

INVESTIGATION OF THE BULLWHIP EFFECT USING SPREADSHEET SIMULATION

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Abstract

Superior supply chains are one of the best ways to compete in today's marketplaces. In Supply Chain Management, overall supply chain evaluation needs to include an important logistical effect known as the Bullwhip Effect. It shows how small changes at the demand end of a supply chain are progressively amplified up the supply chain. Production plans are based on demand forecasting and suppliers not only react on changed demand, they adapt the level of safety stock (variation of stocks and orders increases). In this paper two special situations in a four-stage supply chain are studied: i) stable demand with a single 5 % change in demand (with application of four different stock keeping policies), and ii) changing demand with alternating 5 % changes in demand (up and down, with another three stock keeping policies). The results of spreadsheet simulations are shown in tables and charts. Increasing variability of production orders and stock levels up the supply chain is evident. The Bullwhip Effect is measured by the standard deviation of orders. The comparison of the results shows that the Bullwhip Effect can be partially reduced by appropriate stock keeping policy.

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Key Words: Supply Chain, Changing Demand, Bullwhip Effect, Ordering Policy

1. INTRODUCTION

Companies increasingly find that they must rely on effective supply chains to successfully compete in the global market and networked economy. Supply Chain Management integrates supply and demand management within and across companies. It is said that the ultimate goal of any effective Supply Chain Management System is to reduce inventory (with the assumption that products are available when needed). The idea is to apply a total systems approach to managing the entire flow of information, materials, and services from raw materials suppliers through factories and warehouses to the end customer [1, 2].

A supply chain, logistics network, or supply network is a coordinated system of organizations, people, activities, information and resources involved in moving a product or service in physical or virtual manner from supplier to customer. Today, the ever increasing technical complexity of standard consumer goods, combined with the ever increasing size and depth of the global market means that the link between consumer and vendor is usually only the final link in a long and complex chain or network of exchanges [3, 4].

For make-to-stock production systems, which are involved in different supply chains, the production plans and activities are based on demand forecasting. The orders are supplied by stock inventory, in which the policy emphasizes the immediate delivery of the order, good quality, reasonable price, and standard products. The customers expect that delays in the order are inexcusable, so the supplier must maintain sufficient stock [5]. It has been recognized that demand forecasting and ordering policies are two of the key causes of the Bullwhip Effect which is described later. In the paper a spreadsheet simulation explores a series of stock keeping policies under different demand patterns.

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