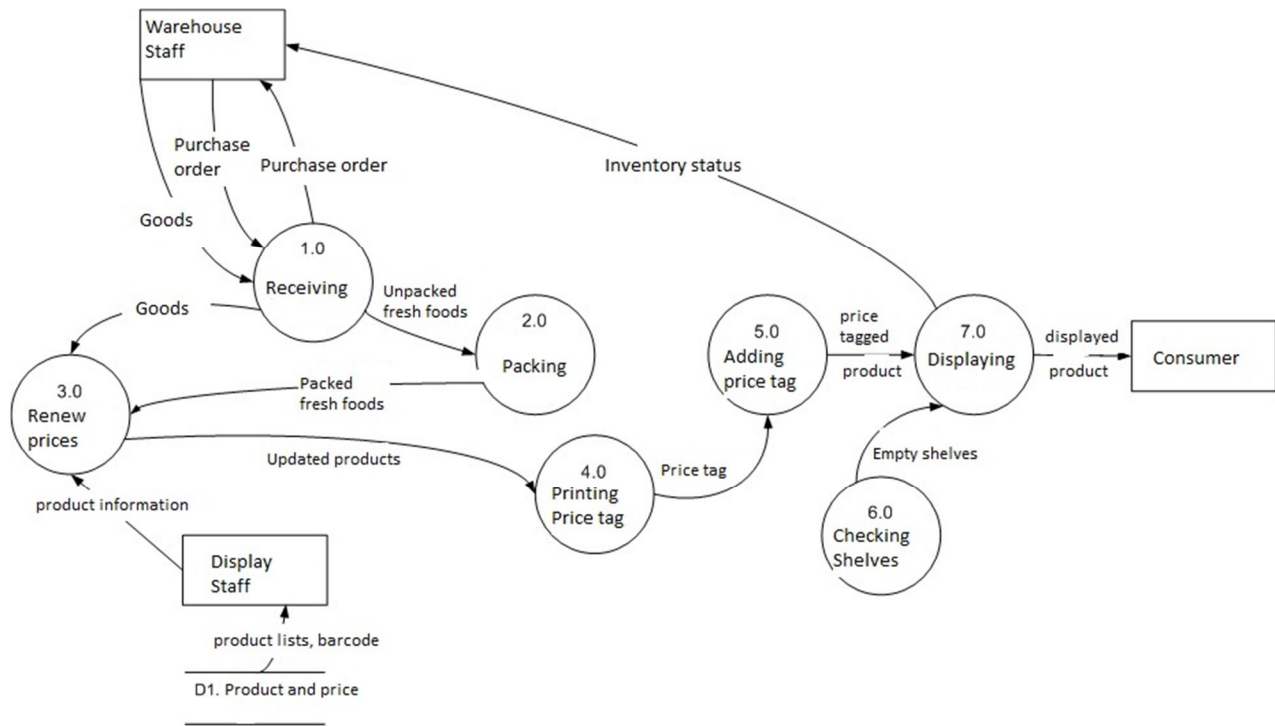


Figure 2. Handling Flow Diagram

3.1 Implementing SCOR Model

Each category of main processes in the chain is presented in a context diagram in Level 1. The context diagrams are then decomposed to their respective data flow diagrams, corresponding with Level 2 in SCOR metrics. The following Table 1 shows an illustrative example of SCOR Level 1 metrics.

Table 1. Metric SCOR Level for Procurement Process

Process	Metriks level 1	Performance Attribute				
		Customer facing			Internal -Facing	
		Reliability	Responsiveness	Flexibility	Cost	Asset
Procurement	Checking inventory status	√		√		
	Making purchase order	√				
	Contacting supplier	√	√		√	
	Printing purchase order	√			√	

The second phase in this process is to determine the performance metrics. In total, there are 27 activities in the Supermarket and for each activity there can be several performance metrics. Table 2 shows the second level of the procurement process and its corresponding metrics.

Table 2. Performance Metrics for Procurement Process

Activities		Performance Metrics	Unit
Level 1	Level 2		
Checking inventory status	Receiving lists from each department	Percentage of minimum inventory	%
	Categorizing all products based on the supplier lists		
Making purchase order	Input name, type, and quantity for each product	Percentage of no error made	%
Contacting supplier	List all orders based on the supplier	Percentage of quantity approved by supplier	%
	Contacting all suppliers		
	Making calls and agreement with suppliers	Phone calls bills	Rupiah
Printing purchase order	Printing purchase order	Printing costs	rupiah
		% of error made in the list	%

3.2 Implementing of AHP

The following process referred as Analytical Hierarchy Process (AHP) is used to determine the importance of each performance metrics. The weights obtained from AHP is then used to calculate overall performance score. AHP uses four steps in the process, namely: modeling the hierarchy, creating pairwise comparison matrices, calculating weight for each criteria, and evaluating the decision maker's consistency (Saaty, 2008). A questionnaire followed by structured interviews is used to gather information on the decision maker's view on all processes. Table 3 shows the weight for the main processes, which shows that procurement, receiving and displaying are the most important processes in Supermarket X. We then follow the same steps for the next levels for each activities.

Table 3. Importance of main processes

Process	Weights
Procurement	0,352
Receiving	0,289
Displaying	0,171
Selling	0,133
Promotion	0,056

Improvement priorities are developed based on the ideal and actual scores of the performance matrices. Ideal scores are defined by Supermarket itself as target values for all processes. Actual scores are collected from field observations using the same sheets as the ideal scores. Table 4 shows the gaps between ideal scores and actual situations, which shows rooms for improvement.

Table 4. Gaps of ideal and actual scores

Process	Overall scores		Overall gaps	Weighted gaps
	Ideal	Actual		
Source (Procurement and Receiving)	10,000	8,723	1,112	0.717
Make (Displaying)	5,000	3,965	1,232	0.210
Deliver & Return (Selling)	5,000	3,081	1,919	0.255
Plan (Promotion)	5,000	2,488	2,512	0.140

From Table 4, it can be shown that actual situations needs to be improved for a better Supermarket X, in particular the main process **Source**. The Source process becomes the highest priority because the Procurement and Receiving activities account for more than 60% of weights for main processes.

Further analysis on Supermarket X shows that in the Source category, 10% of goods received are far below the Supermarket's quality standard. The problem exacerbates when only 70% of the Supermarket's quantity order can be met by its suppliers. The problem arises because suppliers do not have enough inventory to meet the Supermarket's demand. It is therefore necessary to select better suppliers with whom Supermarket X can make long term contracts.

4. SUMMARY

The SCOR and AHP models can be integrated in attempt to measure the performance of a company. A comprehensive model takes into account not only sales measures, but also strategic as well as operational measurement. The resulting model can provide a holistic approach for the company to improve its operations in the supply chain. The SCOR model, as a referenced model, enable the company to describe its business processes systematically using concepts in supply chain management. In order to understand the manager's view about the level of importance for each processes, the analytical hierarchy model (AHP) can be used. In other words, the integration of both models helps the manager to systematically analyze and improve its performance.

We have shown that the SCOR and DFD models can be used as referenced models to describe supply chain processes in a supermarket. We propose a set of performance metrics to Supermarket X and use it to analyze its supply chain performance. The analytical hierarchy process (AHP) is then used to get better understanding on the decision maker's views on its supply chain. Supermarket X considers that Source is the most important process in the supply chain. It is recommended that Supermarket X uses the proposed models, together with visual information tool to monitor, evaluate, and improve its performance. In particular, we propose that Supermarket X considers to redesign its supplier relationships.

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