IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 3, March 2016.
www.ijiset.com
ISSN 2348 – 7968

Supply Chain Logistics Management Using ABC Analysis – An Inventory Control Method

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***Abstract*— Inherent uncertainties in demands and supply make it difficult for supply chains to achieve optimum inventory replenishment, resulting in loss of sales or keeping excessive inventories. An unkempt inventory can take up to one-third of an organization's annual investment. Therefore, in order to compete with invariably erratic demands, it is not only challenging to develop an intelligent system to maintain and control an optimum level of inventory but has also become mandatory. Here we have tried to study the supply chain logistic management in manufacturing industry using XYZ analysis method.**

Supply chain: Supply chain management (SCM) is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies

Logistic: Logistics management is that part of the supply chain that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer requirements

INTRODUCTION

Here we have applied the inventory analysis techniques on an EMU manufacturing industry. Now to understand the application of the analysis on this particular industry we should have some basic knowledge about the Electric Multiple Unit (EMU) coaches.

An Electric Multiple Unit (EMU) is a multiple unit train powered by electricity. The cars that form a complete EMU set is categorized on the basis of their function into four types – viz. Power Car that carries pantograph, transformers; Motor Car that carries traction motor; Driving Car that containing a drivers cab for controlling the train; Trailer Car that is similar to passenger car in a locomotive hauled train.

A complete rake consists of 9 coaches having 3 units or 12 coaches having 4 units. Each unit consists of one motor coach and two trailer coaches.

Arrangement of a 9 coach rake is in the order as B-C-C-D-B-C-C-D-B and 12 coach rake being B-C-C-D-B-C-C-D-B-C-C-B : where, 'B', 'C', and 'D' represent motor cum trailer coach, passenger coach and vendor cum passenger coach respectively.

The preparing shop of EMU has been divided in to four major sections namely Body Shell where structural framework of the EMU is done i.e. roof, side and end assemblies, Under Frame assembly, Bogie Shop, and Furnishing Shop.

The sub assemblies required for EMU assembly are 1) Roof assembly, 2) Side assembly, 3) End assembly, 4) Under Frame assembly, 5) Bogie assembly.

We can categorize the items as a whole else we can categorize them according to the preparation of each sub assembly as well to perform the inventory analysis techniques.

I. LITERATURE REVIEW

Inventory management is the accurate tracking of all materials in the company's inventory. The company has purchased these items from another supplier. There are three possible areas of loss that are reduced through effective inventory management: shrinkage, misplacement, and short shipments. There are various types of inventory control analysis techniques. Here we shall focus on the ABC technique-

ABC classification is a method of classifying inventory items according to the money value to a firm. Class A is smaller volumes but tends to generate higher sales value followed by the class B items. The class C items are of a very large volume but generate a items normally range from 5% to 20% of all inventory items and account for between 50% and 80% of sales value. The class B items normally range from 20% to 40% of all inventory items and account for 20% to 40% of sales value. The class C items normally constitute 50% to 70% of all inventory items and account for 5% to 25% sales value. Fitzsimmons (2004) ,Winston (1994) and Tanwari, al. (2000) reported that is the basis for material management processes and help to define how stock is managed and is an appropriate technique for classifying inventory items according to the importance of their contribution to the annual cost of the entire system.

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II. TABLES AND CALCULATIONS

Table 1 shows us how an ABC analysis is performed. We should have the following data-

1) Name of the items
2) Annual demand of each item
3) Unit price of each item

As shown in the table we have to calculate the percentage annual demand of each item from the available annual demand data of each item. After that we have to calculate the annual usage of each item.

TABLE I . ABC ANALYSIS OF UNDER FRAME ITEMS

Item	*Annual demand*	*% Annual Demand*	*Unit Price*	*Annual Usage*	*% Annual Usage*	*% Cumulative Annual Usage*	*Category*
Tube Complete	104	42.97	1029.6	107078.4	29.61	29.61	A
Cap for Side Bearer	16	6.61	5446.48	87143.68	24.10	53.72	A
Bearing Bracket	6	2.47	11471.2	68827.2	19.03	72.76	B
Modified Arrangement of Side Buffer Base	8	3.30	5737.68	45901.44	12.69	85.45	C
Side Bearer Assembly	104	42.97	280.8	29203.2	8.07	93.53	C
Modified Arrangement of Side Buffer Base	4	1.65	5841.68	23366.72	6.46	100	C

Annual usage can be calculated from the following equation-

$$Annual\ Usage = Annual\ Demand \times Unit\ Price \quad (1)$$

From the annual usage we can calculate the percentage annual usage of each item.

The next step is to calculate the percentage cumulative usage of each item. The percentage cumulative usage of the first item is equal to the percentage annual usage of the first item. The percentage cumulative usage from the second item onwards can be calculated from the following equation

$$\%\ cumulative\ usage\ of\ 2nd\ item = \%\ annual\ usage\ of\ 1st\ item + \%\ annual\ usage\ of\ 2nd\ item \quad (2)$$

The percentage cumulative usage of the remaining items can be calculated from the above mentioned formula.

