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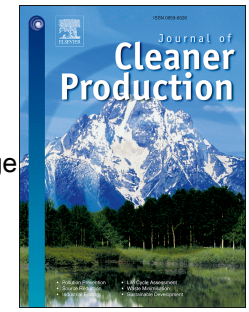

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Sustainable Economic Production Quantity Models for Inventory Systems with Shortage

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Abstract

Recently, new economic order/production quantity models have shifted away from focusing only on economic issues and towards combined economic-environmental concerns because of sustainable development goals. Despite this shift, only a few works have addressed sustainable Economic Production Quantity (EPQ). The theoretical sustainable EOQ and EPQ models are basic models that ignore many real-life conditions such as the possibility of stock-out in inventory systems. In this paper, we develop four new sustainable economic production quantity models that consider different shortage situations. To find optimal values of inventory system variables, we solve four independent profit maximization problems for four different situations. These proposed models include a *basic model* in which shortages are not allowed, and when shortages are allowed, the *lost sale*, *full backordering* and *partial backordering* models can be selected by operations managers depending on the manufacturer's motivation to improve service levels. We have also proposed an algorithm for determining optimum values of the decision variables for these sustainable economic production quantity models. Finally, the formulated models are explained with some different examples and the obtained results have been analyzed and discussed. These results show that the *sustainable economic production quantity with partial backordering* model is a general and more realistic model that can be used in many real cases with a reasonable profit amount, compared with the three other proposed models.

Keywords: Sustainable Economic Production Quantity Models, Shortage, Backordering, Inventory Management, Sustainable Development, Environmental Considerations

1. Introduction

For more than a century, the act of determining order quantity (or lot sizing) for a firm's requirements has been a primary consideration. As early as 1913 Harris developed a simple model for determining order quantity based on basic economic considerations (including holding and ordering costs) that was called an Economic Order Quantity (EOQ) model. Two years later, Harris (1915) presented a similar model that determines Economic Production Quantity (EPQ) and, in 1918, Taft proposed a similar formula for EPQ. Over the years, many models have been developed based on Harris' masterworks, but most of them merely

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