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Supply Chain Integration: Controlling the Bullwhip Effect

BY NICOLAS HIEN



In a globalized context where competition between firms has become little by little a competition between supply chains, supply chain integration appears as a significant source of competitiveness for organizations. One of the goals of this integration is to reduce amplification of the variability of demand, commonly called the “Bullwhip Effect.” In this article, we explain the Bullwhip Effect and its causes, and we describe how to control the phenomenon.

WHAT IS THE BULLWHIP EFFECT?

Have you heard of the Beer Game? Created in the '60s at the Massachusetts Institute of Technology, the Beer Game is a simulation designed to illustrate the concept of amplification of the variability of demand. In this simulation, several supply chains are in competition for the distribution of beer. Each supply chain is made up of a manufacturer, a wholesaler, a distributor and a retailer. The game's principle is

The Bullwhip Effect testifies to the absence of supply chain integration and represents a major brake on competitiveness.

relatively simple: the retailer receives, from one period to the next, the end customer's order, and transmits its replenishment orders to the distributor; the latter in order to manage its stocks, transmits its orders to its wholesaler that can then in turn reorder from the manufacturer.

The performance of each chain is based on the calculation of stocks and shortages occurring throughout the chain. One of the key characteristics of the game is that different links may not communicate with each other, the only relations being the order received from the downstream link and the order sent to the upstream link.

After a certain number of periods, we

realize that although the demand of the end customer varies relatively little, the variability of the demand tends to be significantly amplified the farther we are from the retailer, causing

both accumulation of stocks in the chain and situations of shortage. The phenomenon is called the Bullwhip Effect.

CAUSES OF THE BULLWHIP EFFECT

How can such a phenomenon be explained? In the simulation, concretely, under the impact of a small increase of demand from the end customer, the retailer sends a bigger order to its distributor in order to avoid a shortage. From the distributor's perspective, basing itself on the orders of the retailer as a true reflection of reality, demand has significantly increased. In order to avoid a possible shortage, the latter tends to also transmit an even bigger

order to its own supplier, the wholesaler, and in turn the wholesaler sends an even bigger order to the manufacturer and so on..., increasingly amplifying the variability of the demand.

The primary cause is thus the absence of communication between the different stages. More specifically, by basing its forecasts on orders from the downstream link and not on the actual customer demand, the supply chain is subjected to the phenomenon of amplification, because of the propensity of certain forecasting models to overreact to variability of demand.

The size of batches is also one of the causes of the Bullwhip Effect. In order to reduce ordering costs or transportation costs, or to take advantage of quantity discounts, organizations tend to order by batches, generating an amplification effect since the size of batches tends to increase as the orders move upstream.

The third cause is the variation of prices. In particular, promotions and various discounts provided by organizations artificially and temporarily modify the behaviour of their customers so that their purchases do not reflect their immediate needs, thus

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contributing to the Bullwhip Effect.

Finally, various strategic manoeuvres that result in cancellation of orders or forward buying are also likely to amplify the variability of demand.

CONTROLLING THE BULLWHIP EFFECT

In order to eliminate the Bullwhip Effect, it is indispensable to act on its causes. Hence, the first prerequisite is the sharing of information. This initiative can and must be supported by appropriate information systems to ensure that information is shared concerning the actual demand, the level of stocks, etc. Collaboration throughout the chain, the essential prerequisite to integration, can mitigate the Bullwhip Effect so that the information replaces stockpiling of merchandise.

A second means is to limit the fluctuation of prices by reducing the extent of promotions. Thus, the concept of “every

day low prices” promoted by Wal-Mart is an example of initiatives used to reduce the Bullwhip Effect. Also, the reduction of ordering delays, for example through initiatives such as Vendor Managed Inventory (VMI), the reduction of batch size or the reduction of the number of links in the chain are all solutions used to contain the impact of amplification of the variability of demand.

In short, the Bullwhip Effect testifies to the absence of supply chain integration and represents a major brake on competitiveness. To neutralize this phenomenon, an effort of collaboration is required with the intention of facilitating the circulation of information among the various links, to create a more stable chain, which in any case can only be as strong as its weakest link. ■

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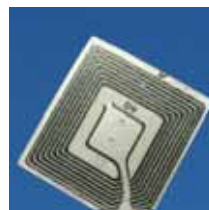
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