



A Review on Inventory Management Control Techniques: ABC-XYZ Analysis

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Abstract

This paper provides the review of the inventory management and its control techniques of various articles in different field of application. Identify the methods to reduce the cost of inventory which effect organization overall cost and use the resources to their maximum efficiency by concentrating items having greatest potential saving. This paper uses the methodology on which literature is collected on ABC and XYZ analysis of inventory control. Some research articles are reviewed to study overall understanding of approach for inventory control. Inventory control technique differs for various industries depending on raw materials of products and suitable model should be applied for inventory management. ABC analysis is very simple classification and it provides very large cost control on company's total inventory. It also provides control on less important items. XYZ analysis is helpful in optimization of ordering process where the demand or product price fluctuates. But, combined approach of ABC and XYZ analysis provides the better results in the inventory management.

Keywords: Inventory control, inventory management, ABC analysis, XYZ analysis

I. Introduction

Inventory management is the activity of developing and managing inventory level of raw materials, work in-process inventory and finished goods so that adequate supplies are available and cost of the stocks is minimum. Inventory management is significant for making organization effective and efficient. Organization encounters the different cost related inventory including cost of holding, cost of ordering and cost of shortage. The increase of each one due to lack of inventory control system will have negative impact on profitability of the organization. So, organizations can save large percentage of their total investment in inventories by appropriate inventory control. Inventory control is not always directly linked to financial saving of inventories, but it also effects in space saving, manpower saving, simplification and transparency of process is increases also provide smooth flow of production and also improve company image. Here are various methods used for inventory control are ABC, XYZ, HML, VED, FSN, SDF, GOLF and SOS analysis as shown in figure 1.

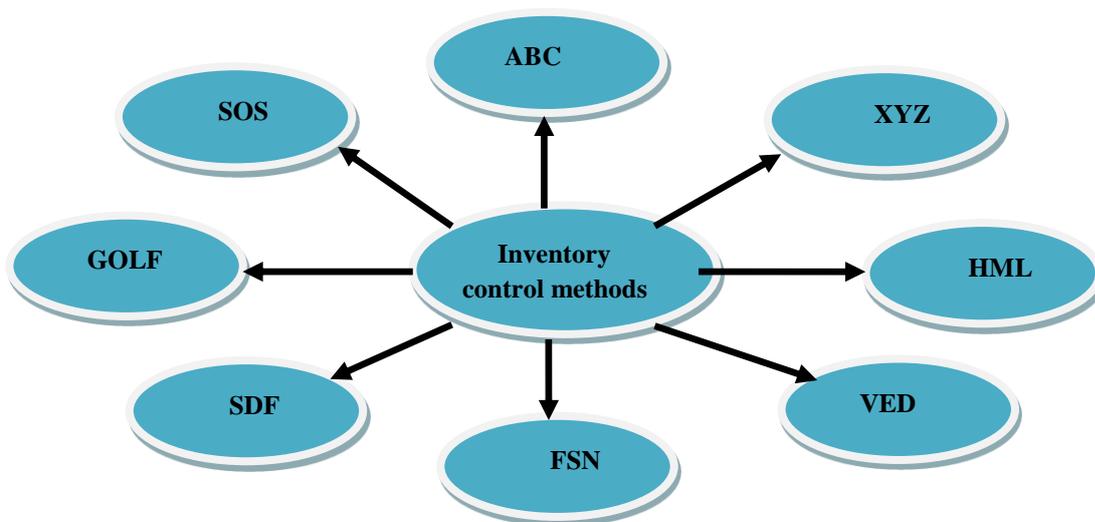


Figure 1: Different inventory management system methods

Different inventory control techniques are available for inventory management. These techniques are used for appropriate criterion and hence, they are recommended for specific applications in the literature. Table 1 shows list of some inventory control techniques along with their criteria and application domain.

