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Vendor managed inventory in organizations- A conceptual framework

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Abstract

Vendor Managed Inventory was first tested on a large scale by Procter & Gamble and retail giant Walmart in the 1980s. Walmart has been able to reap the larger benefits of VMI. The implementation of VMI can potentially provide benefits to both the vendor and the customer when properly applied. It all comes down to thinking through the process, making sure the benefits are real, and making sure there are enough controls in place to protect both parties. As an inventory management technique here a supplier of goods, usually the manufacturer, is responsible for optimizing the inventory held by a distributor. The present study is a conceptual study of the Vendor Managed Inventory in the organisations.

Keywords: Supplier, Inventory, Continuous Replenishment, Goods

1. Introduction

The term 'inventory' originates from the French word 'Inventaire' and Latin word 'Inventarium', which implies *a list of things found*. The term 'inventory' can be defined as, "The term inventory includes materials like – raw, in process, finished packaging, spares and others; stocked in order to meet an unexpected demand or distribution in the future." Inventory includes the following categories of items:

- a. **Production Inventories:** Raw materials, parts and components which enter the firm's product in the production process. These may consist of two types – special items manufactured to company specifications and standard industrial items purchased 'off the shelf'.
- b. **MRO Inventories:** Maintenance, Repair, and Operating supplies which are consumed in the production process but which do not become the part of the product. (e.g. lubricating oil, soap, machine repair parts)
- c. **In-process Inventories:** Semi-finished products found at various stages in the production operation.
- d. **Finished goods Inventories:** Completed products ready for shipment.

2. Materials Classification ^[1]

Lopes *et al.* (2006) argue that there may be low consume materials that are essential to the continuing of organization activities and, therefore, the cost of their lack, may be more costly than the investment to keep them in stock. Thus, one must consider, in addition to consumption, other factors such as difficulty in acquiring the material, supply lead time, volume required for storage, costs, etc. Therefore, a materials classification based on multiple criteria may assist in this matter.

One of the most popular methods for materials classification is the ABC curve, also known as Pareto law, which rests briefly on the fact that there are few critical materials and many insignificant. Other methodologies available for sorting of materials are Analytic Hierarchy Process, Analytic Network Process, Krajilic's Matrix, Utility Theory, among others.

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¹ Inventory management in the public sector: a diagnosis of the inventory management in a Brazilian public warehouse and proposal of materials classification using utility theory and ABC curve by *Anna Paula Galvão Scheidegger, Fabio Favaretto, Renato da Silva Lima and João Batista Turioni*

Gaither and Frazier (2002) state that one of the most frequently used criteria in the ABC classification is valued demand or inventory value, which represents the unit investment of each product multiplied by its demand. However, as already mentioned this method may overlook other important factors and therefore it is suggested the adoption of multiple criteria. Roy (2012) indicates other criteria and parameters to be used in the materials classification, such as: material importance, price, material turnover, difficulty of supply, stability of demand over time, durability, substitutability and reparability.

3. Inventory Management ^[2]

Organization's inventory is an important component and its management is vital to the success and cost reduction of the firm's expenditure. Wild, (2002) recommends, proper warehousing of inventory so that when goods are ordered, they are held at the warehouse for the least time possible minimizing holding cost of inventory. Consequently, other operational costs may increase inventory management costs like through the balance of ordering costs, holding costs, safety stock and stock outs (Palevich, 2012) and (Wisner, Tan and Leong 2011). Once an organization realizes this, it can develop online inventory management tool to monitor its inventory information by breaking it down into groups by correlating the categories with its customers.

Beamon and Kotleba (2006) explain that Re-order level (ROL) is critical for humanitarian organizations to achieve optimal efficiency and be effective. They need to have two reorder levels one that is normal whereas a second one that is for emergency cases in case of disaster. This improves performance and customer satisfaction.

Bachetti, Plebani, Saccani and Syntetos (2010) argue that inventory management need to be organized in a logical way to facilitate the organization knowledge of when to order and quantity to order. Economic order quantity enables organizations plan their inventory replenishment on a timely basis such as monthly, quarterly, half yearly or yearly basis. As organizations try to improve on the inventory management, Economic Order Quantity (EOQ) and Re-order Point (ROP) are important tools organizations can use to ensure that inventory supply does not hit a stock out as explained by Gonzalez and Gonzalez (2010).

