VENDOR MANAGEMENT AND BULLWHIP EFFECT

The purpose of this work is to analyse literature regarding the usability of vendor-managed inventory (VMI) to reduce the bullwhip effect and make the supply chain more agile in the context of Lean. Reasons, for why inventory management is important are provided and concepts to control inventory and the bullwhip effect are explained.

By analysing the literature and creating a critical view on vendor-managed inventory (VMI), the main objective of this study can be discussed which is to determine if vendor-managed inventory (VMI) can contribute to avoid the bullwhip effect.

Further questions have to be considered to achieve the main objective:

- "what is the bullwhip effect?";
- "how does the bullwhip effect affect supply chains?";
- "how does vendor-managed inventory (VMI) work?";
- "what are the prerequisites for using vendor-managed inventory (VMI)".

The purpose is to gather all the findings and outcomes as a fundament for the empirical part in the conclusion.

This paper follows the quantitative research method. The purpose of quantitative research is not only to measure objectives but also to analyse the research data statistically [1, p. 2].

Analysis of literature related to lean management, warehousing, inventory management and bullwhip effect will be used as a research method for the theoretical framework. Further literature for
vendor-managed inventory (VMI) and case studies will be used to analyse the current situation and broaden the theoretical framework. At the present moment my knowledge about vendor-managed inventory (VMI) is not extensive, that is why it is of paramount importance to widen my horizon about this topic using good quality sources.

The development of supply chain management in business practice is primarily attributable to the bullwhip effect [2, p. 21]. Pereira et al. define the bullwhip effect “[…] as the upstream increasing of production variability, caused by a supply chain’s demand variability at the retail level” [3, p. 85].

A weak demand planning and forecasting along the supply chain leads in many cases to an asymmetry between supply and demand, and consequently to product scarcity or excess inventory. Due to forecasting errors along the supply chain, the adjustment of supply and demand fluctuates massively. This is because the upstream supply chain member does not have insights in the true demand of its directly downstream supply chain member [4, p. 113].

Figure provides a simplified presentation of how the bullwhip effect develops in a supply chain with four suppliers and one end-customer.

Due to poor information flow, and every member being responsible for its own inventory, all participants add a safety stock which leads to 46,4 % more produced units at the first-tier supplier. 1464 units are produced by comparison to the real demand of 1000 because all members do not have insight in each other’s real demand. In more complex and global supply chains where the number of intermediaries increases, the impacts of the bullwhip effect are tremendous.

According to Lee et. al. [5, p. 547] the bullwhip effect can increase the total business expenses by 12,5 % to 25 %. Further, they state that 25 % to 33,3 % of inventory value in grocery industry is unproductive (tied up capital) due to being in the pipeline.

The bullwhip effect generates unnecessary costs along the supply chain due to instable production schedules. Manufacturers and suppliers extend their capacities to meet the highly volatile demand. Declining demands result in under-utilisation of capacity which means an increase of unit labour costs. In periods of high demands overtime, agency and sub-contract costs increase. The volatile demand impels companies to create safety stock and build-up their inventories. In low demand periods manufacturer might produce to stock in order to keep a high level of productivity. In addition, volatile demands lead to increases of lead times which, again, favour higher stock levels and the bullwhip effect [6, 10–11].
Lee et al. determine four core causes of the bullwhip effect [5, p. 548–555]:

1. Demand signal processing. The transfer of demand information to the supplier takes place with a temporal delay. Further, members downstream the supply chain generate orders including their own demand forecast (plus safety stock). Changes of demands are not communicated with the supplier immediately and supplying organisations have no view on the real demand situation.

2. The rationing game. Feared supply shortage leads to abrupt changed order behaviour of institutional customers and end-customers (see 4.1.1). Customers tend to secure these goods by the supplier and the supplier wants to satisfy the customers’ needs. The result is inventory build-up along the supply chain.

3. Order batching. Customers strive for economies of scales and reduction of fixed order costs through larger order volume. These large orders misguide suppliers to assume increased future demands.