Table: 1 Selective inventory control categories and criteria [12]

| Sr. No. | Category | Criteria | Application |
|---------|--|--|--|
| 1 | ABC Analysis | Annual usage value(Consumption rate* Price Rs./Piece) | For material which go in to the production |
| 2 | XYZ Analysis (Use for 2-D study) | Closing stock value of inventory at the time of physical stock verification | A category status eg. A category in X: watch C category in X: reduce stock level |
| 3 | HML (High, Medium, Low) Analysis | Unit price | To keep in check high cost items. |
| 4 | VED Analysis (Vital, Essential and Desirable) | Criticality or Loss of production | For controlling maintenance for spare and manufacturing equipment. |
| 5 | FSN Analysis (Fast, Slow and Non-Moving) | Issues from store give idea. Dispose non-moving inventory | Fast moving items should be kept in high level |
| 6 | SDE Analysis (Scars, Difficult and Easily available) | Procurement difficulties (Source of Procurement) | To keep vigil on availability, should be kept in stock keeping in mind difficulty in procurement and may follow forward buying |
| 7 | GOLF Analysis (Govt., Ordinary, Local and Foreign) | Govt.- Lead time more for retrieval, advance payment Foreign- Procedure long through bank, port , permission, duty etc. | Government supplies need patience to get material; canalizing agency can be used, foreign procurement lead time factor counts. |
| 8 | SOS Analysis (Seasonal and Off- Seasonal) | Soya bean, farm produce, high off season price, low in harvest season. | Should buy in harvest season to get price advantage and good quality supply. |

In the present study focuses on ABC and XYZ analysis of inventory control techniques, but other significant techniques are also reviewed. In the Present review different research paper related to ABC and XYZ and/or combined concept of both and their various applications in different field are explained below.

II. Research Methodology

There are various field of application used the ABC and XYZ analysis inventory control techniques aiming to reduce inventory cost, better management for stocks in goods also useful for the finished goods inventory storage. Inventory management is the accurate tracking of all the material in the company's inventory. There are various types of inventory control analysis techniques. Out of that ABC and XYZ techniques are elaborated.

1. ABC Analysis:

ABC analysis is simple classification of material that grouped the product according to frequency of the use and their value. ABC analysis classify the each item in to A, B and C class items so it will be easy to apply tight control to selected categories. The ABC analysis is as shown in table 2.

Table 2: ABC classification strategy

| | Percentage of Items | Percentage of annual usage | Actions |
|----------------------|---------------------|----------------------------|--------------------------|
| A class Items | About 20% | About 80% | Close day to day control |
| B class Items | About 30% | About 15% | Periodic review |
| C class Items | About 50% | About 5% | Infrequent review |

A-items are goods which annual consumption value is the highest; the top 80% of the annual consumption value of the company typically accounts for only 20% of the total inventory.

B-Items are the inter class items, with a medium consumption value typically accounts for 30% of the total inventory items.

C-Items are the contrary items with the lowest consumption value; the lower 5% of the annual consumption typically accounts 50% of the total inventory items.

The annual consumption value is calculated with the formula: **(Annual Demand)* (Item cost per unit)**

Through this categorization, the supply manager can identify inventory hot spot, and separate them from the rest of the items, especially those that are numerous but not that profitable.

