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Postponement Strategies in Supply Chain Management

Springer

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Abstract

Postponement is a supply chain strategy that enables a supply chain to achieve both low cost and fast response by combining some common processes and delaying other product differentiation processes such as packaging and labeling. The point that separates the differentiation processes from the common processes is known as the point of product differentiation. Recent research studies have identified four common postponement strategies, namely pull, logistics, form and price postponements. They aim at balancing the costs and benefits of mass production and customization. In this book, four types of model are presented to evaluate the impacts of pull and form postponement strategies under various supply chain structures.

First, we develop two EOQ-based models to examine the impact of pull postponement. Then we develop some EPQ-based models to examine the impact of postponement. The third type of model is a stochastic model of a single end-product supply chain that consists of a supplier, a manufacturer and a number of customers. In the last type of model, we aim at conducting a simulation experiment of a two-end-product supply chain, for which customer demands are discrete and independent. Besides mathematical models, two case studies from industry are presented to support our theoretical results.

Keywords Supply chain management, Postponement strategy

Preface

Postponement strategy is one of the major supply chain management (SCM) practices that has a discernible impact on firms' competitive advantage and organizational performance. Postponement is a mass customization strategy that captures the advantages of both mass production and mass customization. Recent research studies have identified four common postponement strategies, namely *pull*, *logistics*, *form* and *price postponement*. The former three postponement strategies are linked to production and manufacturing, while the last one is a pure pricing strategy. They aim at balancing the costs and benefits of mass production and mass customization. Practical examples of postponement can be found in the high-tech industry, food industry and other industries that require high differentiation.

However, empirical studies have found that postponement may not be an evident SCM practice compared to the other practices. In addition, postponement has both positive and negative impacts on a supply chain. The advantages include following the JIT principles, reducing end-product inventory, making forecasting easier and pooling risk. The high cost of designing and manufacturing generic components is the main drawback of postponement. Thus, the evaluation of postponement strategy is an important research issue and there have been many qualitative and quantitative models for analyzing postponement under different scenarios.

The core of this book is to analyze how the pull postponement strategy and the form postponement strategy can be leveraged to yield substantial benefits to adopting firms in different competitive environments. This book is made up of seven chapters, the contents of which are outlined in the following.

In Chapter 1 we review the status of development of postponement. We begin with presenting a framework to link postponement with product variety, mass customization and quality. We then identify four types of postponement, followed by providing a review of the cost models for analyzing various postponement strategies. Finally, we present review of the literature pertinent to our model development.

In Chapter 2 we develop an EOQ-based model to examine the cost impact of the pull postponement strategy adopted by a supply chain that orders and keeps n end-products. We formulate a total average cost function for ordering and keeping the n end-products in a supply chain, in which their demands are known and deterministic. Using standard optimization techniques, we show that postponed customization of end-products will result in a lower total average cost and a lower EOQ. Furthermore, we develop an EOQ-based model with perishable items to evaluate the impact of item deterioration rate on inventory replenishment policies. Our theoretical analysis and computational results show that a postponement strategy for perishable items can yield a lower total average cost under certain circumstances.

In Chapter 3 we develop two EPQ-based models with and without stockout to examine the impact of postponement. We formulate the total average cost functions of the two scenarios for producing and keeping n end-products in a supply chain, in which their demands are known and deterministic. Using standard optimization techniques, we show that postponed customization of end-products results in a lower total average cost in certain circumstances. We also find that two key factors that influence postponement decisions are variance of the machine utilization rates and variance of the backorder costs.

In Chapter 4 we study the cost impact of the pull postponement strategy by comparing the total average cost function with the optimal or an approximately optimal total average cost of an (r,q) policy. This is a stochastic model of a single end-product supply chain that consists of a supplier, a manufacturer and a number of customers. We develop two distinct models to represent the inventory system of the manufacturer. We employ Markov chain analysis to determine the exact average inventory level and the exact average accumulated backorder per period at the steady state so that the total average cost can be evaluated analytically. Also, we design an algorithm to find a near optimal total average cost per period. Our results show that the postponement system is more cost effective when the lead-time is zero, while the (r,q) inventory system is more effective when the lead-time is greater than zero.

In Chapter 5 we conduct simulation experiments of a two-end-product supply chain, for which customer demands are discrete and independent. Customer demands follow a uniform, Poisson or normal distribution. Two simulation models, namely one is a postponement system while the other is a non-postponement system, are designed for comparing their performance and total cost after t periods. Given a set of (r,q) policies and a demand distribution, the postponement system outperforms the non-postponement system in terms of average order frequency, average on-hand inventory, average backorder and average fill-rate. Thus, this system provides some cost benefits when the net postponement cost is low.

In Chapter 6 we report on two case studies of applying postponement strategy in industry. The first case is a study of a Hong Kong based toaster manufacturing company, which has successfully implemented postponement strategy. We present a summary of how postponement strategy was implemented in its supply chain and elaborate on all the benefits arising from the implementation of postponement. We also discuss the implications of postponement for its supply chain. In the second case study we present an empirical analysis of the application of postponement strategy in Taiwanese information technology (IT) firms. We present the findings and discuss their managerial and practical implications.

In Chapter 7 we conclude the book and suggest some worthy topics for future research.

This book is intended for researchers in supply chain management interested in conducting in-depth studies on postponement strategy. The book is also intended for business practitioners seeking to understand the nature and law governing the working of postponement strategy and looking for guidance and decision support for the implementation of postponement strategy. Therefore, the book can be useful not only for researchers but also for practitioners and graduate students in operations management, management science, industrial engineering, and business administration.

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