A delayed differentiation multi-product FPR model with scrap and a multi-delivery policy – I, using single machine production scheme

Yuan-Shyi Peter Chiu(1), You-Tsung Hsieh(1), Jyun-Sian Kuo(1), Singa Wang Chiu(2)*

(1)Department of Industrial Engineering & Management, Chaoyang University of Technology, Wufong District, Taichung City 413, TAIWAN
(2)Department of Business Administration, Chaoyang University of Technology, Wufong District, Taichung City 413, TAIWAN
Correspondence email: *swang@cyut.edu.tw

Abstract

This study examines a delayed differentiation multi-product single-machine finite production rate (FPR) model with scrap and a multi-delivery policy. The classic FPR model considers a single product, single stage production with all items manufactured being of perfect quality and product demand satisfied by a continuous inventory issuing policy. However, in real-life production-shipment integrated systems, multi-product production is usually adopted by vendors to maximize machine utilization, and generation of scrap items appear to be inevitable with uncontrollable factors in production. Further, distribution of finished products is often through a periodic or multi-delivery policy rather than a continuous issuing policy. It is also assumed that these multiple products share a common intermediate part. In this situation, the producer would often be interested in evaluating a two-stage production scheme with the first stage producing common parts for all products and the second stage separately fabricating the end products to lower overall production-inventory costs and shorten the replenishment cycle time. Redesigning a multi-product FPR system to delay product differentiation to the final stage of production, has been shown to be an effective supply chain strategy from an inventory-reduction standpoint. Using mathematical modeling, we derive the optimal replenishment cycle time and delivery policy. A numerical example is provided to demonstrate its practical usage and compare our result to that obtained from the traditional single-stage multi-product FPR model.

Keywords: finite production rate model, delayed product differentiation, two-stage production, multi-product system, common intermediate part, multi-delivery, scrap

p.s. 因授權疑慮 請逕自出版社網頁查詢。

*Singa Wang Chiu, Dept. of Business Administration, Chaoyang University of Technology, Taichung 413, Taiwan
*Correspondence: swang@cyut.edu.tw