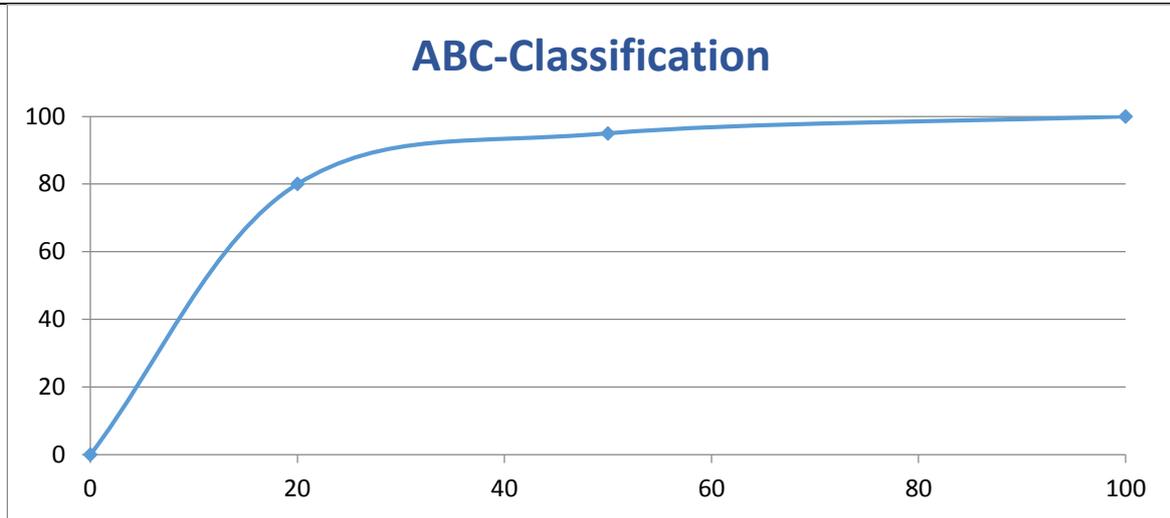


Figure 2: Cumulative curve of ABC analysis

Criticism on the methodology of ABC analysis:

- The classification in to only three categories as very rough
- The determination of limiting values is based on the empirical value and is thus random.
- ABC analysis offers only a figure of the current actual situation.

An ABC analysis is not sufficient for optimized stocking as the accuracy of its prediction [3] and hence optimizations of the ordering process are affected by fluctuation in product demand and product price. To handles the fluctuations in product demand probability commonly grouped by the process XYZ. [1]

2. XYZ Analysis:

XYZ is the special dynamic extension of the static ABC analysis. XYZ analysis is aimed to evaluate the fluctuations in demand or consumption of the items in the store. For each item, Coefficient of variation is computed and items are classified based on this coefficient as per the ratio as 20%: 30%:50% for X, Y, Z respectively.

X-Category includes the materials which use is relatively constant or fluctuates rarely here ability to schedule or correct prediction is very high. [1, 2]

Y-Category includes the material which substantial fluctuations in demand are for seasonal reasons or because of trend in product use also here the ability to schedule or prediction is medium. [1, 2]

Z- Category includes the material that is very irregular in use and ability to schedule or prediction is low. [1, 2]

In combined ABC –XYZ analysis the field matrix is as given below:

Table 3: ABC-XYZ combined analysis

| | A | B | C |
|---|---|--|--|
| X | High value percentage Continuous Demand High Predictive value | Average value percentage Continuous Demand High Predictive value | Low value percentage Continuous Demand High Predictive value |
| Y | High value percentage Fluctuating demand Average predictive value | Average value percentage Fluctuating demand Average predictive value | Low value percentage Fluctuating demand Average predictive value |
| Z | High value percentage Irregular demand Low predictive value | Average value percentage Irregular demand Low predictive value | Low value percentage Irregular demand Low predictive value |

Potential for Rationalization: AX, BX and AY

Control Complexity: AY, AZ and BZ

Field matrix is a combination of ABC and XYZ analysis. Here common items of different categories are identified through these combinations like AX,AY,AZ,BX,BY,BZ,CX,CY,CZ. Common items can identify and inventory control strategies can formulate.

Field matrix of ABC and XYZ analysis provides good inventory management and gives better control on inventory.

III. Objectives of Inventory Control

From study of various research papers it conceptualizes that inventory control techniques are helpful to achieved following objectives:

- To maintain optimum size of inventory for efficient and smooth production and sales operation.
- To maintain a minimum investment in inventories to maximize profitability.
- It provides proper protection against fluctuating demand.

- Proper and effective inventory management also minimizes the risk and uncertainty associated with obsolescence.
- Reduce material cost which may increase profit of an organization.

