



## Implementation of Vendor Managed Inventory (VMI) in Managing Intra Ocular Lenses (IOL) in Eye Care Organization



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### Abstract

Nowadays healthcare has a completely changed scenario as compared with the early 90's. As more and more profit-generating hospitals are coming in the industry, hospital, and health care is no longer remains a charitable or philanthropically act. So to remain in the market and compete within hospitals need to now focus on the different and innovative strategies in every aspect. Supply chain and operations are one of the important keys of any organization which directly impact business and revenue. Vendor Managed inventory is not a new concept but it is not efficiently utilized in service and healthcare industry as of now. Some retail and automobile industries have utilized the concept and also able to reduce the inventory cost with the manageable position of stock out and overstocking position. As the hospital's key functioning is to deal with the life of patients on day to day so the position of material needs to be necessarily on right time and the right place. This paper is based on the insight of the application of vendor managed inventory in the management of inventory for the IOL (Intraocular lenses) that is used for the surgeries in the eye hospital. We will also study the questionnaire on the acceptability of the concept of vendor managed inventory in the hospital that will help to assess the acceptability of VMI in the hospital and healthcare industry. Also, a framework matrix is designed to understand the relation of VMI with the revenue earning and smoothening of operational efficiency.

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### 1. Introduction

Healthcare industry is in a developing stage and it will evolve gradually. Hospitals are playing an important role nowadays to serve the society with the most advanced and equipped healthcare services. Supply chain process is not that much evolved in the hospital industry in India and treated as only much more as a store function. VMI (vendor managed inventory) is not a new concept but it is not utilized in hospitals as a competitive strength. VMI is a

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replenishment program in which the supplier has the right to control the level of customer's inventory on the basis of demand orders and forecasts from the customer. (Spychalska, 2010)

In any business scenario profit generation which is also coined as return on investment (ROI) can be earned by two ways, through gaining the profit from services to the customers and through saving the cost or expense incurred in same. Both are a complement to each other and can be proved best for profit generation. Inventory Management is a process of managing the stock out and overstocking of the material along with the competitive price and standard quality of the material and providing the right material on right time. When inventory management comes in the role than it is not only affected by one factor of the supply chain but is affected by several other factors. VMI is also one of the important factors that can help in managing the inventory and in turn also increased the efficiency of the organization not only in terms of profit generation but also through increasing the customer satisfaction level by providing all the necessary material required on time with quality as in healthcare/service industry customer satisfaction is the most important factor.

Inventory may be served at its best to fulfill the requirement when it is well managed and there is no position of stock out and overstocking. As stated above vendor managed inventory is an acts in which the management of inventory will be given to a vendor in are various terms and conditions.

### *Factors that Affect Inventory Are*

#### *a) Reorder Level*

Reorder level system is a system developed to forecast the inventory requirement with the managed lead time. It is that point where the material is to be ordered when the stock level of material will be used up during the time required to bring in additional stock. The calculated reorder point (also referred as an order point, a statically order point or a trigger) is that predetermined inventory at which replenishment action is been called for when the on hand and on order drops to or below that level. The calculation for reorder point is  $\text{Reorder Point} = \text{Anticipated demand during lead time} + \text{Safety stock}$  (Toomey, 2012, p. 228)

If replenishment is not been done as per the reorder system than it increases the chances of stock out and in case of healthcare setup it leads to some serious medical issues due to non-availability of material on right time.

#### *b) Lead Time*

Lead time is the time required to perform all operations in the process up to the point under the analysis. As an example, the lead time for a finished product includes the time to receive the raw material and components and assemblies as well as time to assemble the final assembly. (Martin, 2006).

Lead time can be of two types, one is “ internal lead time “ which includes the time to analyses the reorder level and of releasing the order and other is the “ External lead time “ which includes the time taken by the vendor to deliver the material.

#### *c) Financial Position of the Firm*

As in the management of inventory, this point is the hidden part but its impact on the management of inventory is equal as of the above-mentioned points. The financial position of the firm states the inventory holding position of the firm and also has an impact on the external lead time. As the financial outstanding clearance also impacts the lead time of the vendor.

