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Case Study on Inventory Management Improvement

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***Abstract* – Inventory management is a challenging problem area in supply chain management. Companies need to have inventories in warehouses in order to fulfil customer demand, meanwhile these inventories have holding costs and this is frozen fund that can be lost. Therefore, the task of inventory management is to find the quantity of inventories that will fulfil the demand, avoiding overstocks. This paper presents a case study for the assembling company on inventory management. It is proposed to use inventory management in order to decrease stock levels and to apply an agent system for automation of inventory management processes.**

***Keywords* – ABC classification, demand forecasting methods, inventory management, replenishment policies.**

I. Introduction

Inventory is the stock of any item or resource used in an organisation [1]. There are three types of manufacturing inventories: raw materials, work in progress and finished goods (Fig. 1).

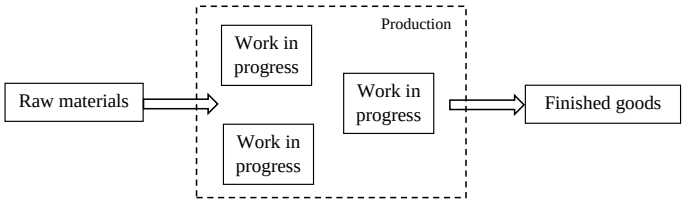

Fig. 1. Types of manufacturing inventories.

The author [2] mentions several reasons why it is needed to have inventories:

- To meet anticipated demand;
- To smooth production requirements;
- To protect against stock-outs;
- To take advantage of order cycles;
- To hedge against price increases or to take advantage of quantity discounts;
- To permit operations;
- To decouple components of the production-distribution system.

Otherwise, it will lead to production delays, shortages and/or dissatisfied customers [3]. The paradox of inventory management is that having inventory is needed, but it is not desirable to have inventory due to inventory keeping costs. This situation makes inventory management a challenging problem area in supply chain management. This paper presents a continuation of the research [3], [4] adding new experiments and forecasting algorithms on the same analysing data.

This paper is organised as follows: at first, the task is presented, after that the existing situation is analysed, then the solution is proposed, after that the experiments are shown and, finally, conclusions are presented.

II. Task Definition

Inventory management is not the novelty, but still not every company uses it in order to reduce inventory costs. The inventory management task is to find out how much and when to order:

- Objective: To keep enough inventory to meet customer demand,
- Purpose: To determine the amount of inventory to keep in stock – how much to order and when to order.

The task of the research takes place within the company, which deals with assembling of microchips from raw materials and selling them to customers. Therefore, there are raw materials and finished goods warehouses with inventories (Fig. 2).

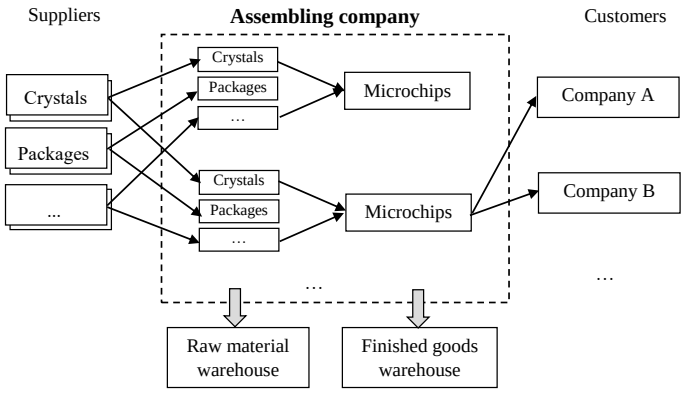

Fig. 2. Assembling company's inventories.

The authors [5] state that only 8 % of the companies have the trained personnel for inventory management. Companies are used to have big safety stock in order to fulfil the demand [3].

The task of this research is to analyse existing inventory management situation for finished goods inventories, to propose the improvement on it and to compare the proposed results with real demand data.

III. Data Analysis

The company's data on sales, inventories in warehouses were analysed for the period of 2014. The data analysis of previous year's microchip quantity fluctuation revealed that there were items in stock with no sale in 2014. The results for these items were the following: 16.69 % of total inventories

(at the end of 2014) in warehouse did not have any movement that year, 3.95 % of total inventories reduced their quantity due to expiration of time, 5.13 % of total inventories having no sale for the year of 2014 increased their quantity due to production of new ones.

In addition, there were some items, whose assembled quantity was higher than the sold one, meanwhile having big amount of inventory in stock (Fig. 3). There were also items, whose inventory level was high, meanwhile company assembled new ones, therefore inventory level was higher than the quantity of annual sales at the end of 2014 (Fig. 3).

