

SELECTIVE INVENTORY CONTROL TECHNIQUE IN DIFFERENT PHARMACEUTICAL INDUSTRY - LITERATURE REVIEW

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ABSTRACT

This paper is a review on various selective inventory control techniques. The references are taken from various research papers already published in this domain but on different types of industry or fields. This paper tells how efficiently selective inventory control technique can be used to optimize the resources and reduce cost. The inventory control techniques are used in combination of one another. Various combinations are used to solve varied types of problems.

Keywords: - Inventory management techniques, ABC analysis, VED analysis, FSN analysis, XYZ analysis, SDE analysis.

1. INTRODUCTION

Every industry works on certain inventory. Thus it forms an important asset of the industry and thus needs to be properly managed. Inventory control technique helps to optimize the inventory by considering various factors depending upon the type of technique. From industry at small scale to large scale needs proper maintenance of inventory. Inventory management includes deciding the inventory level, cost involved and the time at which material should be ordered or stocked. Thus it forms a crucial part of Industrial processes. Inventory management is a systematic approach to sourcing, storing, and selling inventory—both raw materials (components) and finished goods (products). In business terms, inventory management means the right stock, at the right levels, in the right place, at the right time, and at the right cost as well as price.

1.1 Inventory management techniques:-

ABC Analysis:-

ABC analysis is an approach for classifying inventory items based on the items' consumption values. Consumption value is the total value of an item consumed over a specified time period, for example a year. The approach is based on the Pareto principle to help manage what matters and is applied in this context:

- A items are goods where annual consumption value is the highest. Applying the Pareto principle (also referred to as the 80/20 rule where 80 percent of the output is determined by 20 percent of the input), they comprise a relatively small number of items but have a relatively high consumption value. So it's logical that analysis and control of this class is relatively intense, since there is the greatest potential to reduce costs or losses.
- B items are interclass items. Their consumption values are lower than A items but higher than C items. A key point of having this interclass group is to watch items close to A item and C item classes that would alter their stock management policies if they drift closer to class A or class C. Stock management is itself a cost. So there

needs to be a balance between controls to protect the asset class and the value at risk of loss, or the cost of analysis and the potential value returned by reducing class costs. So, the scope of this class and the inventory management policies are determined by the estimated cost-benefit of class cost reduction, and loss control systems and processes.

- C items have the lowest consumption value. This class has a relatively high proportion of the total number of lines but with relatively low consumption values. Logically, it's not usually cost-effective to deploy tight inventory controls, as the value at risk of significant loss is relatively low and the cost of analysis would typically yield relatively low returns.

VED Analysis:-

It attempts to classify the items used into three broad categories, namely Vital, Essential, and Desirable. The analysis classifies items on the basis of their criticality for the industry or company.

- Vital: Vital category items are those items without which the production activities or any other activity of the company, would come to a halt, or at least be drastically affected.
- Essential: Essential items are those items whose stock – out cost is very high for the company.
- Desirable: Desirable items are those items whose stock-out or shortage causes only a minor disruption for a short duration in the production schedule.

The cost incurred is very nominal. VED Analysis is very useful to categorize items of spare parts and components. In fact, in the inventory control of spare parts and components it is advisable, for the organization to use a combination of ABC and VED Analysis. Such control system would be found to be more effective and meaningful.

FAST, SLOW & NON-MOVING (FSN) Analysis:-

This method of inventory control is very useful for controlling obsolescence. All the items of inventory are not used in the same order; some are required frequently, while some are not required at all. So this method classifies inventory into three categories, fast-moving inventory, slow-moving inventory, and non-moving inventory. The order for new inventory is placed based on the utilization of inventory.

XYZ Analysis

XYZ analysis is one of the basic supply chain techniques, often used to determine the inventory valuation inside a Stores. It's also strategic as it intends to enable the Inventory manager in exercising maximum control over the highest stocked item, in terms of stock value.

The XYZ analysis is a way to classify inventory items according to variability of their demand.

- X class items which are critically important and require close monitoring and tight control – while this may account for large value these will typically comprise a small percentage of the overall inventory count.
- Y class are of lower criticality requiring standard controls and periodic reviews of usage.

