Multi-product production quantity model with repair failure and partial backordering

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1. Introduction

Material is considered as one of the most important resources in any production system and management of inventory is playing an important role in increasing the profitability of an organization. In the last decades, there have been tremendous efforts by industries to reduce the cost of inventory. The primary concern on inventory management is to reduce the costs of setup and holding. Inventory management has direct relationship with maintaining market share since customers may switch to different vendors due to the shortage. When goods are produced internally, the economic production quantity (EPQ) model is employed to determine the optimal production lot size. The traditional EPQ model assumption does not consider defective items. Due to imperfect quality of raw materials and/or production facilities, rework and repair of the defective items are considered in this study. This study is significant because a number of production units such as printed circuit board assembly in the PCBA manufacturing, metal components, and plastic injection molding have rework items. In the last few years, considerable researches have been carried out by Cheng (1991), Goh (1992, 1994), Chiu, Chiu, and Wu (2003), Chung (1997), and Lee and Rosenblatt (1987) to address the imperfect quality EPQ problem. Rosenblatt and Lee (1986) proposed an EPQ model where the cost of imperfect items was part of total inventory expenditure. Hayek and Salameh (2001) derived an optimal EPQ policy with rework and imperfect quality items. They assumed that all defective items were repairable and shortage backorders were permitted. Numerous studies have been carried out to address the problems of imperfect quality EPQ model with rework (see, for example, Hayek & Salameh, 2001; Chiu, 2003, 2007; Chiu & Chiu, 2006; Jamal, Sarker, & Mondal, 2004; Ben-Daya, 2002).

In this paper, a production quantity model with random defective items, service level constraints and repair failure is studied. The aim of this research is to determine the optimal cycle length, optimal production quantity and optimal backordered quantity of each product such that the expected total cost (holding, shortage, production, setup, defective items and repair costs) is minimized. Two numerical examples and sensitivity analysis are provided to illustrate the practical usage of the proposed method. © 2010 Elsevier Ltd. All rights reserved.