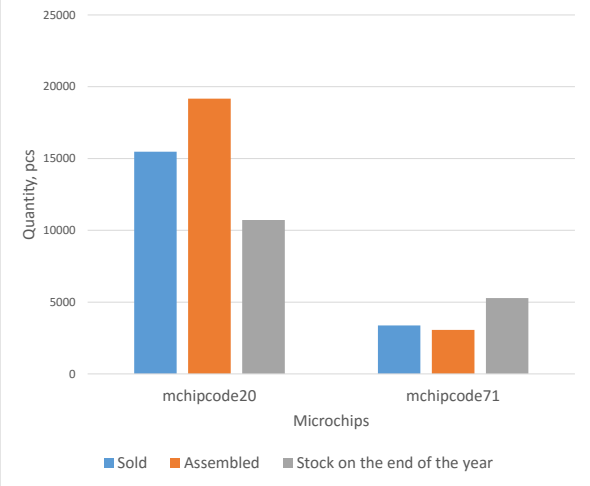

Fig. 3. Annual operations of two microchips.

It was also detected that an inventory level was too high for items, whose quantity on monthly sales was less than their safety stock (Fig. 4).

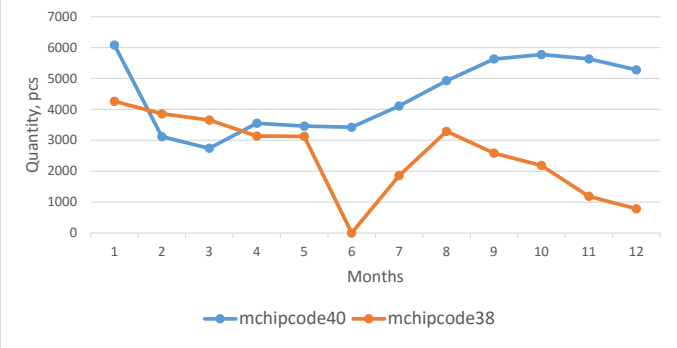

Fig. 4. Inventory levels of two microchips.

In addition, it was noticed that an inventory level for one item fell down to zero, which indicated out-of-stock situation (Fig. 4). Therefore, inventory management was highly recommended for this company.

IV. The Proposed Solution

In order to improve the existing situation of company's inventory control, it was proposed, firstly, to use inventory management for inventory control, and secondly, to apply agent system for inventory management [3], [4].

Effective inventory management consists of ABC classification, demand forecasting algorithms and replenishment policies [3]. Meanwhile, an agent system can provide automatization of inventory management and timely react to demand deviation from the forecasted demand, by making corrections on replenishment policies.

The proposed system can be used in two modes: completely autonomous mode, when an agent performs all of the inventory management operations: ABC classification, future demand forecasting, replenishment policy definition and assembling order making, or it works as a decision support system for a human inventory manager performing all the mentioned activities except ordering by providing the achieved results to an inventory manager and he decides whether to accept or not these recommendations.

A. ABC Classification

ABC classification (or ABC analysis) is a basic supply chain technique, often carried out by inventory controllers/materials managers, and the starting point in inventory control. This classification allows assigning priorities to management time and financial resources. The ABC analysis is based on the Pareto analysis, which says that 20 % of the items contribute to 80 % of sales [6]. It implies that a small portion of items in inventory contribute to maximum sales (Table I). Typically less than 20 % of items classified as *class A* contribute to as much as 80 % of the revenue. *Class B* items do the next 15 % (80 %–95 %) contribution to revenue. Items classified as *class C* generate the last 5 % revenue.

TABLE I

ABC Classification

	Number of items	**Number of annual sales revenue**
Class A items	About 20 %	About 80 %
Class B items	About 30 %	About 15 %
Class C items	About 50 %	About 5 %

ABC classification usually categorises company's products into three classes in order to assign priorities in inventory control [7]:

- *Class A* items are the most critical ones. These items require tight inventory controls, frequent review of demand forecasts and usage rates, highly accurate part data and frequent cycle counts to verify perpetual inventory balance accuracy;
- *Class B* items are of lesser criticality. These items require nominal inventory controls, occasional reviews of demand forecasts and usage rates, reasonably accurate part data and less frequent but regular cycle counting;
- *Class C* items have the least impact in terms of warehouse activity and financials and therefore require minimum inventory controls.

The inventory management starting point is the definition of *class A* items – microchips that represent the top 80 % of total annual revenue; *class B* items are the next 15 % and *class C*