



The 9th International Conference on Traffic & Transportation Studies (ICTTS'2014)

An Optimization Model for Mitigating Bullwhip-Effect in a Two-Echelon Supply Chain

Akhtar Tanweer*, Yin-Zhen Li, Gang Duan, Jie-Yan Song

School of Traffic and Transportation, Lanzhou Jiaotong University, 88 West Anning Rd., Lanzhou 730070, P.R. China

Abstract

Bullwhip effect (BWE) is a conundrum, addressing the shift of a seemingly steady inventory demand into enhancing demand fluctuation in upstream supply chain. On upswing it can be very expensive in terms of stock out costs and capability on-costs while on the downtrend it can be costly in terms of stock carrying and obsolescence costs. To ameliorate the firm's efficiency, in this paper we propose an optimization model to mitigate the bullwhip effect in a two-echelon supply chain. The objective function is to minimize the sum difference between the actual order and the demand forecast of multiple products and the exponential smoothing technique, is performed to forecast demand of products. The model is further testified by an illustration of five products and it shows that the model facilitates to dig out an optimal set of parameters to mitigate the BWE.

© 2014 Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

Peer-review under responsibility of Beijing Jiaotong University(BJU), Systems Engineering Society of China (SESC).

Keywords: bullwhip effect; exponential smoothing; inventory management; supply chain management

1. Introduction

Bullwhip effect (BWE) is an observed phenomenon addresses the shift of a seemingly steady inventory demand into enhancing demand fluctuation in upstream supply chain. At the order side of supply chain It results in an amplified variation of information regarding demand. The supply chain management (SCM) conception has become more challenging since the start of the 20th century owing to the global contest in the world market. And BWE always has been remained and known as a hot and key advance research enigma amidst researchers, practitioners and academician since the commencement of 20th century.

* Corresponding author. Tel.: +86-151-9312-2604.

E-mail address: tanveerakhtar94@yahoo.com

Bullwhip effect presents a continuous conundrum for managers to sort out in an international supply chain. In SCM an unevenness in order sizes surges as demand signs propagate upstream. It has a striking impact on firm's upswing as well as on downtrend, ensuing stock out costs, capability on-costs, and poor customer service owing to inaccessible reserves, stock carrying and obsolescence costs due to inordinate inventory. Unsettled planning for production and like high shipment costs.

Since BWE is the outcome of the lack of information transparency which is the upshot of the lack of coordination amidst the supply chain participants. Therefore right coordination is the key to reduce the BWE.

Isolated forecasting induces BWE, especially when demand forecasts modified primed on orders instead of customer demand and normally ruminates when collaborator works in isolation and try to optimize their personal objective role. Consequently, a very weak harmonization and lack of coordination exist amidst supply chain participants. The fixed charges and economies of scale urging mass sales passing at month's end, price forwarding, advance buying, stockpiling at the end of month/year to satisfy goals. And also owing to rational conduct of supply chain partners and gaming dearth i.e. limited supplies assigned in ratio to called for amounts instead of the capability to sell) etc.

In reality, bullwhip effect or whiplash effect adverts to an internal phenomena rather than extraneous where orders to the manufacturers lean to have bigger difference than sale to the vendees (i.e. variability in demand) and the uncertainty proliferates upswing in an augmented way i.e. variance magnification. BWE, at the firm level, is considered as a reaction to the external environment while the industry is regulated and molded by the natural world. It was posited that BWE is simply a phenomenon colligated with inadequate information flows and is an upshot of rational reaction by the participants.

The information about the exact order sizes to manufacturers, suppliers, and demands from potential customers, distributors, wholesalers, retailers, can help you in a usable way to increase reliability, delivery uptime, and reduce your operational costs.

In supply chain, "information flow" amid participants is a vital factor for coordination and directly impresses production plans, inventory control and delivery scheduling of single comrades in the supply chain. The paper addresses the proposed model to mitigate the bullwhip effect in a multi product supply chains. The objective function is to minimize the sum differences, which instances the BWE, between the actual orders and the demands forecast of each product. The exponential smoothing technique is executed to forecast demand of every product. The result shows that the model facilitates to dig out an optimal set of parameters to mitigate the BWE by setting parameters employing an optimization function. The remaining portion of the paper is organized as follows. In section 2 the literature review is narrated. Section 3 is dedicated to describe our optimization model for a two-echelon supply chain. An illustration and computational results are further presented in Section 4. In Section 5, the paper ends with conclusion.

2. Literature Review

The basic term bullwhip effect is not a new phenomenon and it has been one of the major challenges in supply chains as a magnified variation of information about demand at the order side of the supply chain. It is conceived as a sort of difference amplification of orders across demands. Simon (1952), Forrester (1958), are reckoned as pioneers who surveyed BWE through simulation analysis and named it as "Demand amplification". In 1961, Forrester exemplifies the effect in sequential analysis and remarks that it is an upshot of industrial organizations' dynamic or time changing conducts regarding policies and brings about features and unwanted demeanors in supply chain.

BWE was primitively struck by the Logisticians in unlike cases in the Procter & Gamble (P&G). Besides P&G, firms like Hewlett- Packard in the computer industry, these cases were introduced to educates globally via a simulation business game named the "Beer Distribution Game". Four actors in this game are required, who make autonomous inventory decisions without knowing about other chain players, banking merely on adjacent player as the only informant. The test depicts the fact that the impact of distorted information is one of the reasons of BWE and the orders' variances magnify as one proceeds in the supply chain. Sterman (1989) infers the process as a result of actor's irrational conduct or "misperceptions of feedback". A methodology posed by Jack (1961) for ascertaining manufacturing and inventory regarding the problem of bullwhip effect. The writer presented that conventional stock

Download English Version:

<https://daneshyari.com/en/article/1114224>

Download Persian Version:

<https://daneshyari.com/article/1114224>

[Daneshyari.com](https://daneshyari.com)