Z class require the least controls, are sometimes issues as “free stock” or forward holding

GOLF Classification:-

The letter stands for Government, Ordinary, Local and Foreign. There are mainly imported items which are canalized through the State Trading Corporation (STC) Minerals and Metals Trading Corporation, etc. Indian Drugs and Pharmaceutical Ltd (IDPL), Mica trading corporation etc. These are special procedures of inventory control which may not applicable to ordinary items as they require special procedures.

High Medium Low (HML) Classification:-

HML Analysis classifies inventory based on how much a product costs/its unit price.

The HML classification is same procedure as adopted in ABC.

- High Cost (H) – Item with a high unit value.
- Medium Cost (M) – Item with a medium unit value.
- Low Cost (L) – Item with a low unit value.

The core difference is, for HML classification; unit value is the criterion and not the annual consumption value. The inventories should be place in descending order and it is up to management to fix limits of these three categories. Example: the management may decide all units of items with unit value of Rs 2,000 and above will be H items; between Rs. 2000-1000 will be M items & those below Rs. 1000 will be L items.

SOS Classification:-

SOS analysis is based on seasonality of items and it classifies all the items into two categories

S- Seasonal

OS- Off seasonal

The analysis helps in:

1. Identifying items that are available only during a limited period of the year .For e.g. Raw mangoes are only available only during a summers
2. Identifying items that are seasonal but available throughout the year however their costs in offseason are relatively high.
3. Non Seasonal items

As discussed above there are a number of methods used for selective inventory control and each method highlights a different aspect .The right method should be selected on the purpose for which we wish to carry out the selective inventory control.

SDE Analysis:-

The criterion for this analysis is the availability of the materials in the market. In industrial situations where certain materials are scarce (especially in a developing country like India) this analysis is very useful and gives proper guideline for deciding the inventory policies.

D stands for difficult items, items which are not readily available in local markets and have to be procured from faraway places, or items for which there are a limited number of suppliers; or items for which quality suppliers are difficult to get.

E refers to items which are easily available in the local markets

2. REVIEW WORK

Sr. No.	Paper Title	Author(s)	Inventory control technique used	Summary
1	ABC and VED Analysis in Medical Stores Inventory Control	R Gupta, KK Gupta, BR Jain and RK Garg	ABC and VED analysis	In this research paper we saw that coupling the two techniques ABC-VED matrix was made and drugs were classified in to Category I (AV+BV+CV+AE+AD) comprising 68 drugs, Category II (BE + CE +BD) 159 and Category III (CD) 98 drugs. The management of Category I drugs was monitored by top management resulting in better control on the annual expenses and at the same time making available the vital Category II by middle and Category III at lower managerial level.
2	Medicine Inventory Management by ABC-VED Analysis in the Pharmacy Store of Veterinary Hospital, Yogyakarta, Indonesia	Ida Fitriana , Raden Gagak Donny Satria and Dwi Cahyo Budi Setiawan	ABC and VED analysis	The ABC-VED analysis can be adopted in drug inventory of hospital drug management so that it can plan the availability of drugs efficiently the quality of patient care.
3	ABC-VED analysis of expendable medical stores at a tertiary care hospital	Kumar S, Chakravarty A	ABC and VED analysis	Scientific inventory management tools need to be applied routinely for efficient management of medical stores, as it contributes to judicious use of limited resources and resultant improvement in patient care.

