

# Inventory Control for Perishable Products and the Use of a New Technology<sup>★</sup>

Chaaben Kouki, Evren Sahin, Zied Jemai, Yves Dallery

*Laboratoire Génie Industriel, Ecole Centrale Paris,  
Grande Voie des Vignes 92295 Chatenay-Malabry Cedex, France*

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## Abstract

This paper analyzes the impact of perishability on the well known  $(r, Q)$  review policy. We first formulate an  $(r, Q)$  inventory model for perishables with fixed lifetime. The expected quantity of perished products, the expected shortage and the expected inventory level are derived and a closed form expression of the average total cost per unit time is obtained. Then, we develop a numerical analysis to illustrate the advantages of using the proposed policy compared to the classical  $(r, Q)$  policy which ignores the perishability of products. Finally, we study the benefits of using a Time Temperature Integrator which is a new technology that enables to increase the lifetime of such products.

*Key words:* Inventory control, Periodic review policy, Perishable products, Undershoot, Time Temperature Integrators.

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## 1 Introduction

Many inventory systems assume that products can be stored indefinitely to meet future demand. However in a large number of industrial sectors, products have a limited lifetime. Health care products and foodstuff, for examples, are produced to be consumed in a limited lifetime. Due to the specificity of such products, an effective inventory management can not ignore the effect of perishability. Among other types of products that are very sensitive to temperature and require special storage conditions in order to maintain their freshness, one may find meat, seafood products and prepared salad which require a low temperature conditions to ensure their safety and quality. Therefore, the lifetime of such products is sensitive to temperature and storage conditions in which the product is maintained. The Time Temperature Integrator technology (TTI) can be defined as a device that can easily evaluate and/or provide the shelf life or the remaining shelf life of products. This evaluation depends on the different temperature variations that affect the freshness of products. Actually, since this technology is not commonly used, supply chain actors are taking large margin of precautions while determining products' lifetimes. Therefore, in terms of supply chain improvement, a TTI can extend the lifetime of products by reducing the safety margin that producers take in order to determine products' expiry dates. Another benefit provided by TTI is the cost reduction associated with outdated quantity and stock outs. For details about the potential benefits of using TTI, interested readers are referred to the papers of Sahin [23] and Taoukis [25]. In spite of these

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*Email addresses:* [chaaben.kouki@ecp.fr](mailto:chaaben.kouki@ecp.fr) (Chaaben Kouki), [evren.sahin@ecp.fr](mailto:evren.sahin@ecp.fr) (Evren Sahin), [zied.jemai@ecp.fr](mailto:zied.jemai@ecp.fr) (Zied Jemai), [yves.dallery@ecp.fr](mailto:yves.dallery@ecp.fr) (Yves Dallery).