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## Forrester's Effect. Bullwhip effect

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### **ABSTRACT**

Bullwhip effect term is related with supply chain. Such effect explains the fluctuation in the sales (demand), manufacturing and supply. Such term is understood as distorted demand, that increases when the supply chain is relocated to upper level [1]. Such an effect generally results from the ineffective information flow in the supply chain, what leads to the accumulation of excessive stock at particular partners. Four basic cases of the bullwhip effect can be discerned [2]: Forrester's effect, it is related with the execution time and processing the signal on the demand level; Burbidge's effect, it is related with grouping the orders; Houlihan's effect, it is related with rationalisation and shortage of products; promotional effect, it is related with the fluctuation of prices. Bullwhip effect is described in this papers; general focus is made on its element, namely the Forrester's effect.

**Keywords:** bullwhip effect, Forrester's effect, supply chain

### **1. BULLWHIP EFFECT (BUTTERFLY EFFECT)**

It is most often said, that the bullwhip effect results from the ineffective contact between the customer, the manufacturer and other units that are located in the supply chain [3]. It occurs for one simple reason - it results from the changes in demand or uncertain deliveries on time, thus suppliers make decisions for increased orders, despite lacking demand from market. Every other unit in the chain makes exactly the same, because it gets the signal about the increased demand, without any consumer analysis. The effect are Chinese whispers, that lead to distortions [4]. The bullwhip effect originates on the supply chain level, and the sales fluctuations can be explained in this way, as well as other processes leading to such

sales, namely the production, supplies etc. Such an effect increases in strength, goes on higher level in the chain and leads to the creation of excessive stock [5]. Why? It is the seller who makes an order from first entity in the chain and sends a signal for increased demand, but actually wants to increase the stock against the case of fluctuating prices or extended time for the execution of order. Every another unit receives such a signal, does not verify it and also makes stocks [6]. It is analogically made by every another unit, until the manufacturer. As a result of faulty information transfer, beginning with the stock accumulated in the excess, the bullwhip effect is created [7]. Similar and very often spontaneous and unreal increase in the demand leads to the increased orders on every subsequent link in the chain between the seller and the manufacturer. The more units, the higher resulting stocks and lacking stability of activities [8].

### **Most often causes for the bullwhip effect**

Origins of the bullwhip effect are divided into two categories, namely they may result from the operational activities or behaviour of units in the supply chain. The first category comprises of i.e. incorrectly perceived prognosis for demand, amount in the order, price fluctuations or even faulty control system, lacking regulation for stock, until the awaiting time. The behaviour of units is related with the fear of lacking stock in the warehouse or lacking training for the personnel [9].

The bullwhip effect is most often alleviated with coordinated communication on the level of supplier (manufacturer) and recipient (seller). It is incomplete information circulating in the chain that strengthens the effect, therefore better communication will be the alleviating set-off. Correct control of stock or reduced warehousing for goods on various supply chain levels is also a good beginning for changes [10].

## **2. FORRESTER'S EFFECT**

When working on the concern of distribution network, or according to business practice, the Forrester's phenomenon usually plays the key role at a particular moment, that is also described as the bullwhip effect (also whiplash effect) [11]. Jay Forrester described and explained such an effect for the first time (thus the name). Such an effect is related with biased attitude of managers to the changes in demand: when demand increases, it will be still increasing; when demand decreases, it will be still decreasing. It leads to the overestimated demand value in the upper or lower direction (so called faulty continuation of a trend) [12].

The bullwhip effect is based on the increasingly strengthened relocation of demand changes upward in the supply chain (from the retailer, with proxy of the wholesaler, until the manufacturer) [13]. The information transferred to the subsequent link is falsified: despite the real change in the demand, it also includes decisions on the politics of shaping the amount of stock at particular link. Reaction time between the moment of placing an order and collecting a delivery is also important (time gap). [14] The following factors are recognised as origins of the Forrester's effect: fluctuations in demand on the retail market, fluctuations in prices - particularly formerly communicated ones, rationalised deliveries, lacking products, big dedicated cargo units, unstable stock policy, long distribution chain with many intermediary links. The causes for changes in demand on the market according to the stipulated factors

should be analysed, because they can explain the case and help in avoiding the Forrester's effect gap [15].

The mechanism of the Forrester effect operation is as follows: increase in the demand value downwards in the supply chain (retail level) leads to the violent increase in orders in upper supply chain links (higher levels in the distribution network); it leads to the fact, that the existing stock is very quickly disposed of, the network is cleaned from the stock; then demand (orders) constantly increases, but current deliveries are not sufficient for covering the demand; finally, demand brakes down (preferences are shifted to other product), what is firstly demonstrated with decrease and then with deficiency of orders; in the end, distribution network is filled up with stock (that are not demanded by anyone at that time), coming from deliveries arising from formerly placed increased orders [16].