4	A Case Study of Inventory Analysis in a Healthcare Product Manufacturing Company	Mohd Kamarul Irwan Abdul Rahim, Quamrul Hassan, S.R. Nadarajah, Kamaruddin Radzuan	ABC and VED analysis	<p>we used ABC classification as an important technique to categorize the inventory in three different classes depending on their significance.</p> <p>ABC analysis was used in order to control the inventory items more efficiently.</p> <p>Seven products are categorized in Class A, eight products are categorized in Class B whereas seven products are categorized in Class C.</p>
5	ABC and VED Analysis of the Pharmacy Store of a Tertiary Care Teaching, Research and Referral Healthcare Institute of India	Devnani M, Gupta AK, Nigah R	ABC and VED analysis	<p>As we can see that in this research Items of approximately Rs. 40,012,612 were issued by the pharmacy store of PGIMER. This necessitates application of scientific inventory management tools for effective and efficient management of the pharmacy stores, efficient priority setting, decision making in purchase and distribution of specific items and close supervision on items belonging to important categories. with the help of ABC and VED analysis we could identify the drugs required for stringent control for optimal use of funds and elimination of out-of-stock situations in the pharmacy.</p>
6	Prioritized fsn analysis of inventory management in private and hospital pharmacy followed by questionnaire	Manivel P , Rajesh Ranganathan	ABC & FSN analysis	<p>In this research paper the pharmacy purchasing and the stock maintenance procedure has been observed through a questionnaire and then the constraints and problems faced by the hospital inventory management to be overcome by implementing a new inventory model. Then formed the priority based ABC – FSN inventory matrix and narrowed down the drugs for monitoring and control strategies of pharmacy drugs.</p>
7	A Study on the Selective Controls of Inventory Management And Application of	Dr.K.V.Krishna Reddy,Dr.M.S.Siddarth Sai, Dr.Rakesh Prabhu	ABC and XYZ analysis	<p>In this research we can see various aspects because of which we can understand the importance of inventory. We can see that a classification is adopted so that a major portion of effective</p>

	ABC XYZ Control Matrix in the Cardiology Department of A Tertiary Care Hospital.			managerial time is spent on those materials, which are more important. The motive behind any selective control is that equally detailed analysis of all items is very expensive. Moreover such a concentration on all items will have diffused effect regardless of the priorities. Selective inventory control can indicate where the manager should concentrate his efforts
8	ABC-VEN Matrix Analysis of the Pharmacy Store in a Secondary Level Health Care Facility in Arbaminch Town, Southern Ethiopia	Biruk Wogayehu Taddele, Ayalewu Adinewu Wondimagegn , Mulugeta Asfaw Asaro, Mende Mensa Sorato , Bisrat Gissila Gedayi , Anidinet Assefa Hailesilase	ABC and VEN analysis	In this research paper the analysis showed that the drug expenditure of a general hospital medical store. This demands efficient and effective inventory control technique so as to make right utilization of budget by concentrating on vital or essential medicines based on ABC-VEN matrix analysis. Using ABC-VEN analysis finding medicines requiring strict monitoring for effective and efficient budget utilization. This analysis should be done before and after the procurement of medicine.
9	Multi Unit Selective Inventory Control- A Three Dimensional Approach (MUSIC -3D)	V.R. Girija and Prof. M.S. Bhat	ABC ,SED and VED analysis	The basic objective or the requirement in this research was to stop the stock-out. Computerization, automation and use of technique like MUSIC-3D will aid in achieving these objectives. It is imperative that all measures for the prevention of stock out situations should be implemented. We also came to know availability of pharmaceutical products is essential for patient satisfaction. It is also an essential requisite for provision of life saving, effective and efficient healthcare. Frequency of stock outs is an indicator to assess the effectiveness of the stores department and the materials management.
10	SIGNIFICANCE OF CONSUMPTION PATTERNS AND ABC/FSN	Nang Nwe Ni Hlaing* , Cha-oncin Sooksriwong, Farsai Chanjaruporn, Oraluck Pattanaprateep	ABC and FSN analysis	In this research paper the categorization of vital drugs according to ABC/FSN matrix benefits hospital to determine the level of inventory with minimum investment in dead-stock or slow-moving items. For

