Chapter 23
Stochastic Modeling of Supply Chain Management Systems

C. Elango
Cardomam Planters' Association College, India

ABSTRACT

Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements. Supply Chain Management (SCM) is the practice of coordinating the flow of goods, services, information and finances as they move from raw materials to parts supplier to manufacturer to wholesaler to retailer to consumer. This chapter introduces the concept of Supply Chain Management System(SCMS). Two stochastic modeling problems are discussed in this chapter. Poisson demand process with (s,S) installation policy at retailer nodes are assumed to simplify the study . The system performance measures are computed with reference to specific cost structure. The total average annual variable cost is taken as optimization criterion. Numerical examples are provided to illustrate the problem.

INTRODUCTION

Our growing global economy has caused a dramatic shift in inventory management in recent years. Now, as never before, the inventory of many manufacturers is scattered throughout the world. Even the inventory of an individual product may be dispersed globally.

A manufacturer's inventory may be stored initially at the point or points of manufacture (one echelon of the inventory system), then at national or regional warehouse (a second echelon) then at field distribution centers (a third echelon), and so on, thus, each stage at which inventory held in progression through a multistage inventory system is called multi-echelon inventory system. In the case of a fully integrated corporation that both manufactures its products and

sells them at the retail level, its echelons will extend all the way to its retail outlets.

Some co-ordination is needed between the inventories of any particular point at the different echelons. Since the inventory at each echelon(except the last one)is used to replenish the inventory at the next echelon as needed, the inventory level currently needed at an echelon is affected by how soon replenishment will be needed at the various locations for the next echelon.

The analysis of multi-echelon inventory system is a major challenge. However, considerable innovative research (tracing back to the middle of the 20th century) has been conducted to develop tractable multi-echelon inventory models. With the growing prominence of multi-echelon inventory systems, this undoubtedly will continue to be an active area of research.

Another key concept that has emerged in the global economy is that of supply chain management. This concept pushes the management of multi-echelon inventory system one step further by also considering what need to happen to bring a product into inventory system in the first place. However, as with inventory management, the main purpose still is to win the competitive battle against other companies in bringing the product to the customers as promptly as possible.

SUPPLY CHAIN

A **supply chain** is a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and finally deliver the products to customers through a distribution system that includes as (probably multi-echelon) inventory system. Thus, a supply chain spans procurement, manufacturing, and distribution. Since inventories are needed at all these stages, effective inventory management is one key element in managing supply chain. To fill orders efficiently, it is necessary to understand the linkages and inter-relationship of all the key elements of supply chain. Therefore, integrated management of the supply chain has become a key success factor for some of today's leading companies. The Hewlett-Packard was one of the early pioneers in using operation research to help implement effective supply chain management throughout the corporation.

To aid in supply chain management, multi-echelon inventory, models now are likely to include echelons that incorporate the early part of the supply chain as well as the echelons for the distribution of the finished product. Thus the first echelon might be the inventory of raw materials or components that eventually will be used to produce the product. A second echelon could be the inventory of sub assemblies into the final product. This might then lead into the echelons for the distribution of the finished product, starting with storage at the point or points of manufacture, then at national or regional warehouses, then at field distribution centers, and so on.

The usual objective for a multi-echelon inventory model is to coordinate the inventories at the various echelons so as to minimize the total cost associated with the entire multi-echelon inventory system. This is a natural objective for a fully integrated corporation that operates this entire system. It might also be a suitable objective when certain echelons are managed by either the suppliers or the customers of the company. The reason is that a key concept of supply chain management is that a company should strive to develop an informal partnership relation with its suppliers and customers that enables them jointly to maximize their total profit. This often leads to developing mutually beneficial supply chain contracts that enable reducing the total cost of operating a jointly managed multi-echelon inventory system.

The analysis of multi-echelon inventory models tends to be considerably more complicated than those for single-facility inventory models. Supply Chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these

14 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/stochastic-modeling-supply-chain-management/42268

Related Content

Examining Teachers' Use of Learning Information Systems (LIS) of the Basic Education Schools in the Philippines Using Structural Equation Modeling

Junrie Matiasand Jesterlyn Quibol Timosan (2021). *International Journal of Enterprise Information Systems (pp. 69-84).*

www.irma-international.org/article/examining-teachers-use-of-learning-information-systems-lis-of-the-basic-education-schools-in-the-philippines-using-structural-equation-modeling/268363

Patterns for Organizational Modeling

Manuel Kolpand Stéphane Faulkner (2007). *International Journal of Enterprise Information Systems (pp. 1-22).*

www.irma-international.org/article/patterns-organizational-modeling/2122

Organization Identity: The Business Model

Carlos Páscoa, Pedro Lealand José Tribolet (2012). *Organizational Integration of Enterprise Systems and Resources: Advancements and Applications (pp. 100-116).*

www.irma-international.org/chapter/organization-identity-business-model/66974

Evaluating ERP Implementation Choices Using AHP

S. Parthasarathyand N. Anbazhagan (2007). *International Journal of Enterprise Information Systems (pp. 52-65).*

www.irma-international.org/article/evaluating-erp-implementation-choices-using/2125

Towards E-Government Information Platforms for Enterprise 2.0

Mário Rodrigues, Gonçalo Paiva Diasand António Teixeira (2014). *Handbook of Research on Enterprise 2.0: Technological, Social, and Organizational Dimensions (pp. 644-664).*

www.irma-international.org/chapter/towards-e-government-information-platforms-for-enterprise-20/81130