

REVIEW ARTICLE



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## ABC ANALYSIS AN APPROACH TO SOLVE INVENTORY PROBLEMS: A CRITICAL REVIEW

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### ABSTRACT

ABC analysis is a popular and effective method used to classify inventory items into specific categories that can be managed and controlled separately. It is not clearly possible for the organizations that store hundreds of inventory items to economically design an inventory management policy for each inventory item separately. Moreover, various inventory items may play quite different roles in the business of the organization. Hence, the managers need to classify these items in order to control each inventory category properly based on its importance rating to implement for large inventory systems becomes rather cumbersome because each item requires managements of order cycle and quantity. The inventory control problem is greatly simplified by ABC analysis as only a few groups rather than many items will have to be controlled.

This article presents the survey of applying multicriteria ABC analysis to maintain inventories. Organizations classically employ the ABC analysis to have an efficient control on a large number of inventory items. Recently, several methods have been developed for ABC inventory classification. Conventional ABC analysis classifies inventory items into three categories: A, Band C based on annual usage of an inventory item. Inventory classification using ABC analysis is one of the most widely employed technique in organizations. The need to consider multiple criteria for inventory classification has been stressed in the literature.

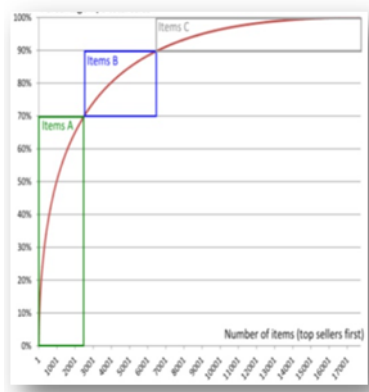
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### INTRODUCTION

In an organization even with moderate size, there may be thousands of inventory stock keeping units. Therefore, it is particularly important for all the organizations to establish the appropriate inventory control systems or to evaluate and improve the existing inventory control systems. Because on the one hand, the organization encounters the inventory-related Costs, including Cost of Holding, Cost of Ordering, Cost of Shortage the increase of each one due to the lack of a suitable inventory

control system will have negative effects on the profitability of the organization. On the other hand, since the number of inventory items is largely increasing due to the increase of the customers' demands for different products, the organizations should have a quick and effective response to the customers' demands to survive and maintain their competitive advantage. Therefore, in order to create a perfect inventory control system, various inventory items should be classified into the significant categories based on appropriate criteria

and standards. Various models and methods have been so far presented to classify inventory among which, ABC analysis approach is one of the most common methods which is widely used for planning and inventory control. The ABC approach states that, when reviewing inventory, a company should rate items from A to C, basing its ratings on the following rules:



Percentage v/s Total sales

**A-items** are goods which annual consumption value is the highest. The top 70-80% of the annual consumption value of the company typically accounts for only 10-20% of total inventory items.

**C-items** are, on the contrary, items with the lowest consumption value. The lower 5% of the annual consumption value typically accounts for 50% of total inventory items.

**B-items** are the interclass items, with a medium consumption value. Those 15-25% of annual consumption value typically accounts for 30% of total inventory items.

#### LITERATURE REVIEW

So many studies have been conducted in recent years on the inventory classification to improve inventory control system, the main part of which has been introduced in this section. 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. The studies conducted in this paper show that the managers can use both "cost criteria" and "non-cost criteria" in the classification of warehouse inventory and formulate

specific policies by using different criteria to manage warehouse inventory[1]. In 2007, an article was presented entitled "A simple classification for multiple criteria ABC analysis". In this paper, a simple model is proposed for multiple criteria classification of the inventory. In fact, this model covers the criteria of all the criteria in a single criterion. The study conducted in this paper shows that by appropriate conversion of the scale model of different criteria of the inventory classification, the organizations can reach some criteria of the inventory items without need for linear optimization. The model presented in this paper can be widely used by the organizations with minimum experience in the optimization. The criteria reviewed in this article include: the dollar value of the annual consumption, the average cost of each unit, and lead time[8].

In 2006, an article was presented entitled "the inventory classification based on multi criteria ABC using weighted linear optimization"[5]. In 2010, an article was presented entitled "The use of techniques based on the artificial intelligence for multiple criteria ABC analysis" by "Maine-Chun-Yu". In this paper, a study has been conducted to compare the classification techniques based on artificial intelligence and traditional classification techniques (MDA)[9]. In 2008, an article was presented entitled "The inventory control by combining ABC approach and fuzzy classification". The purpose of this study is to provide a new approach on the inventory control called "ABC fuzzy classification"[3]. In 2006, "Ramanathan" presents a weighted linear optimization model in order to classify the inventory through multiple criteria ABC approach, which was expanded in 2007 by "Zhou Fan". In 2006, "Ramanathan" and in 2008, "Ng" presented the techniques similar to the model DEA. The weakness of such models is like the statistical clustering techniques. It means that the model should be revised with any new item (Ramanathan, 2001)[6].

Table 1 shows Tools and Techniques used by various authors.