	MATRIX TO OPTIMIZE VITAL DRUGS INVENTORY MANAGEMENT			inventory management of vital drugs, only ABC and VEN matrix classification are insufficient to control the stock in appropriate level with minimum shortage and oversupply. Moreover, consideration of demand consumption patterns in forecasting and setting inventory level give an accurate stock level for optimization of vital drugs inventory management. We can therefore effectively understand the functioning and importance of ABC and FSN analysis in the same.
11	A Study on ABC-XYZ Analysis in a Pharmacy Store	Dr. Babu Krishnaraj R , Meenakshi P K	ABC and XYZ analysis	From this research paper we have concluded that there is a need for conducting such analysis regularly and applying the inventory management tools for effective and efficient management in the pharmacy stores, along with close supervision on items belonging to important categories. We got desired results using the combination of ABC and XYZ analysis and therefore the inventory classification and results of the study are being incorporated in the decision making on purchases, storage, investment and monitoring of the pharmacy items.
12	Drug Inventory control analysis in a Primary level Health care facility in Rural Tamil Nadu, India	Geetha Mani , Kalaivani Annadurai , Raja Danasekaran , Jegadeesh Ramasamy D	ABC and VED analysis	In this research paper the drug inventory analysis using ABC and VED analysis enabled their classification into categories based on their priority and assignment to appropriate managerial levels. This analysis is hoped to promote effective management of drug inventory with minimal monetary resources while maintaining required safety stocks of high priority drugs and reduce frequency of drug supply shortage. An efficient inventory management using the results of this study can create an effective system at a primary health care level will contribute to provision of uncompromised patient care.
13	Application of ABC and VED Analysis for a Pharmaceutical	Kaushik Nag*, Mohammed Anany	ABC and VED analysis	From the study in this research paper, the ABC-VED analysis was found to be an effective inventory tool for identifying the drugs requiring stringent control for

	Distributor's Inventory in Kuwait			optimal use of financial resources and elimination of out-ofstock situations. The study revealed that only 27% of items can be considered as vital and costly, accounting for a high 71% of the Annual Drug Expenditure. Such items therefore require maximum level of control, eliminating the need for equal focus on the remaining items, for which, moderate to low control may be deemed enough. Such categorization of items therefore leads to an efficient priority setting, decision making in purchase and distribution and close supervision of specific item and we can come to this conclusion only by using effective ABC and VED analysis.
14	The integrated abc/fmr/ved-analysis of drug consumption among hospice patients	Sofiya Prokip* and Bohdan Hromovyk	ABC/FMR/VED-ANALYSIS	This research paper was a bit different from the papers we were analysing till now as in this not one or two but three methods of inventory management is used to get the desirable results. This paper shows that 139 international non-proprietary names of drugs from 42 therapeutic groups of ATC classification system were used in pharmacotherapy of patients. The study of drug consumption was based on integrated ABC / FMR / VED-analysis, which is irreplaceable and useful for the management decisions in order to optimize the assortment balance of medicines. It has been found that the highest expenses in the pharmacotherapy of hospice patients are associated with analgesics and psycholeptics, which is related to the ranking position of those groups of drugs by the frequency of prescribing.
15	Analysis of Inventory of Drug and Pharmacy Department of a Tertiary care Hospital	Manhas Anil K, Malik Aubid, Haroon Rashid, Sheikh Mushtaq A, Syed AT	ABC and VED analysis	In this research paper the study has analyzed the inventory of drugs as per their cost and criticality. It is expected to guide the management to delegate the responsibility to different officers and apply the "Principle of Management by Exception". Moreover it will facilitate the management in controlling the cost and ensure the availability of vital and essential items in the hospital which will be in the interest of patients and the

				administration. There are also other suggestions given to the hospital management on the bases of results achieved from the ABC and VED analysis.
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3. CONCLUSIONS

This review paper attempted to provide an overview of different inventory management techniques which are used in solving the various inventory control problems in the pharmaceutical and healthcare industry.

The efficiency of inventory management has become an area of major concern for any organisation. Every organisation wants to improve their inventory management as this is the major tool that leads to the success of the organisation.

The different conclusions which were drawn from the study are as follows -

* Many researchers have used ABC analysis as it is one of the most simple inventory control technique to apply with consideration of the consumption of the materials used. But if the main concern is to reduce the inventory cost then ABC technique alone is not feasible. The combination of either ABC and VED or ABC and FSN is used for optimising the cost for management of inventory.

* When XYZ inventory control technique is used by the researchers the analysis is done in the following manner by dividing all the items in 3 parts, the most critical items are kept in X class, the items which are less critical are kept in Y class and the remaining items which are least critical are kept in Z class.

