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Evaluation of Stock Management Strategies Reliability at Dependent Demand

Valery Lukinskiy, Vladislav Lukinskiy*

National Research University Higher School of Economics (HSE) St. Petersburg, Russia

Abstract

In the article there is a suggested methodical approach that allows calculating the safety stock quantity at the dependent demand in view of supply chains reliability requirements; the variants for different inventory management strategies at the dependent demand are examined; results of total costs calculation in view of the reliability are given.

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1. Introduction

The publications analysis has allowed to reveal the opinions of several authors about features of stocks management at dependent demand. “Dependent demand” means the demand for one item is related to the demand for another item. The dependent technique used in a production environment is called material requirements planning (MRP) (Heizer and Render, 2011). Originally popularized by Joseph Orlicky, MRP deals specifically with supplying materials and component parts whose demand depends upon the demand for a specific end product (Coyle *et al.*, 2003). The purpose of MRP is to avoid carrying items in inventory (Ballou, 1999).

* Corresponding author.

E-mail address: lukinskiy@mail.ru

Effective use of dependent inventory models requires that the operations manager know what is to be made and when; materials and parts required to make the product; what is in stock; what is on order; how long it takes to get various components (Heizer and Render, 2011).

Protection against uncertainty in the requirements and supplies that are part of material requirements planning can be achieved with the aid of safety stock and safety time (Jonsson, 2008). It seems wise to include “some” safety time into the lead-time offset of uncritical operations that is the direct predecessor of a critical operation (Stadtler and Kilger, 2008).

The minimum projected on-hand inventory should not fall below the safety stock level (Wisner *et al.*, 2012). The safety stock is also a planning parameter that can be chosen arbitrarily (Axsäter, 2006). A fixed on hand-inventory level can be maintained that is determined by practical experience or some other means. Although this method is approximate, it is probably the best that can be done (Ballou, 1999).

The usual policy is to use safety stock for end items and purchased items to protect against fluctuating customer orders and unreliable suppliers of components but to avoid using it as much as possible for intermediate items (Krajewski *et al.*, 2013). If the firm does not exceed 99% record accuracy, then material requirements planning will not work (Heizer and Render, 2011).

Summarizing the sources where parameters calculation examples of different planning strategies of inventory quantity at the dependent demand are given, the following can be stated:

1. Planned periods duration, for which the calculation is executed, fluctuates from 6 to 12 weeks.
2. Minimal and maximal stock quantities in each planned period cover the wide range of values, for example, from 20 to 100 products (Axsäter, 2006), from 0 to 50 products (Leenders and Fearon, 1997).
3. To choose the best strategy using the economic criteria the two costs types are used: for the order implementation and for stock holding.
4. Safety stock quantity is mentioned in two works (Axsäter, 2006; Lysons and Gillingham, 2003), but there are no instructions for their determining method.
5. The number of stock quantity strategies and their periodicity planning fluctuates from one to six; the most often indicated strategies are LFL, EOQ and LTC, but there are not any instructions for the most appropriate strategy.

Thus, in spite of having several strategies (lot-for-lot – LFL; least total cost – LTC; least unit cost – LUC; part-period balancing – PPB, Silver-Meal algorithm, Groff’s method etc.) for dependent demand management, all of them are intended to calculate the current stock parameters. Other indexes, for example, probabilistic evaluation of safety stock, deficit, functioning reliability of all stock management system practically are not considered. This problem becomes even more vexed at supplying the component parts (items, details etc.) that cannot be made at this enterprise.

2. Inventory management strategies clarification at dependent demand in view of safety stocks

The inventory management strategies at the dependant demand can be symbolically divided into two main groups. The first one is the empirical strategies based on grouping without considering the stock holding costs. Three strategies belong to them: LFL, FOQ and POQ. When we say ‘grouping’, we mean the union of demands in a unit of some consecutive periods. So, when we use the LFL strategy, we consider single (independent supplies) according to the demands in every period; the FOQ strategy stipulates supply quantity constancy during the whole planned period (at the same time, supply periodicity varies); the POQ strategy stipulates a variable supply quantity at fixed periodicity.

The second group is the economic strategies which use optimization algorithms of supply consignment forming considering supply costs (or starting-up and adjustment works) and stock holding. The three most wide-spread strategies – LUC, LTC and Silver-Meal algorithm – are similar according to the employing procedure: the search and determination of the local groupings indexes in a form of supply units during the planned period according to the costs minimum criteria.

In this way, the dependency for the unit costs evaluation in view of safety stocks (LUC strategy) is recorded in the following way:

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