Chapter 2
Strategic Issues of Supply Chain Design and Management

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ABSTRACT

A supply chain (SC) is composed of different facilities and also their definite roles with the aim of delivering goods or services to the customer in an effective way. Obviously the physical structure of each SC has an important role in its performance. In this chapter, the authors aim to describe SC network (SCN) design definition, classification and related issues to this subject, models and solution methods. At the end, the conclusion is provided.

1. INTRODUCTION

In recent years, SCN (SCN) design problem has become an important issue due to the global competition. The globalization of economic activities together with fast developments in information technologies have led to growth of demand uncertainty and also to a very dynamic customer behavior in terms of their preferences. As a result, a robust and well designed SCN is needed for companies (Melo et al., 2007).

SCN design focuses on strategic decisions including number, location, capacity and mission of the production–distribution facilities and also the selection of suppliers, subcontractors and 3PLs in order to deliver goods or services to a predetermined, but possibly evolving, customer base (Altiparmak et al., 2006).

SCN is used for a long planning horizon while its related strategic decisions are made at first and also under uncertainty. The suitable SCN design needs the prediction of day-to-day amount of procurement, production, warehousing, storage, transportation and demand with their related costs, revenues and service levels. The choice

of performance metrics to assess the quality of network designs is another important challenge.

In order to determine the effectiveness of the SC and / or its efficiency, two types of quantitative and qualitative performance measures are defined. Quantitative performance measures classified into two groups: first group is based on cost or profit such as minimizing costs, maximizing sales and maximizing profits. The second group is based on the measurement of responsiveness to customer such as fill rate maximization, reducing customer response time, reducing delays. Quality performance measures are also defined as effective risk management, customer satisfaction and flexibility.

Generally, SCNs are composed of five main entity types: (i) suppliers, (ii) manufacturers, (iii) distribution centers (DC), (iv) demand zones and (v) transportation assets.

The following questions are the main strategic ones used in SCN design problem (Klibi et al, 2010):

- Which markets should we target?
- What delivery time should we consider in different product markets and at what price?
- How many manufacturers and DCS should be used and where should they be located?
- Which activities should be outsourced?
- Which partners should we choose?
- What production, storage and handling technologies should we use?
- How much capacity should we consider?
- Which products should be produced / stocked in each location?
- Which manufacturer, DC and demand zones should be supplied by others?
- What types of transportation should be used (public carrier, 3PL . . .)?

Wide range of SCN design problems formulations have been in the literature varying from simple single-product kind to complex multi-

product type, and from linear deterministic kind to complex non-linear uncertain type (Jun & Shen, 2007).

2. SCN DESIGN LITERATURE

SCN design problems have been studied for many years by researchers. Here a kind of classification has been suggested for its optimization models (Hübner, 2007):

- **Geographical:** Two kinds of models can be defined in this category: Global (G) and Domestic (D). In Global models, different layers of a SC are placed in different regions and the international trade issues such as tariffs and exchange rates should be considered in the modeling while in domestic models, all of the chain's layers are placed in one region and therefore there is no need to consider the above-mentioned issues.
- **Objective function:** Two kinds of classification can be considered here: Single objective models (C or P) and Multi objective models (M). The first group considers either cost minimization (C) or profits maximization (P) separately and the second group considers multiple objectives such as costs and lead times simultaneously.
- **Products:** Material flow of a single product is considered in the single-product SCN design problems (S). But multi-product models (M) consider the production process of several different goods.
- **Time horizon:** Single-period models (S) optimize a model during a period of time without considering temporal changes but Multi-period models (M) consider changes throughout the different time periods during a planning horizon.

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