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Rainer Kleber

Dynamic Inventory Management in Reverse Logistics

With 55 Figures
and 20 Tables

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Preface

Reverse Logistics is an area that has attracted growing attention over the last years both from the industrial as well as from the scientific side. The proper management of reverse flows of products and materials is of considerable importance in many industries because of its influence on economic performance and environmental impact. The respective management tasks, however, are connected with new challenging planning and control problems. This especially holds for product recovery management concerning remanufacturing operations where used products, after being returned to the manufacturer, are reprocessed such that they are as good as new and can be re-integrated into the forward logistics stream.

A major issue in remanufacturing is how to optimally coordinate the potential activities directed at meeting customer demands for serviceable products and to deal with returns of products after end-of-use. The respective decisions refer to finding a proper mix of manufacturing original and remanufacturing used products as well as of stock-keeping and disposing of returned items. Hereby, relevant cost impacts and time patterns of demand and returns have to be taken into consideration.

Up to now, research contributions to this field of Reverse Logistics have addressed only two main aspects that result in high complexity of decision making in product recovery management. One aspect is that of capacity restrictions and fixed costs in manufacturing and remanufacturing systems that makes coordination of lot-sizing a challenging problem. The second aspect refers to uncertainty of demands and returns that leads to complicated stochastic interactions which have to be coped with by appropriate decision rules and safety stock policies. While these issues are highly relevant for operational and tactical decision making, a third aspect with mainly strategic importance has largely been ignored. This is the aspect of time-variability and dynamic change of major input parameters for product recovery decisions. On the one hand, this refers to the variability of product demand and return schemes that can be observed both due to seasonality and the classical life cycle pattern for many product categories. On the other hand, over larger time spans we also

face specific cost dynamics caused by experience effects in manufacturing and remanufacturing processes.

It is the commendable contribution of this book that it sheds some light into this complicated field of how to respond most effectively to the dynamically changing environment in product recovery strategy. This response refers to choice of time-varying coordination strategies of manufacturing, remanufacturing and disposal activities as well as to the timing of investment decisions in product recovery technologies. Embedded in these considerations an analysis is developed of how and why to use different kinds of strategic inventories to enable best reactions to dynamic cost, demand and return processes. Based on advanced quantitative modeling and optimization techniques a deep analysis of the addressed complex dynamic decision problems is given.

Summarizing, this book presents major progress in scientifically investigating the field of complex problems of product recovery management induced by several types of dynamics in the planning environment. The underlying dynamic problem aspects are of enormous practical importance, but have not been addressed appropriately in research contributions before. By studying this book the reader will learn novel and interesting findings on how to respond strategically to ongoing changes of a product recovery environment by responsive recovery policies and dynamic inventory management.

Magdeburg, April 2006 *Karl Inderfurth*

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