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# BULLWHIP EFFECT IN SUPPLY CHAIN

**SALIM KHAN & EKTA**

Research Scholar, JK lakshmipat University Jaipur, Rajasthan, India

## ABSTRACT

A demand variability increase when it moves downstream to upstream in a supply chain, this phenomenon is known the 'Bullwhip effect'. This Bullwhip effect creates pile upon unnecessary inventory in the supply chain and reductions of this make a significant role. In this paper bullwhip effect causes are analyzed and the reducing measures are suggested, such as: Establishing the information sharing mechanism, Coordinating benefit of information sharing, establishing the strategic alliance, strengthening the cooperation & trust, strengthen the stock managing and reduce the lead time of the supply .

**KEYWORDS:** Bullwhip Effect, Inventory, Supply Chain, Lead Time

## INTRODUCTION

The variability in demand gets amplified as it reaches the final link of the supply chain, which results in increased cost and reduced margin of profit. The information flow in the supply chain is the most essential factor in determining the effectiveness of the supply chain. Batch sizes reduction and recurrent ordering policy, the technology of making the demand and other information visible to all participants of the supply chain will reduce the Bullwhip Effect to a great extent. This can be achieved by well-organized information exchange between the supply chain participants. It can be concluded that Bullwhip Effect causes distortion of information, delays in procurement, and delays in availability of the goods to the customer. This happens largely due to the decisions at every stage of the supply chain. It is apparent that it is not possible to entirely reduce the Bullwhip Effect, but certain care can be taken in order to ensure that it is reduced so that the end consumer is least affected. Information Technology help in reducing the Bullwhip Effect, and used as powerful tool. Internet based information exchange plays effective role in management of a supply chain. Lee et al. (1997), the bullwhip effect occurs in lots of companies. The most famous case which happened in Procter & Gamble (P&G) and Hewlett-Packard (HP) offer good understandings of the bullwhip effect. This phenomenon was first pointed out by Forrester (1958) in his system dynamics, and he also suggested that the way to tackle is reducing delays in the supply chain (Hussain and Drake, 2011). The most famous ”Beer Distribution Game” was reported by Sterman (1989) as an proof of the bullwhip effect, in this game, players are segregate into four parts and each part represent brewer, distributor, wholesaler and retailer. The four players can only make inventory decisions by the orders from nearest player; they cannot exchange information with other player. The result of the game show that demand information distortion in supply chain internal transfer due to the irregularity of information flow between each node of the enterprises in the chain. The bullwhip effect could easy cause a set of risks gradually, from downstream to upstream; it will influence the operation of the total supply chain, increase the inventory and waste of resources. Therefore, study the bullwhip affects and removes its harmful impacts on the supply chain has a significant significance. To mitigating the bullwhip effect there have different insights according to various researchers. Forrester (1961) hold the view of that the bullwhip effect can be mitigated through alteration in

behavioural practice, Sterman (1989) have the insight of adaptation in individual education can help to tackle the bullwhip effect. While according to Lee et al. (1997), there are four main cause of bullwhip effect: 1.update the Demand forecast, 2. Order batching, 3. Fluctuation in price, and 4. Rationing and shortage game. Lee et al. (1997) also suggest that the institutional and inter-organization infrastructure and associated processes can create for organizations to manage the bullwhip effect.

## OBJECTIVES OF THE STUDY

The aim of this paper is to give an extensive literature overview of the bullwhip Effect, and explain its causes and proposed remedies.

## RESEARCH METHODOLOGY

This paper is purely conceptual in nature which is based on the review of relevant literature. For the purpose of reviewing the literature, we selected the relevant titles thereafter; we conducted an extensive literature review to reach at meaningful conclusion.

### Causes of Bullwhip Effect

**Forecast:** Each entity in the supply chain gives their own forecast about the demand and this multiple demands lead to distortions. Each members demand is based on orders received at his end and not based on the demand given by the end customer.

**Order Batching:** To get the economies of scale in production and transportation every member of the chain practice order batching. Sometimes order bunching takes place due to the planning practices of the firm. For example if firm work on MRP software once a fortnight, of course all the orders for the fortnight will get bunched.

**Price Fluctuations:** Price promotions or discount causes forward buying and creates much distortion. Frequent changes in the price affect the pattern of buyer's ordering and this creates distortions.

**Shortage:** In the case of shortages the suppliers usually resorts to rationing which in turn provides incentives to buyers to inflate orders.

**Long Lead Time:** Due to long lead times the planning horizon of other partners increase further every partner is forced to keep safety stock resulting in an overall distortion increase in the chain.