4. Developments in Inventory Management ^[3]

In recent years, two approaches have had a major impact on inventory management: Material Requirements Planning (MRP) and Just-In-Time (JIT). Their application is primarily within manufacturing but suppliers might find new requirements placed on them and sometimes buyers of manufactured items will experience a difference in delivery. Material requirements planning are basically an information system in which sales are converted directly into loads on the facility by sub-unit and time period. Materials are scheduled more closely, thereby reducing Inventories, and delivery times become shorter and more predictable. Its primary use is with products composed of many components. MRP systems are practical for smaller firms. The computer system is only one part of the total project

which is usually long-term, taking one to three years to develop.

Just-in-time inventory management is an approach which works to eliminate inventories rather than optimize them. The inventory of raw materials and work-in-process falls to that needed in a single day. This is accomplished by reducing set-up times and lead times so that small lots may be ordered. Suppliers may have to make several deliveries a day or move close to the user plants to support this plan.

5. Theory of constraints

The Theory of Constraints (TOC) was developed by an Israeli physicist E. Goldratt. The TOC concept was initially used only in the production environment (it was previously known by the name of Optimization Production Technology, OPT), however today there are many examples of TOC application both in distribution, procurement and marketing, i.e. various areas of supply chain management. TOC is a method which has a well-developed research apparatus referred to as the Thinking Process. The mechanism makes it possible to analyse systems and to identify and remove any constraints which act like obstacles preventing the company from achieving its goals. Constraints also include "bottlenecks", i.e. weakest links within an enterprise which, in critical situations, are first to become sources of problems.

If they are not promptly removed, they adversely affect the development of the enterprise or supply chain (e.g. in the aspect of production or financial liquidity). Application of the Thinking Process in the Management of enterprises which function as links in the supply chain makes it possible to establish robust standards in such areas as development of strategies, HR management, sales and marketing, finances and creation of coherent systems for measuring economic efficiency.

In addition to the basic measure of production value, assessment of the degree of goal achievement in the TOC framework also involves stock, i.e. capital "frozen" in materials. The aim of each system should be striving to increase the volume of sold production, ensuring a reduction of stock levels and operating expenses and, at the same time, contributing to an increase in profits. The implementation of TOC should make it possible to reduce costs of material flow through the supply chain. Appropriate stock allocation for different links within the supply chain, coupled with the application of suitable models of stock replenishment, is the basis for cost optimisation. In this article, authors seek to outline the possibilities of using TOC as an element of a hybrid system for stock management in supply chains.

6. Meaning of VMI ^[4]

In its simplest form, Vendor Managed Inventory is the process where the vendor assumes the task of generating purchase orders to replenish a customer's inventory. VMI is a term that is used to describe many types of supply chain initiatives. These different 'VMI' activities can vary substantially in purpose and application.

In all of its forms VMI should be about improving visibility of demand and product flow in a supply chain, facilitating a more timely and accurate replenishment process between a supplier (vendor) and an inventory site (customer,

² Inventory Management And Supply Chain Performance Of Non-Governmental Organizations In The Agricultural Sector, Kenya By Anthony Gakinya Mwangi

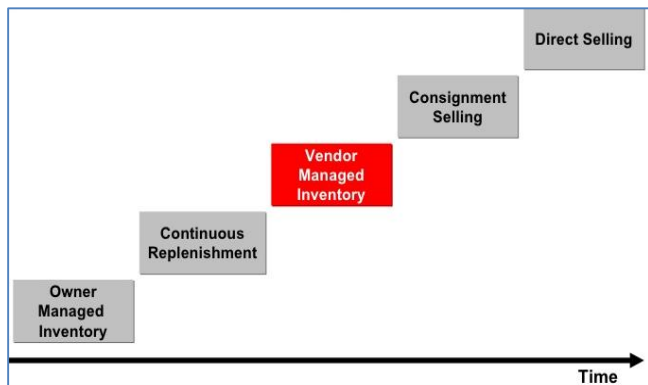
³ Techniques Of Inventory Management

⁴ Vendor Managed Inventory by Indian Institute of Materials Management

distributor, distribution center, etc). The application of VMI can be at any point within a supply chain:

