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Lot sizing for imperfect production-remanufacturing processes with quality corrective interruptions and improvements*

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Abstract

Classical inventory models assume items produced and stocked to be of perfect quality. However, production and repair/remanufacture processes are not free of defects. Defective items generated from imperfect processes are reworked. This paper assumes that the production and remanufacturing processes are interrupted to restore quality to in-control state. This approach reduces the number of defective items. As in the literature, this paper considers a production environment that consists of two stocks; namely the serviceable stock (newly produced and remanufactured items), and the repairable stock (collecting used items for repair). This paper introduces the imperfect production and reworking concept in a reverse logistics context. Mathematical models are developed with numerical examples presented and results discussed.

Key words: Inventory; Reworks; Reverse Logistics; Reverse Supply Chain; Production/remanufacturing interruptions.

1 Introduction

The flow of products in supply chains is from upstream to downstream, i.e., from the supplier's supplier to the customer's customer. Shorter product life cycles and changes in customers' consumption behaviours resulted in faster generation of waste and depletion of natural resources. This enticed manufacturers to consider remanufacturing of used products to extend their useable lives, and thus, reduce waste and preserve natural resources. Economical incentives accompanied with governmental legislations mandated the implementation of product recovery (e.g., remanufacturing, repairing, recycling, etc) programs at many companies. These factors brought Reverse Logistics (RL) to become a new business term. RL manages the flow of returned used products from downstream to upstream. It is defined as the process of planning, implementing and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal [20]. Managing inventory in reverse logistics has been stressed in several studies. See [6], [4], [12] and [9].

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