4. Price variations. Sales promotions as discounts normally lead to a short-termed surge in demand. Volatile demand makes inventory planning before, while and after sales promotions unpredictable.

VMI is "[...] by far the most widely implemented supply chain improvement initiative, [...]" [7, p. 81].

The term “vendor-managed inventory” reflects the basic idea: A customer (e.g. retailer) puts his manufacturer ("vendor-") in charge for planning and controlling ("managed") the inventory. The vendor decides date and quantity regarding the replenishments. Thus, the customer transfers the responsibility for inventory control to the manufacturer. At the same time, the customer provides the manufacturer with forecast and actual demand data without time delays. With this information the manufacturer generates production and transport planning. Further, the manufacturer defines minimum and maximum levels of inventory available at any time at the customer [8, p. 115].

Vendor-managed inventory (VMI) is a collaborative concept where the vendor is responsible for the inventory of its customer, while the customer provides his vendor with real time sales and demand forecast data. Regarding the main objective of this paper it can be said that vendor-managed inventory (VMI) is an appropriate method to avoid the bullwhip effect and decrease inventory levels along the supply chain. The quantitative investigation of 21 researches has shown that vendor-managed inventory (VMI) counteracts the bullwhip effect and thus reduces inventory levels along the supply chain. The transfer of real time sales and forecast data as well as removing one order decision point in the supply chain enables the vendor for optimal utilisation of his capacities. Production and delivery planning are aligned to market needs.

Additionally, vendor-managed inventory (VMI) entails several benefits such as cost reductions in many areas, improved service levels and flexibility.

Nevertheless, it could also be shown that vendor-managed inventory (VMI) implies negative effects. Some authors postulate that vendor-managed inventory (VMI) only relocates the stock from customer’s to vendor’s warehouse, others claim that this concept is only beneficial for small organisations, only the customer or only the vendor.

One issue that should be considered is that most of the investigated researches were of virtual nature (analytical, simulation, model). Further, the researches were limited to small scenarios, consisting of a few supply chain members.

In a business with resources all around the world the supply chain will be more complicated, for example the information sharing between the supply chain members is more complex. The fact remains that simulation models, no matter how well-made they are, never can be a true representation of reality. Many factors exist which cannot be caught by simulation tools. That calls the reliability and validity of such results into question since it raises the question to what extent they are applicable to the real world.
Therefore, real case studies of companies using vendor-managed inventory (VMI) were taken into consideration. These case studies showed clearly that vendor-managed inventory (VMI), once implemented correctly, can improve business and more important, the service level for the customers.

This research could show, that in almost all cases vendor-managed inventory (VMI) could contribute to improve business and reduce the bullwhip effect.

In the context of Lean, vendor-managed inventory (VMI) seems to be an appropriate concept to remove waste and ballast from businesses, make supply chains leaner, more efficient and flexible.

Since vendor-managed inventory (VMI) is classified as one of the collaborative concepts, the next steps for further studies should include collaboration strategies such as QR, CRP, ECR, and CPFR.

This paper gives an extensive insight into vendor-managed inventory (VMI). The next interesting step would be to analyse the above mentioned collaboration strategies and compare them to vendor-managed inventory (VMI) regarding inventory management, material flow, the bullwhip effect and supply chain control.

References


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ON THE WAY TO CREATIVE ECONOMY:
ADDRESSING THE PRINCIPALITY OF LIECHTENSTEIN

In the raising amount of research works on the turn to the creative economy the Principality of Liechtenstein is quite rarely considered as one of the most representative examples, or at least as a supporting and fitting one within the context of the world fashionable trends in rebranding national economies. This paper aims to demonstrate that nowadays even the smallest and most developed countries turn to the conception of the creative economy in order to rebrand their own economies in terms of the ‘creative one’. To clarify this raising interest in an emerging socio-economic conception, it is necessary to enquire into the official reports of Liechtenstein and reveal both theoretical and empirical background for this shift.