- Manufacturer – Wholesale Distributor Wholesale Distributor - Retail
- Manufacturer - End Customer/OEM Wholesale Distributor – End Customer/OEM
- Manufacturer – Internal Inventory Sites

The VMI process is a combination of (Click link for more info and facts about e-commerce) e-commerce, software and people. The e-commerce layer is the mechanism through which companies communicate the data. VMI is not tied to a specific communications protocol. VMI data can be communicated via (Click link for more info and facts about EDI) EDI, (Click link for more info and facts about XML) XML, (Protocol that allows users to copy files between their local system and any system they can reach on the network) FTP or any other reliable communications method. The key feature of the e-commerce layer is that the data be timely and accurate. The balance of this paper will focus on the interaction between the people and software to create and execute a VMI process that is germane to the business and delivers tangible benefits to the supply chain partners.



Annual Inventory Carrying Cost	
Category	Cost as a % of Inv. Value
Housing costs (building rent, depreciation, operating cost, taxes, insurance)	6% (3 - 10%)
Material handling costs (equipment, lease or depreciation, power, operating cost)	3% (1 - 3.5%)
Labor cost from extra handling	3% (3 - 5%)
Investment costs (borrowing costs, taxes, and insurance on inventory)	11% (6 - 24%)
Pilferage, scrap, and obsolescence	3% (2 - 5%)
Overall carrying cost	~ 26% _

Fig 1: Inventory Management Evolution

7. Review of literature

Frederik Zachariassen, Henning de Haas, Sirle Bürkland (2014) [5] opines that research on inventory management in general and on VMI in particular has intensified during the recent decade (Williams & Tokar, 2008). Despite this increased focus and VMI’s ostensible benefits, the concept has, however, not gained the popularity that was expected since its successful introduction and application in US retail

stores, such as Wal-mart and K-mart in the early 1990’s (Blatherwick, 1998). It has even been noted that “most of the accounts [of VMI] are anecdotal providing company-specific examples. Little empirical work has appeared in academic publications” (Daugherty & Myers, 1999, pp. 63) with others stating that convincing people to engage in VMI adoptions has proven to be a “monumental task” (Pohlen & Goldsby, 2003, pp. 566).

Hui Shi (2010) [6] finds that the most of the medicines and related supplies in hospitals belong to perishable goods. Considered the features of these goods in this article, Vender Managed Inventory (VMI) is introduced to the research of supply chain management in hospitals. A quantitative model of tow stage supply chain inventory or supplier-hospital is established to compare the inventory cost of hospitals and their suppliers before and after the adoption of VMI. Through a quantitative comparison, it is confirmed that the adoption of VMI can effectively reduce the overall inventory cost of the hospitals and the supply chain. Though the suppliers' inventory cost may increase, a win-win solution between suppliers and hospitals could be worked out through transferred payment method. With this method, VMI could help to reduce the overall inventory cost and get Pareto equilibrium of the supply chain.

Scott Frahm (2003) [7] propounds that the goal of Vendor Managed Inventory is to provide a mutually beneficial relationship where both sides will be able to more smoothly and accurately control the availability and flow of goods.

In VMI a manufacturer or distributor assumes the role of inventory planning for the customer. Extensive information sharing is required so that the manufacturer/distributor can maintain a high degree of visibility of its goods at the customer’s location. Instead of the customer reordering when its supply has been exhausted, the supplier is responsible for replenishing and stocking the customer at appropriate levels. Wal-Mart has mastered VMI and is the company against which many other organizations benchmark themselves

Riccardo Mangiaracina, Marco Melacini and Alessandro Perego (2012) [8] study the benefits and the drawbacks of vendor managed inventory (VMI) in the grocery supply chain. Despite its being the most popular approach to collaboration within supply chains, its level of adoption is still far from the expected, primarily due to the difficulty in identifying the benefits and assessing their economic value. This paper presents a simulation model in the context of a two-level supply chain (manufacturers and retailers) in the grocery industry. The model was developed in order to understand the impact of VMI on the overall costs for the supply chain players and the effect of some key variables. In particular, a ‘one producer-many retailers’ system was modelled in order to better assess the ‘critical mass’ effect on the success of VMI projects.