### Impact of Bullwhip Effect

The distortion of demand has led to the Bullwhip effect; the destruction is done not only at the micro level but also at macro level (Deng and Ma, 2009)

At the micro level, the bullwhip effect in supply chain will bring a dual loss for companies i.e. effectiveness and profitability. First, the product stock is to adapt the demand so that the firm try to remove the excessive demand fluctuation caused to supply chain. Second because the demand uncertainty engorged, the difficulty of the firm's ideal forecast to the demand is also enlarged. Third, the demand distortion also affects firm's production. Due to distortion of demand information. At macro level, the Bullwhip effect is a typical "market failure" incident, as the upstream node of the supply chain received the demand information deviated from the exact demand; it may lead to over-investment or investment shortage.

### Bullwhip Effect Remedies

**Reducing Uncertainty:** Reducing uncertainty is the vital step towards reducing the Bullwhip Effect. Centralizing the demand information can decrease uncertainty to a great extent. This will make the customer demand and forecasted retailer's demand seen to all partners of the supply chain. This decreases forecasting error. But, different buying policies and forecasting methods used by various supply chain partners induces the Bullwhip Effect into the system. It is also true that even if all the supply chain partners use the identical forecasting technique and buying policy the Bullwhip Effect cannot be totally eliminated. Data desires to be made accessible to all the links in the chain. This meek alteration in demand data transfer permits parallel anticipating and avoids the magnification that outcomes from a multi-stage estimating process. It also has the added benefit of eliminating the delays inherent in a multi-stage system.

**Reducing Variability:** Reducing the inconsistency in the demand can decrease the Bullwhip Effect considerably. Regular variation in product prices results in a pseudo increase or decrease in demand thereby introducing the variation into the system. If a product is offered for a constant price as in EDLP (everyday low pricing), the Bullwhip Effect can be decrease to a substantial level.

**Lead Time Reduction:** Lead-time can be separated into order lead-time and information lead-time. Reducing both types of lead times will decrease a significant amount of variation. Functions of lead time are safety stock levels and reorder points; reduction in lead-time reduces the variation. Systems such as cross docking and EDI (Electronic Date Interchange) can reduce both the ordering lead-time and the information lead time

**Strategic Partnering and Buying:** Decreasing in lead time by Strategic partnering exchange the Information in strategic partnering decreases variation in the system. This can be accomplished by adopting VMI (Vendor Managed Inventory). This needs the manufacturer to sustain the inventory at the point of use thus decreasing the variation in the system. The strategic buying policies implemented by the buyer and the manufacturer diminish the variation caused due to quantity discounts provided by the manufacturer.

**Advanced Information Technology:** Advances in information technology has made the concept of easily access of the information possible. Elimination of the intermediaries such as the retailer from the system and provides the point-of-sale demand to all the supply chain partners is possible with the help of E-Commerce removes the mediators such as the retailer from the structure and gives the point-of-sale demand to all the supply chain partners. Removal of the mediators, known as disintermediation reductions the variation in the system to a large level This makes the demand information accessible to all the members of the supply chain this help in enhancing the effective integration of supply chain partners having conflicting objectives and views. Company internal internet called intranet, changes the sequential flow of the information within the system with the dynamic flow of the information help in reducing the manufacturing lead-time and ultimately the Bullwhip Effect. This also incorporates flexibility to the system and increases the speed of response. A good information exchange system, like the internet, united with a good quality warehouse management and transportation management system can significantly reduce the Bullwhip Effect.

## CONCLUSIONS

The variability in demand gets augmented as it reaches the final stage of the supply chain, which results in increased cost and reduced margin of profit. The information flow in the supply chain system is the most imperative factor in determining the effectiveness of the supply chain. Besides batch sizes reduction and recurrent ordering policy, the

technology of making the demand and other information visible to all participants of the supply chain will reduce the Bullwhip Effect to a great level. This can be achieved by adopting information interchanged between the supply chain partners.

It can be summarized that Bullwhip Effect causes information distortion, delays in procurement, and delays in availability of the goods to the end users. This occurs due to the decisions at each stage of the supply chain. This paper has discussed the major factors that lead to the Bullwhip Effect and also listed the possible remedies. It is obvious that it is not possible to completely eliminate the Bullwhip Effect, but certain care can be taken in order to ensure that it is reduced so that the end consumer is least affected. Information technology can be used as controlling instrument to reduce the Bullwhip Effect. Internet based information exchange plays a significant role in effective and efficient management of a supply chain, by increasing the quality and speed of the information interchanged.

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