After that sort the data from the higher values to lower values taking into account the annual usage as the base value

The table we have used here shows us the inventory analysis of items of a under frame assembly. Similarly we can analysis the items of the bogie assembly, body shell assembly, furnishing stage items, completion stage items as well as all the items required to produce a rake of a Electric Multiple Unit.

The graphs obtained are as follows-

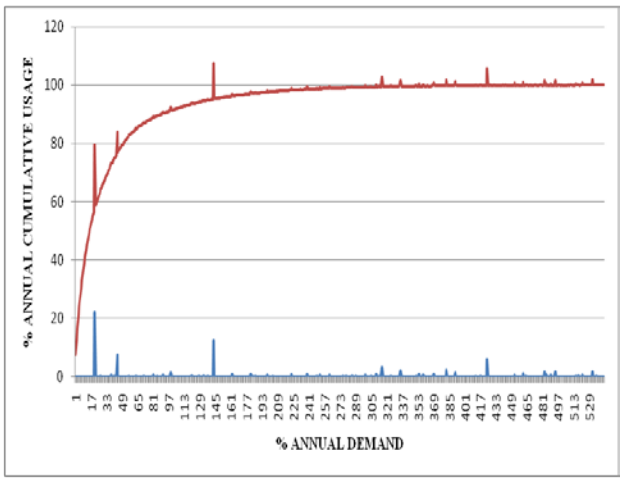

Figure 1: ABC analysis of EMU items

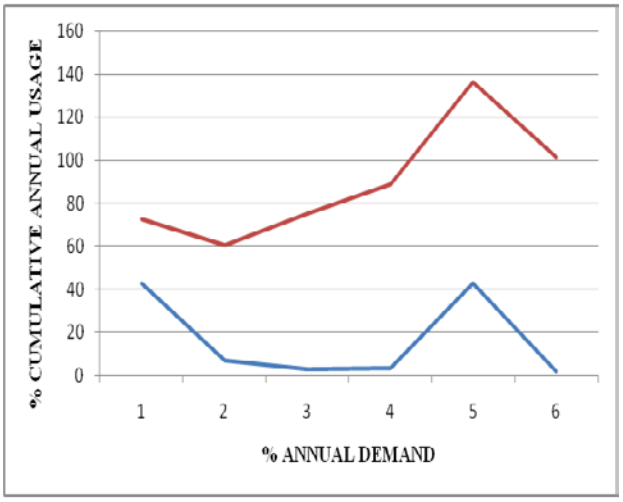

Figure 2: ABC analysis of under frame items

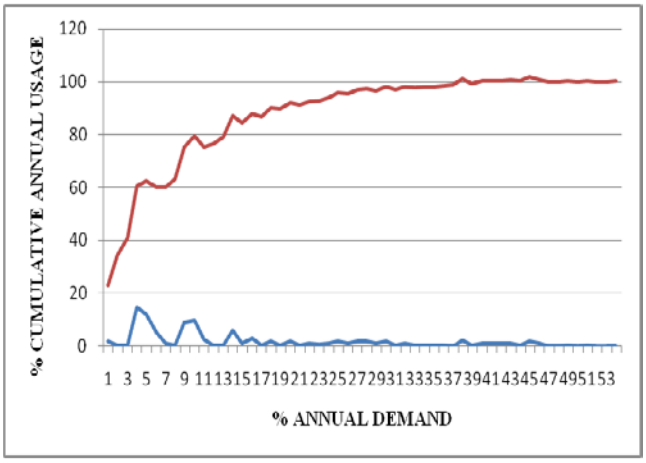

Figure 3: ABC analysis of bogie items

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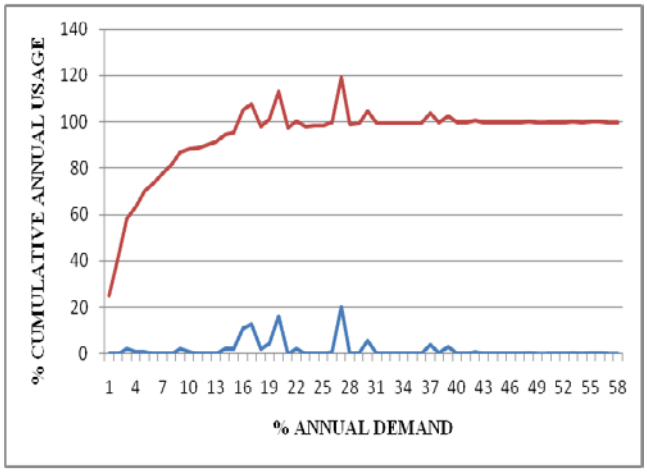