#### *d) ABC and VED Analysis*

In the management of inventory, it is most important to segregate the product/ material of the inventory in ABC category. ABC analysis divides the inventory into three classifications on the basis of annual rupee value. ABC analysis is an inventory application of what is known as the “Pareto Principle”.

The Pareto Principle state that there are critical, few and trivial many. Class A items consist of maximum value and represent 20% of the total item & include approx. 70% of the total cost of the budget, Class B items are of medium value and represent 40% of the total inventory & include 20% of the cost of budget whereas Class C items are of less value and represents 60% of the total items and represent 10% of the cost of total budget. (Heizer, 2008).

In compliment with ABC analysis VED (Vital, essential, desirable) analysis helps to classifying the material on the basis of criticality. Vital are those inventory items that are critical to function, essential are those items that are essential and desirable category are those material without which functioning can be done but are desirable.

a) *Categorization of Inventory in Hospitals*

As hospitals have different sections for diagnosis, so as the material of inventory are also classified accordingly for procurement and likewise the roles are also categorized for purchase manager. For example, the consumables that are used in surgeries are categorized under surgical consumable, then assets which include equipment for the hospital, general items like IT and marketing consumables are there and one of the important inventory of a hospital is an inventory of drugs. Hospital's business profit depends on expenditure on the consumables used in the inventory and revenue from the retail business and services sold.

Retail business mainly comprises for Pharmacy business and optical business. Most of the vendors are dependent on the orders of the purchasing department to supply the goods or services to the hospital due to which supply/purchase department is one of the key functioning department of the hospital, and it also makes the same manpower dependent.

b) *Eye Care And Intra Ocular Lenses (IOLS)<sup>1</sup>*

Eyes are the sophisticated organ that we rely on heavily to help us process our world. Because they are so vital so they are well protected. Each eyeball is protected by a bony orbit to prevent trauma to the eye from the larger object. (Al Lens, 2008) The visual system of eye involves the process in which eye takes the information from the environment in the form of light and analyze and interpret it. The eye houses the elements that take in light rays and changes them in the neural signal. Muscles attached to outer coat of the eye, control and direct the globe's movement and the muscle of both eyes are coordinated to provide the binocular vision. (Remington, 2011)

As per the research survey ICMR for ophthalmic research total load of blindness in the world is 23 million and for 9 million in India comprising three major disorder namely cataract, Glaucoma, and trachoma. Cataract was found as the cause of blindness in more than 70% cases followed by corneal blindness and optic nerve disease each of which causes 1/7<sup>th</sup> of all blind eyes and other sites (retina, macula, unknown) are 15% of the causes. (Dr. D.K. Mehta) The lens is one of the important parts of the eye which is used to transfer the light from the cornea to retina for visualization of images. It helps in contracting the size of the object and able to accommodate itself according to the distance of the object.

In eye care hospitals the inventory of the lenses is the most important as an inventory of the intraocular lenses need to be maintained and looked very carefully for conducting the surgeries. *Intraocular lenses*, or *IOLs*, are implantable lenses that are used to replace the natural lenses of the eyes when they have become damaged. Scientists originally designed IOLs to treat cataracts. When your doctor removes your old, clouded lens and replaces it with an IOL, you could enjoy significantly enhanced vision at all distances. Like many patients, you could even enjoy 20/20 vision or better without glasses or contacts. (Barsam A). The global market of IOL (intraocular lenses) is expanding with the aging of a more affluent middle-class population. The global market of intraocular lenses (IOL) is expected to reach \$3.8 billion by 2019. (Intraocular Lens (IOL): Market Shares, Strategies, and Forecasts, Worldwide, Nanotechnology, 2013 to 2018, FEB, 2013)

Approx. 6 million lenses are used for the eye surgeries in India. Intraocular lenses are of various types i.e Mon focal, Multifocal, TORIC etc. and accordingly the supply chain of the respective lenses are different.

c) *Traditional Inventory Management of IOLS*

The supply chain of intraocular lenses in India is not that much advanced as in other parts of the world. Even the eye care hospitals in India are manpower dependent nowadays also. The management of intraocular lens (IOLs) in the Eyecare is already been based on the LIBRARY SYSTEM. Library system is more or less similar system as that of VMI (Vendor-managed Inventory), the difference in the two is that in the "Library System" for the inventory management of IOLs, vendor is responsible to replenish the inventory stock of library but real-time data of the consumption is not accessible to the vendor and vendor need to be dependent on the information provided by the customer (Hospital's purchase or store department).