Technological development and modern management techniques and concepts establish the convenient conditions for the extended cooperation of business units in the chain.

IT technology enables and accelerates transactions, it enables the establishment of new communication methods between the companies, as well as new management processes and methods for particular areas of company activities and supply chains. Last years are characterised with rapid development of the electronic trade in broad meaning. The development of B2B trade (between business units) is of great importance for integration and improvement in the supply chain, as well as various concepts and techniques in the field of e-business: the Efficient Consumer Response - ECR and the Collaborated Planning, Forecasting & Replenishment - CPFR. The Internet, alternatively to the Electronic Data Interchange (EDI), as a result of universality, open standards and easy access to broad collection of recipients, comprises the effective platform for cooperation for all partners in the chain [17].

### **3. CONCLUSIONS**

Forrester's effect and bullwhip effect are phenomena demonstrating the ways, in which small changes in the behaviour of supply chain members can lead to domino effect or even chaos. Chaos in the market economy is a natural phenomenon. Untypical behaviour of purchasers can be falsely perceived as a "new trend", what is related with the set of changes in the whole chain. The reaction time between the moment of placing an order and collecting a delivery is also important (time gap).

### **References**

- [1] Council, Supply Chain. Supply-chain operations reference-model. Overview of SCOR version 5.0 (2008).
- [2] Christopher, Martin. Logistics & supply chain management. Pearson UK, 2016.
- [3] Seuring, Stefan, and Martin Müller. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of cleaner production* 16.15 (2008) 1699-1710
- [4] Srivastava, Samir K. Green supply-chain management: a state-of-the-art literature review. *International journal of management reviews* 9.1 (2007) 53-80

- [5] Šćukanec, Anđelko, Kristijan Rogić, and Darko Babić. Bullwhip Effect'in Supply Chains. *PROMET-Traffic & Transportation* 19.5 (2007) 289-293
- [6] Campuzano, Francisco, and Josefa Mula. Bullwhip effect in supply chains. Supply chain simulation. Springer London, 2011. 23-35.
- [7] Sucky, Eric. The bullwhip effect in supply chains—An overestimated problem?. *International Journal of Production Economics* 118.1 (2009) 311-322
- [8] Duc, Truong Ton Hien, Huynh Trung Luong, and Yeong-Dae Kim. A measure of bullwhip effect in supply chains with a mixed autoregressive-moving average demand process. *European Journal of Operational Research* 187.1 (2008) 243-256
- [9] Barlas, Yaman, and Baris Gunduz. "Demand forecasting and sharing strategies to reduce fluctuations and the bullwhip effect in supply chains. *Journal of the Operational Research Society* 62.3 (2011) 458-473
- [10] Ouyang, Yanfeng, and Xiaopeng Li. The bullwhip effect in supply chain networks." *European Journal of Operational Research* 201.3 (2010) 799-810
- [11] Tayur, Sridhar, Ram Ganeshan, and Michael Magazine, eds. Quantitative models for supply chain management. Vol. 17. Springer Science & Business Media, 2012.
- [12] Moyaux, Thierry, Brahim Chaib-draa, and Sophie D'Amours. Information sharing as a coordination mechanism for reducing the bullwhip effect in a supply chain. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)* 37.3 (2007) 396-409
- [13] Bottani, Eleonora, Roberto Montanari, and Andrea Volpi. The impact of RFID and EPC network on the bullwhip effect in the Italian FMCG supply chain. *International Journal of Production Economics* 124.2 (2010) 426-432
- [14] Kanda, Arun, and S. G. Deshmukh. Supply chain coordination: perspectives, empirical studies and research directions. *International journal of production Economics* 115.2 (2008) 316-335
- [15] Bhattacharya, Ranjan, and Susmita Bandyopadhyay. A review of the causes of bullwhip effect in a supply chain. *The International Journal of Advanced Manufacturing Technology* 54.9-12 (2011) 1245-1261
- [16] Zarandi, MH Fazel, Morteza Pourakbar, and I. B. Turksen. A Fuzzy agent-based model for reduction of bullwhip effect in supply chain systems. *Expert systems with applications* 34.3 (2008) 1680-1691
- [17] Carbonneau, Real, Kevin Laframboise, and Rustam Vahidov. Application of machine learning techniques for supply chain demand forecasting. *European Journal of Operational Research* 184.3 (2008) 1140-1154

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