Y. A. Hidayat; I. D. Anna; A. Khrisnadewi (2011) [9] considers the application of VMI in a supplier-buyer relationship and develops an analytical model to prove the benefits obtained from the VMI collaborative initiatives. A mathematical model is developed for a two-level supply

⁶ Research on supply management in hospital based on VMI

⁷ Vendor Managed Inventory (VMI): Three Steps in Making It Work

⁸ A Critical Analysis of Vendor Managed Inventory in the Grocery Supply Chain

⁹ The application of vendor managed inventory in the supply chain inventory model with probabilistic demand

⁵ Vendor Managed Inventory: Why you need to talk to your supplier; Journal of Industrial Engineering and Management – http://dx.doi.org/10.3926/jiem.1195

chain consists of single supplier and single buyer in a probabilistic demand situation. The analytical model shows that the VMI implementation in the probabilistic inventory model, considering lead time as a decision variable, has the ability to reduce the supply chain expected total cost, reduce the lead time, therefore increase the frequency of replenishment and improve the service level.

S.M. Disney, A.T. Potter and B.M. Gardner (2003) ^[10] investigate the impact of a vendor managed inventory (VMI) strategy upon transportation operations in a supply chain. Specifically, the issue of batching to enable better use of transport vehicles is studied. A system dynamics methodology is used to develop difference equation models of three scenarios— traditional, internal consolidation and VMI. The holistic nature of inventory management within VMI enables batching to minimize transport demand without negatively impacting the overall dynamic performance of the supply chain. Using the concept of cost escapability, it is shown that transport cost savings are possible in both the short and long term.

Ika Deefi Anna (2016) ^[11] develops model to prove the benefits obtained from implementing VMI to supplier-buyer partnership analytically. The model considers a two-level supply chain which consists of a single supplier and a single buyer. The analytical model is developed to supply chain inventory with probabilistic demand which follows normal distribution. The model also incorporates lead time as a decision variable and investigates the impacts of inventory management before and after the implementation of the VMI. The result shows that the analytical model has the ability to reduce the supply chain expected cost, improve the service level and increase the inventory replenishment.

Marco A. Gutierrez and J. Rene Villalobos (2004) ^[12] describes an analysis performed for the implementation of a vendor managed inventory system in a two-level supply chain. A model for calculating replenishment quantities is presented, and problems such as incentives to deviate from optimal inventory levels and imbalanced savings are addressed. Vendor Managed Inventory (VMI) is a planning and management system that optimizes the supply chain performance in which the vendor is responsible for maintaining the customer's inventory levels but is not necessarily tied to inventory ownership.

8. Benefits from vendor managed inventory

The goal of Vendor Managed Inventory is to provide a mutually beneficial relationship where both sides will be able to more smoothly and accurately control the availability and flow of goods.

In VMI a manufacturer or distributor assumes the role of inventory planning for the customer. Extensive information sharing is required so that the manufacturer/distributor can maintain a high degree of visibility of its goods at the customer's location. Instead of the customer reordering when its supply has been exhausted, the supplier is responsible for replenishing and stocking the customer at appropriate levels. Wal-Mart has mastered VMI and is the company against which many other organizations benchmark themselves (1).

8.1 Customer Benefits

When the supplier can see that its customer is about to exhaust its inventory, the supplier can better prepare to replenish the customer because the supplier can then better schedule its own production/distribution. Customers will reduce/eliminate stockouts because they will not have to reorder goods at the last minute without knowing whether the supplier has the ability to restock without interrupting the customer's operations. Therefore, part of VMI's goal is to reduce uncertainty that arises when the supplier is blind to the customer's inventory status.