This Library System can also be said as "Partial VMI" as management of inventory by the supplier is there but access to the real-time data of customer i.e information sharing is not there.

The library concept of the intraocular lenses are in place in the eye care chains in which some common power lenses are kept in inventory in the warehouse of the hospitals, and as soon as the lenses are consumed the purchasing department need to place the order on time to replenish the library of the lenses.



Figure 1. Steps of the process involved in Traditional Inventory management cycle

This process can lead to various issues in the supply chain process of the intraocular lenses or IOL's. Hoya (a multinational lens manufacturing organization) has adopted the advanced supply chain management system for the supply of Lenses. With the help of RFID system, the barcode attached is scanned and recorded in the system which can help in eyeing in the inventory of the lenses. As soon as the inventory is consumed the system will automatically create order as per the reorder level and send the information to the vendor to replenish the inventory of the warehouse so that there will not be any shortage of lens and can be timely supplied to the customer.

On an average, in India, approximately 3-4% of the eye surgeries are being canceled due to:

- 1) Delay in the transport of lenses
- 2) Breakage of the lenses at the time of surgery
- 3) Delay in the ordering of the lenses that leads to unavailability of same.
- 4) Financial challenges (Payments, Invoice submission etc.)

#### d) Vendor Managed Inventory (VMI)

There are different definitions and elaboration about VMI in different books and articles but in the healthcare industry, specifically, the Hospital sector the definition of same would become slightly different. As in Hospital's setup, one needs to deal with the patient care and hence the availability of the stock and Quality of the material is necessary.

Right product at the right place at the right time is a must and supplier must respond spontaneously to the hospital's request. (Turhan, July 6, 2012). VMI stresses the responsibility of the vendor in inventory Management (Frederick Zachariassen, July 2014). One of the research paper by Dr. U. KIRAN RAVEENDRAN in "VMI systems in India- Focus on Retailing" (Raveendran, March 24, 2015) it is stated that the traditional system of managing the inventory has given way to more advanced systems like Just In Time (JIT), Postponement or delayed configuration, flexible manufacturing system(FMS), Quick response logistics

(QRL), 3PL 4PL (Third party & forth logistics), Collaborative planning forecasting and replenishment (CPRF) and Vendor-managed Inventory (VMI).

The concept of VMI has been adapted by Retail and manufacturing in early 90's but since then the concept has not been widely accepted in India and very less accepted by Indian healthcare Industry, the scenario of the acceptance in Indian hospitals sectors are almost nil.

The factors of failure of VMI includes the "Confidentiality of information sharing", Risk of control of cost by customer", and increased supplier's administrative cost which make the failure of one out of two attempts of implementation of VMI.



Figure 2. Steps involved in the process of Inventory Managed inventory system

## 2. Research Methods

### *Need for Research*

From extensive review of literature regarding the concept of VMI, it is clear that the concept of VMI is not new and has been successfully adapted in various industries, for example, WAL MART (Retail Industry), GSK Pharmaceuticals (Pharmaceuticals Industry), Tata Motors (Manufacturing Industry) and many other but it is also clear that this concept is not been adapted yet at the hospital industry due to its own specific nature and complications.

So this study will help in filling the gap of the need of advanced concept for the inventory management like VMI in the hospital setups in India. As the hospital industry has its own unique nature and the management of inventory is also need to be looked critically because the patient care and quality of service are essential in the industry.

