Study of Distribution System Using SCOR Model

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***Abstract*: Managing supply-chain operations is critical to any company's ability to compete effectively. The supply chain has traditionally been managed as a series of simple, compartmentalized business functions. It was driven by manufacturers who managed and controlled the pace at which products were developed, manufactured and distributed. In recent years, however, customers have forced increasing demands on manufacturers for options, styles, features, quick order fulfillment and fast delivery. Success for many companies now depends on their ability to balance a stream of product and process changes with meeting customer demand for delivery and flexibility. Optimally managing supply-chain operations has therefore become critical to compete effectively in the global marketplace. One of the most interesting and important of these recent developments is SCOR (Supply Chain Operations Reference Model). The SCOR isolates key supply-chain management processes and matches their process elements against industry-specific best practices, benchmarking performance data, and appropriate software applications, providing users with a framework for understanding where they need to make improvements. This paper presents a case study in which SCOR model is used to find out the performance of the distribution system of an industry, in this process the model is built, simulated using Arena whose outputs are used to calculate performance.**

***Key words*: SCOR, Distribution system, Simulation**

I. INTRODUCTION:

Increasingly, firms are adopting supply-chain management (SCM) to reduce costs, increase market share and sales, and build solid customer relations. SCM can be viewed as a philosophy based on the belief that each firm in the supply chain directly and indirectly affects the performance of all the other supply chain members, as well as ultimately, overall supply-chain performance.

The effective use of this philosophy requires that functional and supply-chain partner activities are aligned with company strategy and harmonized with organizational structure, processes, culture, incentives and people (Abell, 1999). Additionally, the chain-wide deployment of SCM practices consistent with the above-mentioned philosophy is needed to provide maximum benefit to its members.

The Supply-Chain Operations Reference (SCOR) model was developed by the Supply-Chain Council (SCC) to assist firms in increasing the effectiveness of their supply chains, and to provide a process-based approach to SCM. The SCOR model provides a common process oriented language for communicating among supply-chain partners in the following decision areas: PLAN, SOURCE, MAKE, and DELIVER. Recently, the details for the decision area of "RETURN" have been added to the SCOR Version 5.0 model.

The SCOR isolates key supply-chain management processes and matches their process elements against industry-specific best practices, benchmarking performance data, and appropriate software applications, providing users with a framework for understanding where they need to make improvements. SCOR builds on the concepts of business process reengineering, benchmarking, and process measurement by integrating their techniques into a cross-functional framework that addresses management issues at the enterprise rather than at the functional level.

It provides companies with powerful tool in improving supply chain operations.

SCOR is designed to enable companies to communicate, compare and develop new or improved supply-chain practices from companies both within and outside of their industry segment. Its key components are:

- Standard descriptions of the process elements that make up complex management processes.
- Benchmark metrics used to compare process performance to objective, external points of reference.
- Description of best-in-class management practices.
- Mapping of software products that enable best practices.

II. LITERATURE REVIEW:

Many analytical and numerical models, stemming from conventional business and engineering principles, have been proposed to handle supply chain operational and design issues (Chopra and Meindl, 2001).In contrast, models for strategic decisions, which need to deal with the entire supply chain as a whole, are scarce. Samuel H. Huang, Sunil k. Sheoran and Ge Wang briefly reviewed the SCOR model, analyzes its strength and weakness, and proposes some enhancements.

The SCM research literature provides significant insight on the role of planning in facilitating the effective management of supply chains. For example, one area of SCM research focuses on planning the design and configuration of the supply chain to achieve competitive advantages (Vickery et al., 1999) This area of research corresponds to P1 in Level 2 of the Supply-Chain Operations Reference Model. Another SCM research area revealed in the literature review is the necessity for supply chain information technology (IT) to foster information sharing (Chandrashekar and Schary, 1999), supply chain competitiveness (Narasimhan and Kim, 2001). This literature suggests that the effective use of supply chain IT can have a dramatic impact on each of the four decision areas provided in SCOR Model Version 4.0 (Plan, Source, Make, Deliver).

The literature review also revealed the importance of partnership planning activities for collaborating among supply chain partners (Corbett et al.,1999; Narasimhan and Das,1999; Raghunathan, 1999), coordinating the supply chain (Kim, 2000). This literature also corresponds to each of the four decision areas provided in SCOR Model Version 4.0. Finally, the literature highlights the need for overall strategic supply chain planning to facilitate customer and supplier integration, effective order fulfillment and inventory management (Viswanathan and Piplani, 2001).