IV. Literature Review

A huge variety of research in the field of inventory management is being carried out. This literature review is focuses on ABC and XYZ models of the inventory control techniques that are used at different field of application. In 1987 an article was presented entitled “The application of multiple criteria ABC analysis” in which the results of the use of multiple criteria ABC analysis have been provided to classify the storage inventory. This study shows the use of “Cost criteria” and “Non-cost criteria” in classification of ware house inventory and formulates specific policies to manage ware house inventory by using different criteria. In 2006 an article was presented entitled “ Cost analysis in interventional radiology- A tool to optimize management cost” this paper use the combined ABC and XYZ analysis as optimized tool and reduce storage and capital tie-up cost of A-product in interventional radiology without affecting the quality of the service provided to patient. In 2011 an article was presented entitled “Integration of demand forecast in ABC-XYZ analysis: practical investigation at an industrial company” in this paper they recommended specific implementation of ABC –XYZ classification and utilize the demand forecasting for that classification and reduce the forecasting errors at focal company. In 2012 an article was entitled “Inventory management and its controlling techniques at wheels India limited” this study includes the tools ABC analysis, Economic order quantity, Economic batch quantity, Inventory ratio, correlation analysis and trend analysis in measuring the efficiency level of inventory management system. In 2012 an article was entitled “ABC: Evolution, problem of implementation and organizational variables” this paper focus on evolution of the ABC model also highlighting the implications of the implementation process. The authors used activity based costing, process factor and context factor as organizational variable that firm have to control in order to succeed with ABC. In 2013 an article was presented entitled “An application of XYZ analysis in company stock management” here the XYZ analysis provide the accuracy of predicting the material in demand (the consumption). In 2014 an article was presented entitled “Multicriteria Inventory ABC classification in an automobile rubber component manufacturing industry” they used the concept MCCI, ADU and AHP they obtained the weights for the different bins and also classifies bins according to usage. From this they improved the traceability and utilizations also identified inventory classification for the automobile rubber component manufacturing industry. In 2015 an article was presented entitled “Stock control in chemical firm: FSN and XYZ Analysis” in this paper authors use the combined approach of FSN and XYZ for the inventory management and they found by salvaging the unnecessary items space and money also saved. In 2015 an article was presented entitled “Productivity improvement in a tractor trailer manufacturing plant using selective inventory control model” here the authors use the ABC-VED combined matrix as raw material inventory model and they achieved the significant inventory reduction. In 2016 an article was presented entitled “Frame work for spare parts inventory cost optimization and adequacy in stock control management using technique of multi-unit selective inventory control: perspective to downstream plants of petroleum industry” here they reduce cost by using MUSIC techniques with FSN and ABC category for stock control management of spare parts.

V. Benefits gained by case studies

Various advantages gained by different case studies given below. There are various field of application of ABC and XYZ analysis and these analyses are beneficial in many engineering aspects like. In purchasing, sales, marketing, Quality management as well as inventory management. Some applications field of the various case studies are as following.

Table 4: Field of application of research articles

| Sr. No. | Title | Journal, Year | Author/Authors | Fields of application |
|---------|---|--|---|---|
| 1 | Cost analysis in interventional radiology-A tool to optimize management cost | European journal of the radiology, 2006 | D.A.clevert, M. Stickel, E.M.Jung, M.Reiser, N.Rupp | Interventional Radiology |
| 2 | Multicriteria inventory ABC classification in an automobile rubber components manufacturing industry | Procedia CIRP conference on manufacturing system 2014 | K.Balaji, V.S. Senthil kumar | Automobile rubber components |
| 3 | Stock control in chemical firm- FSN and XYZ analysis | International conference on Emerging trends in engineering, science and Technology, 2015 | Divyadevrajan, M.S.Jayamohan | Chemical industry |
| 4 | Integration of demand forecast in ABC –XYZ analysis :Practical investigation at an industrial company | International journal of productivity and performance management 2011 | Bernd Scholz-Reiter, Jens heger, Christian Meinecke | Demand Forecasting |
| 5 | Inventory management and its controlling techniques at wheels India limited | International journal of marketing and technology (IJMT) 2012 | Dr. R.Akila, Mrs.N.Padmavathy, Dr. N Thangavel | Inventory management (At Wheel India Ltd) |
| 6 | Productivity improvement in tractor trailer manufacturing plant using selective inventory control model | International journal of engineering research. 2015 | Sagar s. Awachat, Dr K N Agrawal | Tractor trailer inventory management |

