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For more information, contact
MIT Global SCALE Network

Postal Address:
Massachusetts Institute of Technology 77
Massachusetts Avenue, Cambridge, MA 02139 (USA)

Location:
Building E40, Room 267
1 Amherst St.

Access:
Tel: +1 617-253-5320
Fax: +1 617-253-4560

Email: scale@mit.edu
Website: scale.mit.edu

Research Report: ZLC-2010-8
Postponement Strategies for Pharmaceutical Supply Chain
Sumeet Ladsaongikar and Roberto Martinez
For Full Thesis Version Please Contact:
Marta Romero
ZLOG Director
Zaragoza Logistics Center (ZLC) Edificio
Náyade 5, C/Bari 55 – PLAZA 50197
Zaragoza, SPAIN
Email: mromero@zlc.edu.es
Telephone: +34 976 077 605
Postponement Strategies for Pharmaceutical Supply Chain

By Sumeet Ladsaongikar and Roberto Martinez
Thesis Advisors: Prof. Beste Kucukyazici and Prof. Mustafa Cagri Gurbuz

Summary:
This thesis attempts to create and implement a structured approach for the decision to postpone the packaging decision at a later point in time in a global pharmaceutical company. The approach includes selection criteria for products that could show significant benefit thorough postponement. It also includes a simulation model that attempts to recreate the present and postponed inventory management scenarios.

Introduction
For the past several years there has been a significant proliferation in the number of Stock Keeping Units (SKUs) across most companies. This has been largely driven by severe competitive pressures in industry whereby in the quest for higher market share, companies have tried to capture niche customer segments. This trend is especially evident in industries such as consumer products, electronic goods, pharmaceuticals, and so on. As a result of this SKU proliferation, there has been a significant increase in supply chain complexity. Not only does manufacturing have to produce a larger variety of products but also overall inventory levels in supply chains have increased significantly with an increase in the number of SKUs. In the quest for market share, a large number of companies have thus significantly increased overall supply chain costs.

One of the ways to deal with increasing complexity of number of SKUs is the concept of postponement, a concept wherein companies can delay the differentiation of their product at a later stage in their supply chain. This would help companies respond to demand much faster as the overall lead-time for order fulfillment would reduce, the further one went downstream in the supply chain. Also, delaying differentiation could have the advantage of reducing overall inventory levels in the supply chain as generic “Sub-Assembly” or “Work in Process” inventory would be stored as opposed to Finished Goods inventory. This generic work in process inventory could be used for multiple finished products, thus reducing the level of Finished Goods Inventory required to maintain a specified service level. In this study, we have tried to study the application of postponement to the supply chain of a large global pharmaceutical company. In the pharmaceutical industry supply chain, country-specific government regulations and language specifications make it mandatory for pharmaceutical companies to have packaging that is customized for almost every country. In a global scale...
pharmaceutical company, this results in a huge increase in the number of SKUs. Also, given the nature of the pharmaceutical industry wherein the final product needs to be delivered with a very high service level, this phenomenon results in high inventory levels across the supply chain. In order to deal with this complexity, this thesis examines the applicability of the concept of postponement to this problem. The methodology used is as described in the following exhibit:

In the first phase of the study, the supply chain of the the sponsor company was studied. Inventory at the sponsor company could be categorized into three basic types:

i. Drug Substance (DS) Inventory – This is the preliminary stage of drug formation. This is the key active ingredient in the final drug.

ii. Drug Product (DP) Inventory - This is the primary dosage form in which the drug is manufactured. An example of a DP would be a 50 mg tablet of aspirin in a ready to consume form.

iii. FP (Finished Product) - This is the final stage of drug formation. Drug product packed in the appropriate package with the correct country specifications and instructions would constitute the Finished Product.

The material flows and inventory positions in the sponsor company in the present (AS-IS) and the postponed (TO-BE) scenario can be depicted as shown in the following exhibit.

In the present (AS-IS) scenario, Drug Product and Finished Product is manufactured based on a pull from the market and the finished product is stocked in the CPOs. In the postponed scenario, Drug Product would be stored in inventory at the factory and only packaging and delivery would be performed on market pull.

Product Selection Process

After getting an initial understanding of the sponsor company’s supply chain, criteria for selection of product was identified. The 5 criteria used for selection of products for postponement were as follows:

i. Number of SKUs in the product

ii. Dollar value of sales

iii. Safety Stock levels in the CPOs

iv. Contribution of the product to the total cost of goods sold

v. Increase in inventory value from the DP to the FP stage

An analysis of 200+ products with 500+ dosage forms was conducted with each of these 5 criteria to identify the products which would give the greatest possible benefit from postponement. Products which were in the top-quartile for each of the above criteria were selected for further analysis. Out of these selected products, one product was chosen for creation of a simulation model. The model was created for two purposes – to quantify the benefits from postponement and to perform sensitivity analysis for variation in key input parameters.

Simulation model & Sensitivity Analysis

Two simulation models were created for evaluating the postponement decision. The first one was the AS-IS model which attempted to replicate the present inventory management and material flow system and the second one was the TO-BE model which recreated the system with the implementation of postponement. Demand distributions for the SKUs were considered based on past demand data from the sponsor company. For inventory ordering and replenishment a standard (r, Q) model was assumed. In the AS-IS and TO-BE scenarios, inventory holding costs were calculated and the difference between the holding costs across the two models were the expected savings from postponement. The simulation model was created using the Arena simulation software.

The results of the simulation were as shown in the following exhibit:
As seen in the above exhibit, with up to 3 SKUs, there is a net loss if postponement were to be implemented. However, beyond 4 SKUs the savings from postponement start increasing. At 10 SKUs for the product, close to a 4% reduction in inventory holding cost could be expected for the selected product. For a higher number of SKUs, the reduction in the inventory holding cost is expected to be even greater as there is greater pooling of demand uncertainty from SKUs sold in different countries.

We then perform a sensitivity analysis to examine the impact of changes in key factors such as FP and DP unit costs, variation in lead times for the DP manufacturing, packaging and delivery stages as well as packaging capacity on the level of savings from postponement.

For changes in the unit cost of the DP and FP inventories, we assume a 10% or a 20% increase or decrease in the unit cost of the DP and FP inventories. An increase in FP unit costs could be due to higher packaging, transportation or warehousing costs, whereas changes in DP costs could be due to changes in the DP manufacturing process as well as variation in DP manufacturing process from one plant to another. The impact of these changes in unit costs is as shown in the following exhibit.

As a general trend, in the case of the selected product, a change in the FP unit cost seems to affect the possible savings more than changes in the DP unit costs. The results of the impact of variation in the lead times at the manufacturing, packaging and delivery stages is shown below:

An increase in the coefficient of variation of the manufacturing lead times increases the savings from postponement significantly as compared to similar increase in the variation in packaging and delivery variation. This could be because of the fact that in the TO-BE process, the DP inventory buffer in the manufacturing plant would obviate the need to have higher FP safety stocks in the CPOs to account for the variation in the manufacturing lead-time. In comparison, the variation in packaging and delivery lead times affect the AS-IS and the TO-BE scenarios equally, and therefore, there is no significant improvement in savings from postponement due to greater variation in these lead times.

Conclusions

From the simulation results, we can conclude the following:

- Postponement may be a good decision only if implemented in a product with a large number of SKUs and therefore a greater level of pooling of demand variation.

- Changes in the unit costs of the inventories can significantly impact the level of savings from postponement.

- Variation in the lead time for differential process steps (such as DP manufacturing) between the present and the postponed scenarios can result in significant changes in the benefits from postponement.