III. METHODOLOGY:

The actual methodology going on is development of a Simulation Model for the Distribution System (Figure1) in a Supply Chain.

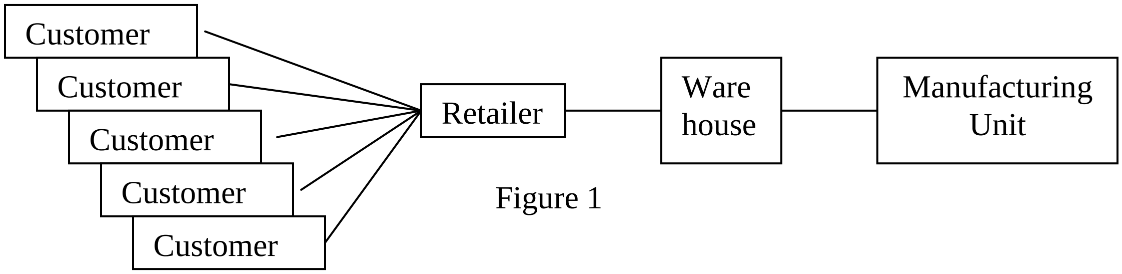
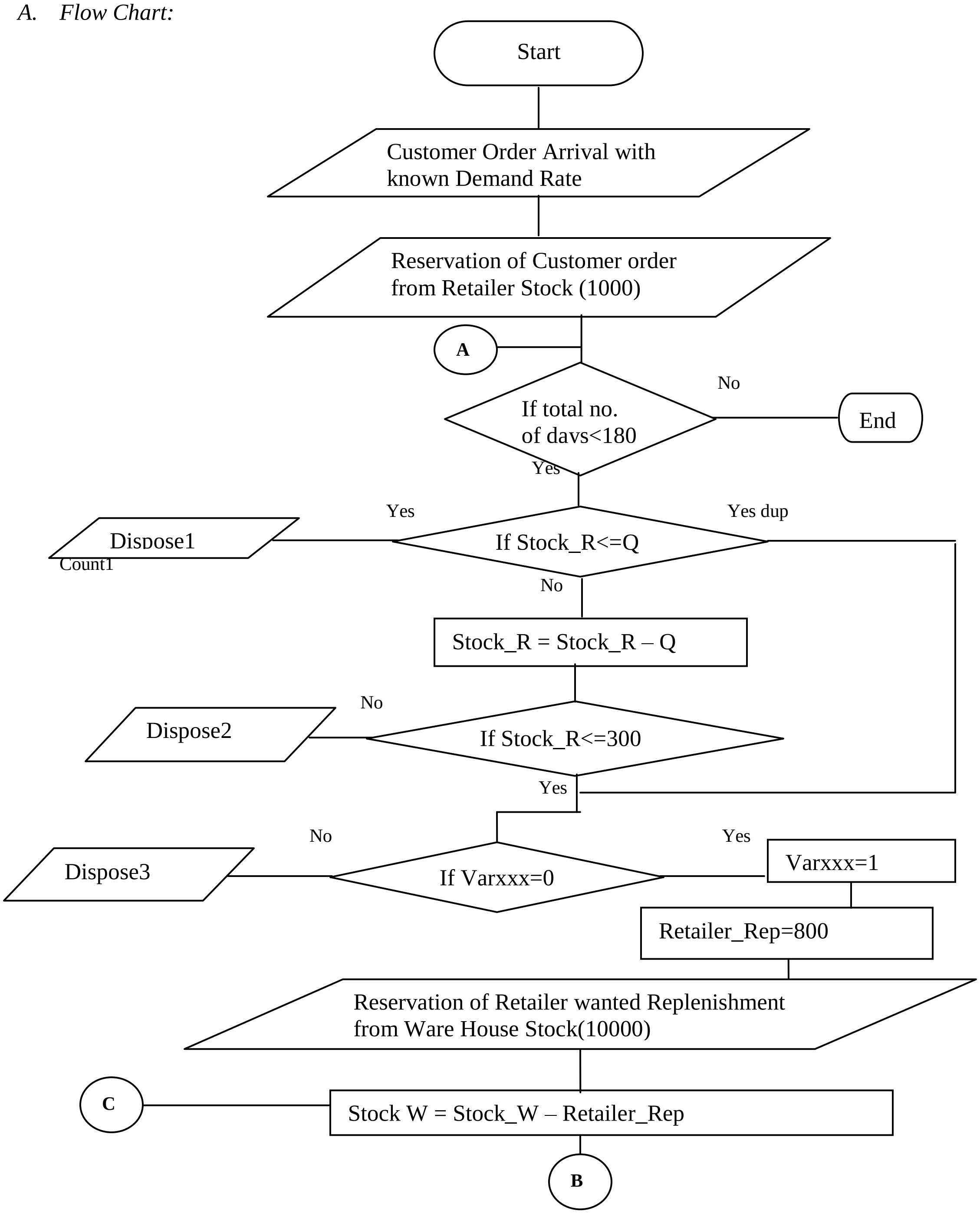