This research will also help in identifying the supplier's and management's perspective regarding the implementation of the concept. With the measure of tangibles performance measures, the Intangible measures are also measured in the study that indirectly helps in assessing the patient care service which is the goal of every Hospital.

Up to now, all the research are based on the parameters that are tangibles but this study bridge the gap to the intangible performance parameters.

## 3. Results and Analysis

### *Data Analysis*

In the research Paper, the performance and success rate of Vendor Managed inventory of IOLs' (Intraocular lenses) is measured through a matrix that will help in evaluating and comparing the data.

The Matrix will provide the indicators to measure the performance and efficiency measurement of the "traditional management of inventory and with "Vendor managed inventory". With the use of this matrix data analysis is been done which will be shown further. These indicators will help not only to measure the efficiency but also provides the tool to compare the transition with Vendor managed inventory.



Figure 3. Matrix designed for measuring the performance of the supply chain and purchase function to assess the efficiency and improvement in the inventory management

- a. TAT (Turnaround Time) – The TAT taken in the study is 1 day to reach the IOL (intraocular lens) to the end user from the time of generation of requirement.
- b. OFR (Order Filling Rate) – as per this study the ideal OFR should be 100% for IOL's.
- c. Accuracy- The measure of correctness of item delivered should be 100% ideally as per the norms of the organization.

In the paper the data of two set is collected, one is off from July-Sept and other is of October- December. July to September is the phase working on traditional inventory system and October-December is the phase working on “Vendor Managed Inventory” system.

Table 1  
The phase working on traditional inventory system

ITEMS	TAT	OFR	ACCURACY
IOL	1 day	100%	100%
OT/OPD CONSUMABLES	3 days	100%	90-100%
PHARMACY	3 days	100%	90-100%

Table 1- Represents the ideal measurement of performance indicators of Purchase and supply chain function for IOL, Consumables, and Pharmacy which further help in measuring the same with traditional inventory management and with Vendor managed inventory.

With reference to the above table as the Accuracy and OFR should be 100 %, it is for the reason that the surgeries of the patient are highly dependent on the IOL and it is necessary that the product delivered should accurate as demanded because the surgery is dependent on the accuracy as well.

#### 1. Turn Around Time (TAT)

Table 2  
Shows the improvement of Turnaround time from July-Sept to Oct-Dec

Month	Total no. of Lens Indented	Total no. of lens issued within 1 Day	Percentage of TAT
July-Sept	171	161	94.15
Oct-Dec	336	329	97.92



## 2. Order Filling Rate (OFR)

Table 3

Shows the comparative number of the indented quantity (requirement quantity) and issued quantity (delivered quantity) from two working phase i.e. from July-September and October- December. Also shows the percentage of filling rate

Name of Lens (IOL)	July-September			October-December		
	Sum of Indent_QTY	Sum of Issue_QTY	OFR (in%)	Sum of Indent_QTY	Sum of Issue_QTY	OFR (in%)
IOL ALCON IQ LENS	7	7	100	3	3	100.00
IOL ALCON RESTORE MF LENS	0	0	0	2	2	100.00
IOL AMO SENSAR 1 LENS	127	93	73.23	23	17	73.91
IOL AMO TECNIS 1 LENS	311	271	87.14	30	23	76.67
IOL AMO TECNIS MF LENS	0	0	0	3	3	100.00
IOL AMO TECNIS TORIC LENS	1	1	100	4	1	25.00
IOL AMO TECNIS TORIC MF LENS	4	4	100	9	7	77.78
IOL APPA SUPRAPHOBE LENS	35	29	82.86	26	24	92.31
IOL AURO AC LENS	0	0	0	16	15	93.75
IOL AURO VUE LENS	226	184	81.42	26	22	84.62
IOL AUROLAB 5.25 MM	0	0	0	5	5	100.00
IOL CIMAFLEX LENS	12	9	75	36	20	55.56
IOL IOC FLEXIFOLD LENS	28	16	57.14	65	53	81.54
IOL IOC ULTIMA LENS	78	64	82.05	34	29	85.29
Total	829	678		282	224	