SR. NO.	AUTHOR NAME	TOOLS	FINDINGS
1	Siong Sheng Chin, Edmund Chan, Terrence Yeo-2008	Inventory analysis, Normal distribution analysis, ABC analysis	Paper dispensed methodology & approach in the development of an inventory analysis tool for stock availability optimizing & enhanced delivery performance.
2	Benito E. Flares, D. Clay Whybark-1988	Inventory analysis, ABC analysis, multiple criteria	This paper addresses both the need to use multiple criteria in classifying each item and the lack of specificity in the guidelines for managing each classification.
3	Chao Hsien chu, Ying chan chu-1987	Inventory analysis, ABC analysis, Pareto analysis	This paper present microcomputer based ABC analysis for inventory management. The conceptual framework & technical issues involves in the design of the system are discuss.
4	S.A. Torabi, S.M. Hatefi, B. Saleck Pay-2012	Inventory analysis, ABC analysis, multiple criteria, Data envelopment analysis, qualitative criteria, and idea models.	This paper presents a modified model originated from some existing DEA like models. The modified model is a linear programming model approach.
5	Wan Lung Ng-2007	Analytic hierarchy process (AHP), genetic algorithm (GA),artificial neural networks (ANN), (DEA), multiple criteria, weight linear optimization model	A weighted linear model is first formulated. A transformation is then applied on and which induces a simple solution mechanism for calculating a unified measurement of overall score of an inventory item.
7	Ramakrishnan Ramanathan-2006	Multiple criteria, ABC analysis, weight linear optimization model	A weighted linear optimization model has been proposed and illustrated in this paper for classifying inventory items in the presence of multiple criteria
8	Ye Chena, Kevin W. Lib, D. Marc Kilgourc, Keith W. Hipela. -2006	Inventory management; ABC analysis; Multiple criteria decision aid; Case-based distance model; Euclidean distance stock-keeping units(SKUs)	In this paper a case-based multiple-criteria ABC analysis that improves on this approach by accounting for additional criteria, such as lead time and criticality of SKUs, thereby providing more managerial flexibility

9	Jin-Xiao Chen-2011	Multiple criteria, ABC analysis, Peer estimation, R-model.	A peer-estimation approach is proposed in this paper for multi-criteria inventory classification (MCIC). The proposed approach determines two common sets of criteria weights and aggregates the resulting two performance scores in the most favorable and least favorable senses for each item without any subjectivity.
10	Ching-Wu Chu , Gin-Shuh Liang, Chien-Tseng Liao-2008	ABC classification Multi-criteria inventory control Fuzzy classification	The purpose of this paper is to propose a new inventory control approach called ABC-fuzzy classification (ABC-FC), which can handle variables with either nominal or non-nominal attribute, incorporate manager's experience, judgment into inventory classification, and can be implemented easily.
11	Peng Zhou, Liwei Fan-2006	ABC analysis, Multiple criteria, weight linear optimization model, R-model.	In this paper author present an extended version of the R-model for multi-criteria inventory ABC classification. While keeping the simplicity of the R-model, the proposed model could be viewed as providing a more reasonable and encompassing index.
12	P. Amorim, H.-O. Gunther , B.Almada-Lobo-2012	Perish ability Multi-objective Production and distribution planning	In this paper, author have discussed the importance of integrating the analysis for a production and distribution planning problem dealing with perishable products.

**RESEARCH IMPLICATIONS**

Table 2 shows the previous studies of ABC analysis of multiple criteria carried out by various authors in various industries in manufacturing. Most researchers used manufacturing industry as their sample of study in order to investigate the ABC analysis of multiple criteria and implementation in various companies such as manufacturers in paper;

textile and dyeing; chemicals, plastics and rubbers; metals; machinery and equipment manufacturing; electronics; automobile; printing; construction and others. Traditional polluting industries such as manufacturers in chemical, electrical and paper industries generally experience higher environmental pressure.

**Table 2. Various parameters used in the previous studies of ABC analysis of multiple criteria**

	Benito E. et.al (1988)	Benito Flores et.al (1987)	Chao Hsien Chu et.al (1987)	Wan Lung Ng et.al (2007)	R. Ramana than et.al (2006)	Ye Chen et.al (2008)	Jin-Xiao Chen et.al (2011)	Peng Zhou et.al (2007)	Min-Chun Yu et.al (2011)
No. of Items	✓	✓							
% of Items	✓	✓							
% of \$ Usage	✓	✓	✓	✓	✓	✓	✓	✓	✓
Part No.			✓		✓	✓	✓	✓	✓
Unit price			✓						
Min.annual usage values			✓						
Average unit cost			✓	✓	✓	✓	✓	✓	✓
Lead Time			✓	✓	✓	✓	✓	✓	✓
Critical Factor					✓	✓	✓		✓
Optimal inventory score					✓				✓

**Advantages of ABC Analysis**

- It ensures a closer and a more strict control over such items, which are having a sizable investment in there.
- It releases working capital, which would otherwise have been locked up for a more profitable channel of investment.
- It reduces inventory-carrying cost.
- It enables the relaxation of control for the ‘C’ items and thus makes it possible for a sufficient buffer stock to be created

**CONCLUSION**

In this paper we have provided an up to date review of literatures from various authors. Other criteria than dollar usage are important in managing the maintenance of inventory items. The use of specific policies to guide the classification of the item for management purpose proved to be useful. The resulting classification make sense to the managers, the people who count, and the policies provided them explicit strategies for managing the different categories.

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