VI. Conclusions

Inventory management is an important technique for manufacturing organizations. The review of the research papers indicates that, timely flow of inventory is imperative for the success and the growth of any organization. Some conclusions are drawn from various case studies are as following:

- ABC analysis is the kind of technique which provides the means for identifying the items which have largest impacts on organization's overall inventory cost. ABC is very simple inventory model and recommended by many researchers as it is also considering consumption of materials.
- Inventory management implies several benefits like control of dead stock materials, purchasing of required quantity materials, reduced lead time, better material procurement procedure, better space management, and provides right incoming quantity of inventory with better material handling.
- XYZ analysis is preferable when fluctuation in demand is more and consumption of items is very high. But combined study of ABC and XYZ provides better results in inventory management.

Acknowledgment

We are appreciating the efforts made by previous researchers for creating platform for this study.

References

- [1]. D. A. Clevert, M. Stckel , E.M. Jung, Mreiser, N Roop "Cost analysis in interventional radiology-A tool to optimize management cost" *European jour. of radiology* 61 (2007) 144-149.
- [2]. Divya devrajan, M S Jayamohan, "stock control in chemical firm: Combined FSN XYZ analysis" *Inter. Conf. on Emerging trend in Engg. Sci and Tech (ICETEST)*, *Procedia Technology* 24(2016) 562-567.
- [3]. Bernd scholz-Reiter, Jens Heger and Christian Meinecke "Integration of demand forecasting ABC-XYZ analysis: practical investigation at an industrial company" *International Journal of productivity and prfo. Management*; 61 (4), pp 445-451, 2011.
- [4]. Brent D Williams, A review of inventory management research in major logistics journals, *The international journal of logis.magt*,19(2) 2008 pp212-232.
- [5]. Martin Krajkovic, Dariusz Plinta, "Comprehensive approach to the inventory control system improvement" *Magt and prod. Engg. Review.* 3(3), 2012 pp 34-44.
- [6]. Dr.R.Akila, Mrs.N. Padmavathy, Dr. N Thangavel, "Inventory management and its controlling techniques at wheels India ltd." *International Journal of marketing and Tech.* 2(6) , June 2012.
- [7]. Sagar. S. Awachat, Dr.K. N. Agrawal, "Productivity improvement in tractor trailer manufacturing plant using selective inventory control model" *International Journal of Engg. Reserch*,3(2), 2015
- [8]. Pramod Kumar, Mohd.Anas, An ABC analysis for the multiple - Product inventory management- Case study of scooter India ltd., *International Journal of research in Engineering and Advance Technology.*, 1(5), 2013.
- [9]. Anichebe Nnaemeka Augustine, Okoro Agu, Effect of inventory management on organizational effectiveness, *Information and Know. Mgmt.* Vol.3, No.8, 2013.
- [10]. K.Balaji, V. S. Senthil Kumar, Multi-criteria Inventory ABC Classification in an automobile Rubber Components Manufacturing Industry, *Procedia CIRP* 17 (2014) 463-468.
- [11]. Sarbjeet Khurana, Neelam Chhillar, Vinod Kumar singh Guatam, "Inventory control techniques in medical store of tertiary care neuropsychiatry hospital in Delhi" *Health* Vol.5 No.1.8-13, 2013.
- [12]. Dr.G.Brindha, "Inventory management" *Inter. Journal of Innovation Research in Science Engineering and Tech.* Vol.3 Issue.1, Jan-2014.
- [13]. A K Madam, Ranganath M S, "Application of selective inventory control techniques for cutting tool Inventory modelling and inventory Reduction- A case study". *International Conference of Advance Research and Innovation (ICARI-2014)*
- [14]. Anna Maria Moisello "ABC: Evolution, Problem of implementation and organizational variable" *American jour of Indus and business mgmt.* 2012.