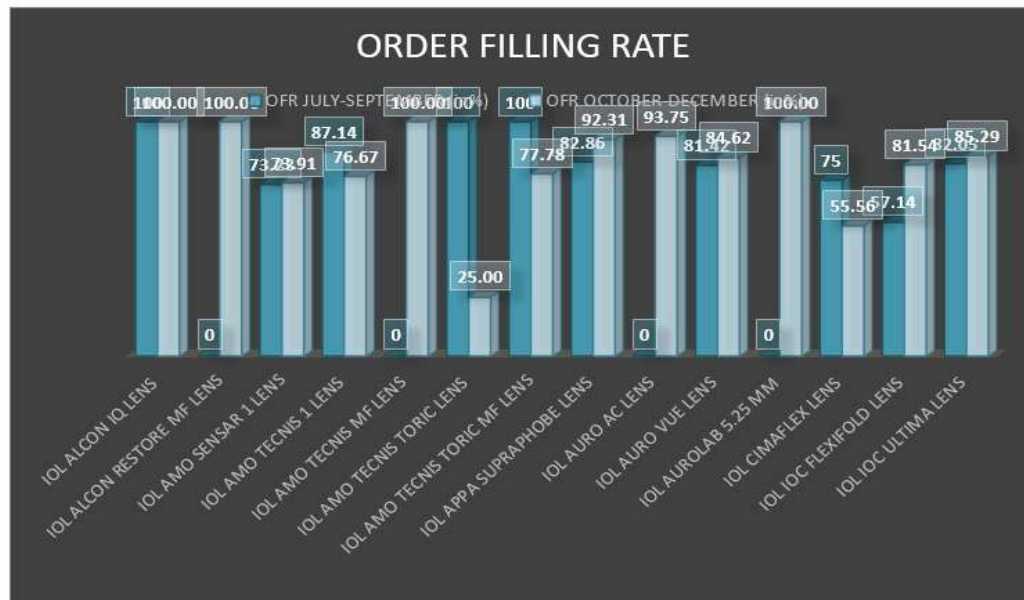


Figure 4. Above figure shows the graphical representation of the order filling rate (OFR) percentage for indented quantity and issued a quantity of IOL's for comparison of traditional inventory management and with vendor managed inventory

### 3. Accuracy and Surgery Cancellation

Overall observation in the study for accuracy is the 100% accurate delivery of products before and after the implementation of “vendor managed inventory” concept. As far as cancellation of surgery is concerned the cancellation of surgery due to unavailability of the lenses decreased by the implementation of vendor managed inventory concept.

### 4. Conclusion

The study concludes that although our current health care system and hospitals are using traditional vendor managed inventory system but this system has a number of shortcomings due to which it can impact the whole system of the hospital. From the above data analysis, it is clearly shown that there is a comparative decrease in the TAT (Turnaround time) and increase in the OFR (order filling rate). As seen in the month from July to September with the use of traditionally managed inventory the TAT and OFR are approximately 95% but as we implement Vendor Managed Inventory concept in the month of October- December it increases up to 98%. As far as accuracy is concerned it is 100% in both the periods.

So as the organization of the study was having loss and issues due to traditional inventory management concept, with the implementation of Vendor managed inventory concept improvement in the indicators of performance of supply chain. Also, the matrix of the performance provides the indicators that will help in measuring not only the operational efficiency but also helps in identifying the gaps for the future research.

#### *Scope for Future Research*

In this paper, the focus is on the improvement of the efficiency of the various indicators of inventory management and supply chain. Some aspects are not highlighted here like the division or categorization of the material as per their criticality to be included in the Vendor managed inventory concept. As in the set of the hospital every item cannot be included in the vendor managed inventory concept so it is necessary to categorize them and accordingly include the same. Also, the trust management and vendor relationship management in context to the hospital scenario can be studied which can help in providing the solutions for the sharing of data with the other party and makes the management much more comfortable in taking the decisions.

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#### *Statement of authorship*

The author(s) have a responsibility for the conception and design of the study. The author(s) have approved the final article.

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