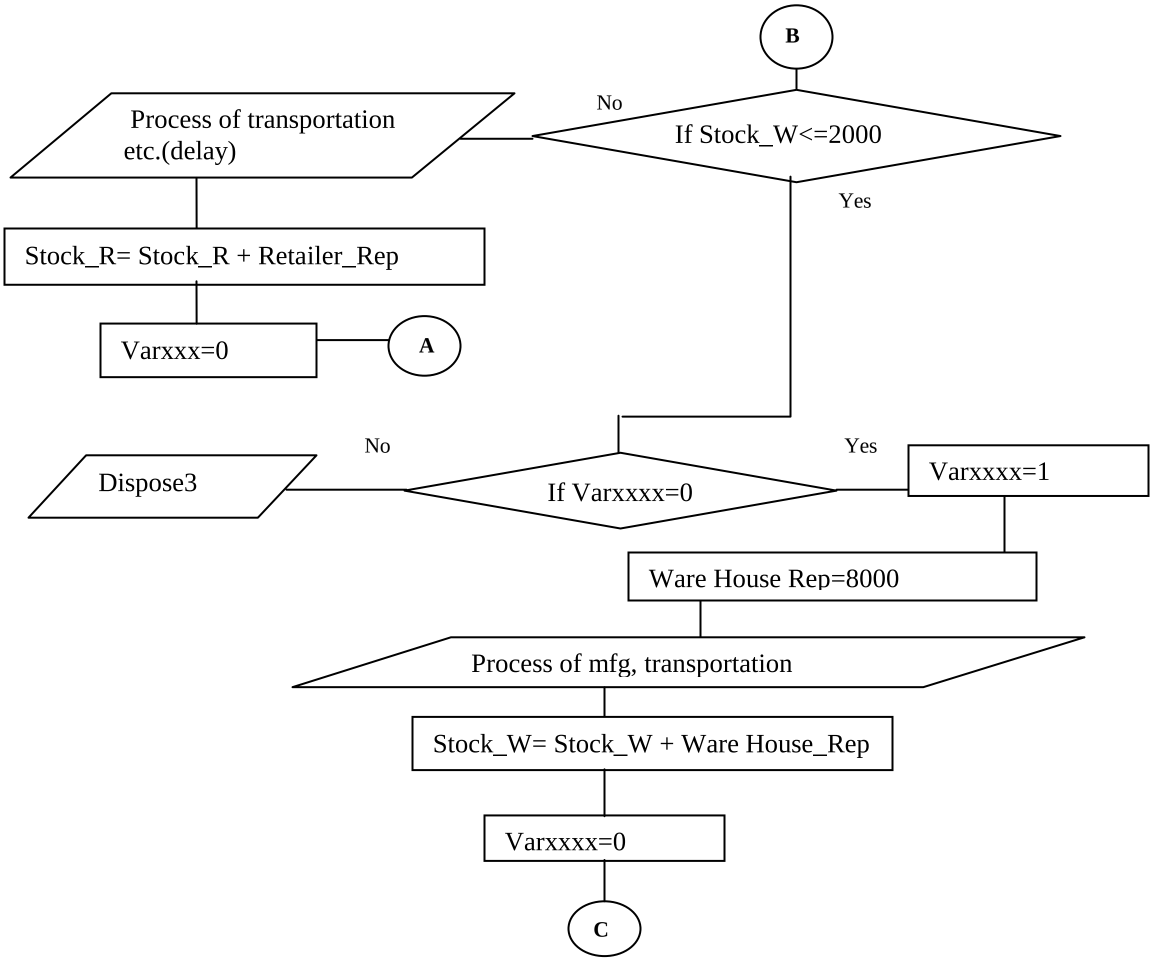
Figure 1

This paper presents a case study in which SCOR model is used to find out the performance of the distribution system of an industry, in this process the model is built, simulated using Arena whose outputs are used to calculate performance. In the preliminary model, a distribution system with 5 customers, 1 retailer, 1 ware house, single product and with a total cycle time of 6 months is considered. In that model a condition was introduced, that is only single order is served at a time either the order is from retailer to ware house or from ware house to manufacturing plant. Only after fulfillment of one order the next order is taken into service. The simulation model is done in the ARENA 7.0 simulation package.

The model is described by the following flow chart. The flowchart starts with customer order arrival. The customer order is placed with his required demand rate i.e., quantity required and interval between 2 successive orders. Here interval is considered as one day and quantity per day varies from 0-100 and is generated randomly by uniform distribution. When ever retailer gets the order from customer he reserves the stock and checks whether there is enough stock to fulfill the order. If stock at retailer is less than the order quantity then any customer arriving at that time has to wait to get his order fulfilled. So the number of customers who have to wait for their order are calculated as one of the outputs. If stock at retailer is more than the order quantity stock remains as (stock-quantity ordered), and then the stock is checked for the minimum safety stock level. Here it is considered as 300 and initial stock is considered as 1000 units. If the stock <= 300 then the retailer goes for replenishment order from a ware house or else disposes. Then the logic is prepared for the single replenishment order ware house service at a time. The logic is, first a variable varxxx is considered as 0 then it becomes 1 when ever it goes through replenishment order. During this process if any other order comes for replenishment service then the condition i.e. “only if varxxx==0” won’t allow it to pass until the varxxx value becomes zero which is given at the end of replenishment cycle of an order. Then a retailer replenishment of 800 units of product is processed for each retailer’s replenishment order. Each replenishment involves in some delay in terms of transportation, loading/unloading times etc. Then the stock at retailer becomes stock+800. This is the cycle of customer