8.2 Supplier Benefits

As long as the supplier carries out its task of maintaining predetermined inventory and avoiding stockouts, it will be able to lock in a VMI-supported customer for the long term with or without a contract. This will produce a steady and predictable flow of income for the supplier and reduce the risk that the customer will switch suppliers (Switching would be too costly for the customer). A VMI arrangement will allow the supplier to schedule its operations more productively because it is now monitoring its customer's inventory on a regular basis. Furthermore, reductions in inventory will be achieved once the supplier develops a better understanding of how the customer uses its goods over the course of a year.

9. Benefits of VMI for vendors ^[13]

9.1 More Control

VMI gives vendors more control so they can accurately forecast the demand of their customer's stock. They are able to make production more efficient, can practice lean manufacturing, make frequent deliveries, reduce stock levels, and decrease stock shortages. Vendors using VMI will have complete visibility into their customers' inventory levels, which allows them to meet their customers' inventory demand, reduce inventory errors, and reduce costs.

9.2 Strengthen Customer-Vendor Relationships

Suppliers are able to develop stronger relationships with their customers by providing them with better quality customer service. Vendors managing their customers' stock will become more valuable suppliers, and in turn will increase the strategic nature of communication with their customers.

9.3 Reduce Inventory Costs

Since VMI gives vendors and control over their customers' stock, they are able to eliminate wastage, non-value adding factors, and other costs associated with inventory errors. Accurate inventory planning cuts the cost of storing excess inventory and reduces the risk of stock becoming obsolete. More importantly, vendors are able to eliminate stock shortages which cause them to pay high delivery costs to ship expedited orders.

10. Working of VMI ^[14]

10.1 Clarify expectations

There needs to be thorough discussion about how the system will benefit both organizations in the long term or one of the

¹⁰ The impact of vendor managed inventory on transport operations

¹¹ The Implementation of Vendor Managed Inventory In the Supply Chain with Simple Probabilistic Inventory Model

¹² Vendor managed inventory and cost reduction in an international two level supply chain

¹³ The Benefits of Vendor Managed Inventory; <http://www.clearspider.com>

¹⁴ Vendor Managed Inventory (VMI): Three Steps in Making It Work by Scott Frahm(2003)

parties, particularly the supplier, is prone to disappointment with some of the short-term results. If these items are not addressed the program will likely be terminated quickly with neither side gaining any of the benefits expected from the program. The objective is clear and constant communication between the supplier and customer. When the two parties work in conjunction they can be assured that the planning function, for both sides, will begin to smooth over time.

10.2 Agree on how to share information

If the supplier and customer can agree to share information vital to restocking in a timely manner, then the odds of a synchronized system will dramatically improve. Proprietary information would not have to be shared between the supplier and customer, but enough information to maintain a steady flow of goods is necessary. The customer should be willing to share production schedules and/or forecasts to provide some visibility for the supplier.

10.3 Keep communication channels open

When the two parties set out to implement a VMI program, they need to meet and discuss their goals and how they need to proceed in order to realize those goals. Once a VMI program has been activated, each side needs to understand that there are going to be some miscues. These miscues need to be studied as opportunities for learning and then used to avoid repetitive problems in the future.

11. The downsides of VMI

VMI isn't a perfect system. Vendors vary widely in quality, and some vendors just aren't good at managing your inventory needs. You may find that a vendor more efficiently manages your inventory under VMI, or you may find you prefer an alternative system.

One of the key things to know about VMI is that businesses need to set limits and controls on supplied quantities, including minimum and maximum quantities.

At the same time, businesses need to make sure these limits aren't *too* restrictive, otherwise they'll impede the vendor's ability to accurately meet demand.

This becomes particularly important when you're setting fill-rate requirements. You don't want to require 99% fill rates without an increase in inventory levels if you were only getting 95% fill rates when you managed the inventory.

12. Conclusion

Vendor Managed Inventory is one of the widely accepted partnering initiatives where the organisations have been able to leverage multi-firm supply chain initiatives. This is effective enough to reduce the total costs in the channel system. The VMI approach has not only benefited the large but also small organisations.

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