Figure 4: ABC analysis of body shell items

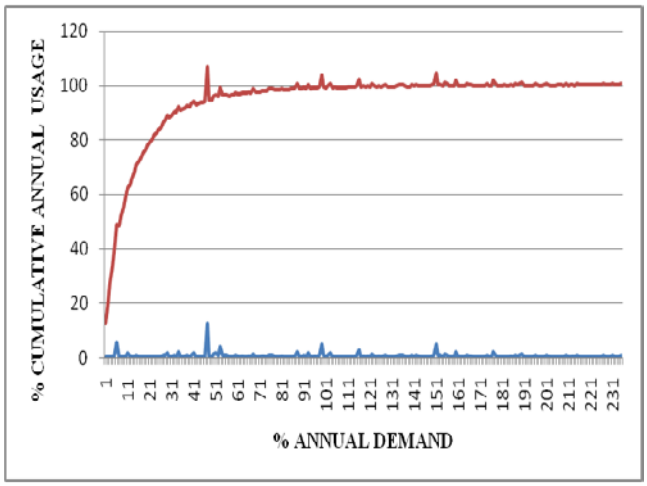

Figure 5: ABC analysis of furnishing stage items

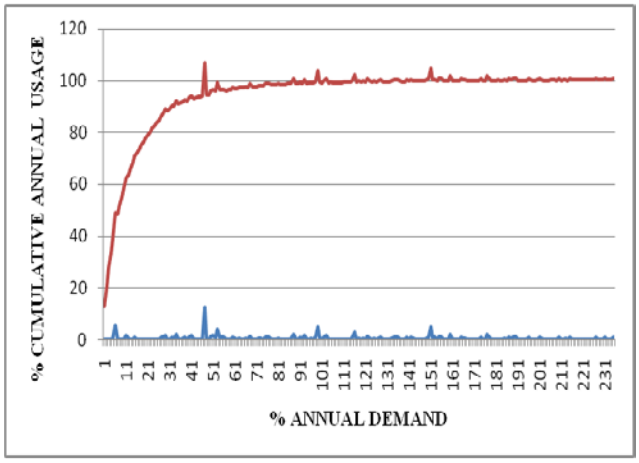

Figure 6: ABC analysis of completion stage items

III. CONCLUSION

Inventory Analysis and Control has become inevitable for a manufacturing industry. In order to refrain from having an inventory go dead it is of utmost importance to stay abreast with the number and condition of items in that particular inventory. In this regard both periodic and continuous techniques can be used for appraising the stats of the stocks. Once the figures are accurately determined it is yet again very important to be able to further determine the level at which a particular item's stock needs to be maintained. For which calculations and analysis are mandatory. The research discusses ABC analysis method for inventory control analysis of an Electric Multiple Unit manufacturing industry.

From ABC analysis of all the items required to manufacture an EMU, it has been found that about 4% of the items are classified as 'A' items which contribute towards 60% of the annual consumption. Further 4% 0f the items are classified as 'B' items which contribute towards 25% of total annual consumption. The remaining 92% items are classified as 'C' items which contribute towards 15% of the total annual consumption.

From the ABC analysis of the under frame items we have found that about 33% of the items are classified as 'A' class items which contribute towards 60% of the total annual consumption. About 17% of the items are classified as 'B' class items which contribute towards 25% of the total annual consumption. The remaining 50% items are classified as 'C' class items which contribute towards 15% of the total annual consumption.

From the ABC analysis of the bogie items we have found that about 13% of the items are classified as 'A' class items which contribute towards 60% of the total annual consumption. About 17% of the items are classified as 'B' class items which contribute towards 25% of the total annual consumption. The remaining 70% items are classified as 'C' class items which contribute towards 15% of the total annual consumption.

From the ABC analysis of the body shell items we have found that about 5% of the items are classified as 'A' class items which contribute towards 60% of the total annual consumption. About 10% of the items are classified as 'B' class items which contribute towards 25% of the total annual consumption. The remaining 85% items are classified as 'C' class items which contribute towards 15% of the total annual consumption.

From the ABC analysis of the furnishing stage items we have found that about 5% of the items are classified as 'A' class items which contribute towards 60% of the total annual consumption. About 10% of the items are classified

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as ‘B’ class items which contribute towards 25% of the total annual consumption. The remaining 85% items are classified as ‘C’ class items which contribute towards 15% of the total annual consumption.

From the ABC analysis of the completion stage items we have found that about 4% of the items are classified as ‘A’ class items which contribute towards 60% of the total annual consumption. About 7% of the items are classified as ‘B’ class items which contribute towards 25% of the total annual consumption. The remaining 89% items are classified as ‘C’ class items which contribute towards 15% of the total annual consumption.

From the graphs it has been observed that the graph showing the ABC analysis process of the under frame shows a little bit of deviation compared to the other graphs. This is due to fewer number of items of the under frame assembly.

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