retailer and warehouse. In the same manner we consider the retailer warehouse and manufacturing plant as the extended cycle of the previous one. Instead of retailer replenishment order, ware house replenishment order is fulfilled in the next extended cycle. Initial stock at ware house is considered as 10000 units (ware house capacity), a safety stock is considered as 2000 units. When ever stock goes less than safety stock, a replenishment order is made to mfg plant. Then here also, only single replenishment order is served at a time using the same logic. The ware house replenishment is considered as 8000 units of product, continued in some delay in terms of manufacturing, transportation time etc(lead time). Then ware house stock becomes stock+8000. In this way the cycle repeats for a period of 6 months.

A. Flow Chart:


Start
Customer Order Arrival with
known Demand Rate
Reservation of Customer order
from Retailer Stock (1000)
A
No
If total no.
of days<180
End
Yes
Yes
Yes dup
Dispose1
Count1
If Stock_R<=Q
No
Stock_R = Stock_R – Q
No
Dispose2
If Stock_R<=300
Yes
No
Yes
Dispose3
If Varxxx=0
Varxxx=1
Retailer_Rep=800
Reservation of Retailer wanted Replenishment
from Ware House Stock(10000)
C
Stock W = Stock_W – Retailer_Rep
B



B. Results:

Delivery performance:-Percentage of orders delivered on time with respect to the total number of orders delivered. 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. It affects the balance sheet on accounts receivable.

Various inputs are given to the arena model as customer demand, various delay periods for the processes as loading/unloading, transportation, and manufacturing etc.

Count1 is one of the outputs we get, which indicates the number of customers for whom delivery did not take place on time, in full.

Finally we calculate the result from the output we have got as

Delivery performance = percentage of orders delivered "on time and in full"

= orders delivered "on time and in full"/total orders*100.

= (total orders-count1)/total orders*100.

= (181*5-31)/(181*5)*100 = 96.57.

IV. CONCLUSION:

In this paper an attempt is made to build a model for distribution system of a supply chain using Arena which follows SCOR model. Simulation using Arena is very realistic and provides very good results. This model considers a distribution system with 5 customers, 1 retailer, 1 ware house, single product and with a total cycle time of 6 months. This can be further expanded considering all realistic situations of a supply chain.

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