4. REFERENCES

1. R Gupta, KK Gupta, BR Jain and RK Garg, "ABC and VED Analysis in Medical Stores Inventory Control", Med J Armed Forces India, DOI 2011 Jul 21.
2. Ida Fitriana, Raden Gagak Donny Satria and Dwi Cahyo Budi Setiawan, "Medicine Inventory Management by ABC-VED Analysis in the Pharmacy Store of Veterinary Hospital, Yogyakarta, Indonesia" Asian Journal Of Animal And Veterinary Advances, vol.13 DOI 2018
3. Kumar S, Chakravarty A, "ABC-VED analysis of expendable medical stores at a tertiary care hospital" Med J Armed Forces India, doi: Sept 4 2014
4. Mohd Kamarul Irwan Abdul Rahim, Quamrul Hassan, S.R. Nadarajah, Kamaruddin Radzuan, "A Case Study of Inventory Analysis in a Healthcare Product Manufacturing Company" Int. J Sup. Chain. Mgt Vol. 7, No. 3, June 2018
5. Devnani M, Gupta AK, Nigah R, "ABC and VED Analysis of the Pharmacy Store of a Tertiary Care Teaching, Research and Referral Healthcare Institute of India" J Young Pharm. 2010 Apr-Jun
6. Manivel P, Rajesh Ranganathan, "Prioritized Fsn Analysis Of Inventory Management In Private And Hospital Pharmacy Followed By Questionnaire" Int. Res. J. Pharm. 2016, 7 (12)
7. Dr.K.V.Krishna Reddy, Dr.M.S.Siddarth Sai, Dr.Rakesh Prabhu, "A Study on the Selective Controls of Inventory Management And Application of ABC XYZ Control Matrix in the Cardiology Department of A Tertiary Care Hospital" OSR Journal of Dental and Medical Sciences 16(05):06-09 · May 2017
8. Biruk Wogayehu Taddele, Ayalewu Adinewu Wondimagegn, Mulugeta Asfaw Asaro, Mende Mensa Sorato, Bisrat Gissila Gedayi, Anidinet Assefa Hailesilase, "ABC-VEN Matrix Analysis of the Pharmacy Store in a Secondary Level Health Care Facility in Arbaminch Town, Southern Ethiopia" Journal of Young Pharmacists, 2019; 11(2)
9. V.R. Girija and Prof. M.S. Bhat, "Multi Unit Selective Inventory Control- A Three Dimensional Approach (MUSIC -3D)" CVR Journal of Science and Technology, Volume 5, December 2013
10. Nang Nwe Ni Hlaing*, Cha-oncin Sooksriwong, Farsai Chanjaruporn, Oraluck Pattanaprateep, "SIGNIFICANCE OF CONSUMPTION PATTERNS AND ABC/FSN MATRIX TO OPTIMIZE VITAL DRUGS INVENTORY MANAGEMENT", Journal of Management And Pharmacy Practice, Volume 7 Nomor 3-September 2017

11. Dr. Babu Krishnaraj R , Meenakshi P K, “A Study on ABC-XYZ Analysis in a Pharmacy Store” International Journal of Mathematics and Statistics Invention (IJMSI), Volume 4 Issue 9 , November. 2016
12. Geetha Mani , Kalaivani Annadurai , Raja Danasekaran , Jegadeesh Ramasamy D, “Drug Inventory control analysis in a Primary level Health care facility in Rural Tamil Nadu, India” Healthline ,Volume 5 Issue 2 July December 2014
13. Kaushik Nag*, Mohammed Anany, “Application of ABC and VED Analysis for a Pharmaceutical Distributor’s Inventory in Kuwait” Proceedings of the 2016 Industrial and Systems Engineering Research Conference, May 2016
14. Sofiya Prokip* and Bohdan Hromovyk, “The Integrated Abc/Fmr/Ved-Analysis Of Drug Consumption Among Hospice Patients” International Journal Of Pharmaceutical Sciences And Research, DOI 01 January, 2014
15. Manhas Anil K, Malik Aubid, Haroon Rashid, Sheikh Mushtaq A, Syed AT, “Analysis of Inventory of Drug and Pharmacy Department of a Tertiary care Hospital” JIMSA Vol.25 No.3 July-September 2012

