

# Chapter 6

## Economic Impacts of Closed-Loop Supply Chains

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### ABSTRACT

*Closed-loop supply chain management has begun to gain more importance in recent years due to increased environmental concerns, reduced natural resources, and legal regulations. In addition, with the shortening of product life cycles, the rate of returning products is increasing day by day. Therefore, businesses are trying to find ways to get more value from these returning products. Here, the closed-loop supply chain (CLSC), which comes into effect at this point, refers to the design, operation, and control of the system to ensure maximum value from returning products of different breeds and quantities. Recycling these returned products by different methods will provide significant savings in terms of both the production costs by providing return of the economically valuable materials to the economy as an input and the waste disposal costs by reducing the amount of waste. This chapter investigates the concept of closed-loop supply chain and its benefits to the businesses.*

### INTRODUCTION

With the tightening of environmental regulations, the increasing volume of waste, and the concentration of recycling of used products for the economy, the concept of a closed loop supply chain has begun to gain importance. Closed loop supply chain refers to the design, operation and control of the system to ensure maximum value from returning products of different breeds and quantities over time (Guide & Wassenhove, 2009). In short, this concept is expressed as systems in which forward and reverse supply chain structures work integrally (Talbot, Lefebvre, & Lefebvre, 2007; Guide, Jayaraman, & Linton, 2003a; Guide, Harrison, & Wassenhove, 2003b). Forward supply chain generally includes processes related to obtaining final products from raw materials and activities related to the delivery of these products to customers. Reverse supply chain includes the selection and implementation of the most appropriate

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recycling (repair, reproduction, recycling) option or disposal methods by collecting products from the end user (Govindan, Soleimani, & Kannan, 2015).

In a closed-loop supply chain network that takes forward and reverse flows together, the raw materials, parts and components procured from the suppliers are processed at the production facilities to obtain new products and these products are delivered to the customers. If the products delivered to the customers are no longer able to fulfill their functions or if they are not required, they will be returned or discarded. In the later stages, for those products returned, the most appropriate recovery option is determined or these products are properly disposed of. With the products obtained after the recovery, the customer's demands are met again. The products which are decided to be disposed of are destroyed and leave this cycle between the producer and the customer. As a result, the two main tasks of a closed loop supply chain are: Creating processes that create value which meets the needs of the customer (as it used to be). The second task is to collect the scrap products from the customers and try to find the best way to evaluate these products (Govindan & Soleimani, 2017). However, it is no longer easy for manufacturers who routinely plan forward flow activities to plan reverse flow activities, including collection, recovery and disposal of used products. Because, by including reverse logistics activities in the system, the process becomes more complicated and some additional costs (e.g., acquiring, transporting, remanufacturing) arise (Kumar & Malegeant, 2006). One of the main problems that can be encountered in forward and reverse logistics (RL) is how to integrate these two different distributions (Fleischmann et al., 1997). There are some important differences between RL and forward logistics. The most important difference is, while in forward logistics the production and distribution of a new product is considered, in RL the post-stage distribution of products used in RL, such as sorting, inspection, recycling, recovery, etc. is considered. That is, producers need to integrate both production and reproduction activities using raw materials purchased from their suppliers and recovered items from returning products. The flow in the opposite direction is not as planned and regular as the forward flow due to uncertainties about the quality, quantity and timing of the returning product (Jindal & Sangwan, 2014). In addition, it is relatively difficult to transport, store, and handle products that are returned in the reverse flow. It is becoming increasingly difficult to apply reverse flow for certain product groups, especially non-durable products (Kumar & Malegeant, 2006). Due to these differences between RL and forward logistics, it is quite difficult for an organization to include RL operations into its existing logistics structure.

In addition to these difficulties, there are many benefits to returning used products to the market. It is known that a remanufactured product uses 20% less material and 16% less energy and releases only 35% of greenhouse gas emissions released during the process of producing a new product (Jindal & Sangwan, 2014). As can be seen, CLSC practices contribute to the combined development of the environment and the economy by reducing resource use and amount of waste. Many businesses, such as Hewlett-Packard and Kodak, have discovered that the collection of used products improves significantly their prestige as well as causes significant reductions in production costs (Zhang & Ren, 2016). However, many of the businesses are not aware of the benefits that the CLSC will provide them (Kumar & Malegeant, 2006). Therefore, in order for the use of CLSC to be widespread, it is necessary to discuss the benefits of this concept for the organization. With this in mind, it is aimed to examine the CLSC concept and its benefits in this study.

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