

An Approach for Setting Inventory Norms for a Two-Echelon Supply Chain

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ABSTRACT

Managing inventories is crucial to the objective of minimizing supply chain costs. This paper presents an approach for setting inventory norms in context of a real-life case of an industry which practices Vendor Managed Inventory (VMI). The role of warehouses and the inventories held by them becomes significant in such an environment. This paper presents a two-phase approach to determine various components of inventory norms taking into account lead time and demand variability. Innovative strategic product classification has been done to decide upon stocking quantity at warehouses.

Keywords: Inventory Norms, Product Classification, Two-Echelon Supply Chain, Vendor Managed Inventory (VMI), Warehouses

INTRODUCTION

Service levels in supply chain depend on key levers such as *availability* - stocking the right material at the right location, *responsiveness* - to supply material that is not readily available as inventory and *visibility* - to sales and to customers' order and material status. Inventory and its distribution across the supply chain ought

to be planned so as to ensure availability with vendors being able to meet sudden changes in demand, optimize the product flow, enhance the agility of manufacturing and provide visibility across the supply chain. This paper focuses on the management and control of inventories at warehouses. A consulting experience with an Indian client in the Electrical and Electronics domain motivated the current study. The company aims to achieve an order fill of 95% in maximum of 7 days. The distributor products

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are influenced by learning curve effect. The current manufacturing strategy suggests an increase in production in order to cope with the fluctuation in market demand. In the present situation, there is no inter-warehouse transfer of finished goods as per the distribution policy. When there is a stock-out at a warehouse, the system is designed trigger a manufacturing plant / contract manufacturers. This causes frequent production shocks / disruptions in production planning and scheduling. Besides, such immediate dispatches of materials to warehouses from the plant after the production, results in mal-distribution of inventory. An example of such a situation is as follows:

In warehouse 'X', as on 8th December 2009, the pending sale order quantity for a distributor product is 36 and opening inventory is 45. So available to promise inventory at that warehouse becomes 9. This low ATP inventory triggers production at manufacturing plant on 9th December 2009. But at the same time, the national level ATP inventory, as on 8th December 2009 is found to be 4479. Considering the average line fill rate (LFR) of 86% for this product, there is significant scope for improvement if the key issues are resolved. This situation is depicted in Figure 1.

Analysis of order fulfilment lead times for December 2008 to December 2009 indicated that only 65% of the products were supplied within 7 days from manufacturing plants and 65% of the products were supplied within 7 days from contract manufacturers (Figure 2). This call for further analysis in the aspect of improvement of order fill rate.

Analysis of order fulfilment lead time in the various weeks of a month indicates that, across all categories, average order fulfillment lead time in Week 4 is much less than that in Week 1 (Figure 3).

This calls for detailed weekly production planning and scheduling with an optimized and smoothened product flow.

Initial analysis was followed by analysis of demand planning process. Weighted average Mean Absolute Percentage Error (MAPE) for current forecast was compared with statistical forecast for 12 months. Weighted average MAPE is calculated for the current demand forecasting at national level and it is indicated in Figure 4. It calls for tremendous improvement in the forecasting accuracy, process and methods which will directly affect the order fill rate of the supply chain. Forecast accuracy is critical in a make-to-stock scenario. It is critical for procurement planning and has an impact

Figure 1. Example situation of mal-distribution



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