# Chapter 9
# Sustainable Value Enhancement in Closed Loop Supply Networks

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## ABSTRACT

*Closed-loop supply chains (CLSC) deal with integrating product returns into the total supply chain over the lifecycle of the product, thereby recovering a maximum amount of value. In this chapter, the CLSC is studied through quantitative models at three levels. The study at the first level analyses a generic closed loop strategic framework under various scenarios, capturing the implementation maturity of CLSC. In the second level, a quantitative model for multi stage integrated forward and reverse logistics network is analyzed. Finally in the third level of study, a microscopic view is taken in which a joint economic order quantity (EOQ) and economic production quantity (EPQ) model is studied to optimize value by using proper mix of newly purchased components /products with recycled components /products. The final control parameters may be utilized by policy makers, CLSC network designers or practicing managers for effective decision making and coordination.*

## 1.0 INTRODUCTION

### 1.1 Closed Loop Supply Chain: Background

Since the term SCM first appeared in the literature more than twenty years ago (Oliver and Webber 1982) numerous academics, practitioners, and professional organizations have offered definitions. These SCM definitions are a disparate set of descriptions. Some definitions offer a narrow, functionally based perspective (e.g., '"SCM is the management and control of all materials and information in the logistics process from acquisition of raw materials to delivery to end user" (Gibson, Mentzer and Cook 2005). Others define SCM broadly e.g.. "SCM is the integration of business processes from end user through original suppliers that provides products, services, and information that add value for customers" (Lambert 1994).

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The boundaries and relationships enclosed by Supply Chain Management can be viewed as an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance, and information technology.

CSCMP defines Logistics Management as that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements. Thus the activities related to logistics are contained in that of supply chain management.

Reverse logistics includes all of the activities that are mentioned in the definition above. The difference is that reverse logistics encompasses all of these activities as they operate in reverse. Therefore, reverse logistics can be thought as:

*The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.*

In a forward supply chain, the customer is typically the end of the process. However, a closed loop supply chain includes the returns processes and the manufacturer has the intent of capturing additional value and further integrating all supply chain activities. Therefore, closed loop supply chains include traditional forward supply-chain activities and the additional activities of the reverse supply chain. These additional activities include product acquisition to obtain the products from the end-users, backward logistics to move the products from the points of use to a point(s) of disposition, testing, sorting, and disposition to determine the product's condition and the most economically attractive reuse option: direct reuse, repair, remanufacture, recycle, or disposal, and remarketing to create and exploit markets for refurbished goods and distribute them. Reverse logistics encompasses logistics activities such as network design, information flow, transportation, inventory, warehousing, material handling, and packaging all the way from products no longer required by the last user to products again usable in a market (Fleischmann, 1997).

After ensuring delivery of the product to the customer, average supply chain manager 'refuses' to think about product's eventual return. All or part of the product is likely to become the responsibility of the manufacturer, distributor or retailer, once again, at some stage during the product's life cycle. While some actors in the supply chain have been forced to take products back, others have pro-actively done so, attracted by the value in used products. Hence the approach to the concept of closed loop supply chain can be broadly two types (Rogers and Tibben-Lembke 1998). It could be looked at with the problem perspective leading to reactive approach as anything that is returned must have some problem associated with it. This generates 'exception driven processes' in an organization. On the other hand one could take the differentiator perspective on the closed loop supply chain giving rise to operational and strategic approach. Such approach would create practices and policies providing sustainable competitive advantage to an organization. Thus one way or the other, Reverse Logistics has become a key competence in modern supply chains.

Today, many business enterprises use substantial capital assets in the form of electronic equipment (*e.g.*, laptops, personal computers and workstations) in large quantities. The estimate for average comput-