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# Analysis of interactions among the barriers of reverse logistics

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## Abstract

The aim of this article is to analyze the interaction among the major barriers, which hinder or prevent the application of reverse logistics in automobile industries. A key task of top management is to diagnose those barriers of reverse logistics that could be crucial to the survival of the organization in the future. Existing models have focused on diagnosing these barriers independently. As a result, we lack a holistic view in understanding the barriers that hinder reverse logistics. This paper utilizes the Interpretive Structural Modeling (ISM) methodology to understand the mutual influences among the barriers so that those driving barriers, which can aggravate few more barriers and those independent barriers, which are most influenced by driving barriers are identified. By analyzing the barriers using this model, we may extract crucial barriers that hinder the reverse logistics activities. It can be observed that there are some barriers, which have both high driving power and dependency, thus needing more attention. An actual example of a small case automobile company provides some managerial insights into the methodology. Finally, the implications for practice and future research are discussed.
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## 1. Introduction

Supply chains are undergoing radical transformations due to the mega-competition taking place on a global scale. Technological changes are becoming a primary driver in the domain of businesses.

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Companies are finding that they must deal with a high level of uncertainty, which is not only technical in nature. It is being observed by companies that there is an increase in the flow of returns of the product due to product recalls, warranty returns, service returns, end-of-use returns, end-of-life returns, and so on. Reverse logistics stands for all the operations related to the reuse of used products, excess inventory of products and materials including collection, disassembly and processing of used products, product parts, and/or materials [1]. Economic, environmental or legislative reasons have also increased the relevance of reverse logistics in the present-day scenario. Many industries have adopted reverse logistics practices. Fleischmann et al. [2] review the case studies on logistics network design in different industries. Some industries have also engaged third parties for providing reverse logistics services. Krumwiede and Sheu [3] have dealt with a model for reverse logistics entry by third-party providers. Martino and Lenz [4] identify the major barriers that hinder the application of policy-relevant information, derived from analytical techniques, to practical decisions by actual decision makers. Ettlie [5] report a study of barriers, facilitators, and incentives to innovation among suppliers to the U.S. automotive industry. Veloso and Fixson [6] provide a new framework to analyze the decision of the automakers of whether to develop a new component in-house or to subcontract it to a supplier.

The concept of reverse logistics has received growing attention in the last decades, due to a number of factors. Competition and marketing motives, direct economic motives and concerns with the environment are some of the important of them. With the legislative measures tightening up, there are not many options left with the companies, but to go for reverse logistics practices. The implementation of these may be a risky endeavor for the top management as it involves financial and operational aspects, which determine the performance of the company in the long run. A critical analysis of the barriers hindering reverse logistics and their interaction with the various aspects in integrative planning can be a valuable source of information to decision makers.

The Indian automobile industry is flooded with automobile manufacturers like General Motors, Hyundai, Fiat, Honda, etc., setting up manufacturing bases in India. These industries invest a great deal of resources in terms of capital, labor, energy, and raw materials in delivering goods and services to customer. When the products complete their life cycle, an important question that remains to be answered is what would be the ultimate fate of these products. Thus, the reverse distribution of the process of bringing products from the retailer level through the distributor back to the supplier or manufacturer is an important factor, which needs consideration. The reverse logistics assumes tremendous importance in this context. Reverse logistics is extensively used in the automobile industry [7] and many other industries are following suit. However, the deployment of reverse logistics is not free from barriers. Some of these barriers are lack of systems, management inattention, financial resources, personnel resources, lesser importance of reverse logistics relative to other issues, and company policies [8]. The above-mentioned barriers not only affect the operations of reverse logistics but also influence one another. Thus, it is very essential to understand the mutual relationship among the barriers. The identification of the barriers that are at the root of some more barriers (called driving barriers) and those which are most influenced by the others (called driven barriers) would be helpful for the top management implementing the reverse logistics programs. This can be a guide for taking appropriate action to tackle barriers in reverse logistics.

Interpretive Structural Modeling (ISM) can be used for identifying and summarizing relationships among specific variables, which define a problem or an issue [9,10]. It provides us a means by which order can be imposed on the complexity of such variables [11,12]. Therefore, in this paper, the barriers of