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Inventory Control Using FSN Analysis – A Case Study on a Manufacturing Industry

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ABSTRACT
The various concepts of inventories like inventory: a major cost component, lead time influences on inventories and productivity of inventories have been discussed.
The basic problem of inventory control is to strike a balance between the operating efficiency and the cost of investment and other associated costs with large Inventories, with the object of keeping the basic conflicts at the minimum while optimizing the inventory holding. The decisions as to which item to make and when to keep inventories in balance require application of a wide range of techniques from simple graphical methods to more sophisticated and complex quantitative techniques. Many of these techniques employ concepts and tools of mathematics and statistics and make use of various control theories from engineering and other fields. They are primarily aimed at helping to make better decisions and getting people employed and follow a wiser policy. Here we have tried to study the inventory management system of an EMU coach manufacturing industry using FSN analysis.

Keywords- FSN analysis, EMU coach, Inventory control

I. 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.

II. 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 following:

FSN analysis (Based on Turnover ratio):

In any manufacturing industry, not all items are required with the same frequency. Some materials are quite regularly required, yet some others are required very occasionally and some materials may have become obsolete and might not have been demanded for years together. FSN analysis groups them into three categories as Fast-moving, Slow-moving and Non-moving (dead stock) respectively. Inventory policies and models for the three categories have to be different. While performing this particular analysis the turnover ratio of each item has to be calculated because the items are sorted and analyzed according to the turnover ratio it possesses.

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III. CASE STUDY

TABLE I. FSN Analysis of Under Frame Items

SL NO	ITEM	TOTAL QTY/RAKE	RAKE/YEAR	ANNUAL DEMAND	UNIT PRICE (Rs)	AVERAGE INVENTORY	TURNOVER RATIO	ANNUAL USAGE (Rs)	ANNUAL USAGE (%)	CUMULATIVE ANNUAL USAGE (%)	CATEGORY
1	Tube Complete	52	2	104	1030	80	1.3	107078.4	29.61	29.618	N
2	Cap for Side Bearer	8	2	16	5446	16	1	87143.68	24.10	53.723	N
3	Side Bearer Assembly	52	2	104	280.8	104	1	29203.2	8.07	61.801	N
4	Modified Arrangement of Side Buffer Base	4	2	8	5738	8	1	45901.44	12.69	74.498	N
5	Modified Arrangement of Side Buffer Base	2	2	4	5842	4	1	23366.72	6.46	80.961	N
6	Bearing Bracket	3	2	6	11471	6	1	68827.2	19.03	100	N

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

Name of the items, Annual demand of each item, Turnover Ratio, Unit price of each item, Annual Usage and cumulative annual usage of each item.

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

The turnover ratio is calculated from the following formula-

Turnover Ratio= Annual Demand/Average Inventory.

After that the annual usage of each item is calculated followed by calculation of percentage annual usage of each item. The annual usage is calculated from the following formula-

Annual Usage of each item= Annual Demand of each item x Unit Price of each item.

After this the percentage cumulative usage of each item is calculated. The percentage cumulative usage is calculated from the following formula-

Percentage Cumulative Usage of 1st item= Percentage Annual Usage of 1st item.

Percentage Cumulative Usage of 2nd item= Percentage Cumulative usage of 1st item + Percentage Annual Usage of 2nd item.

From the above analysis it has been found that all the items of this stage are classified as 'N' class items as all of them have a turnover ratio of less than 2.

The following graph has been obtained from the above analysis. The table used here shows us the inventory analysis of items of a under frame assembly. Similarly we can analyze 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 an Electric Multiple Unit.

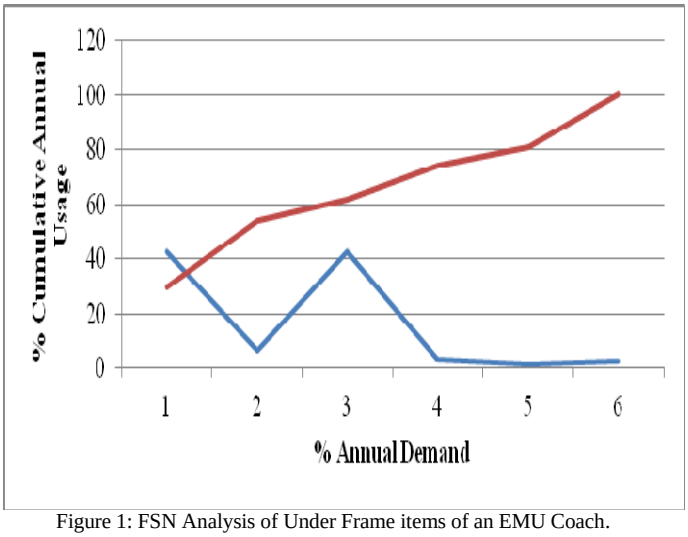

Figure 1: FSN Analysis of Under Frame items of an EMU Coach.

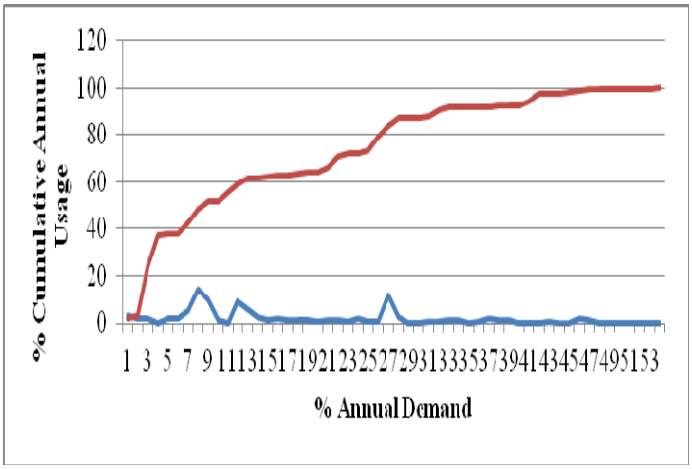

Fig 2: FSN Analysis of Bogie items of an EMU Coach.

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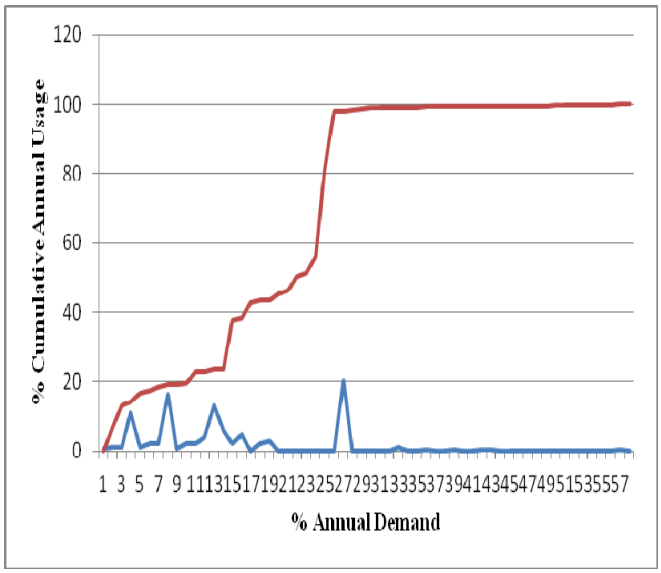

Fig 3:FSN Analysis of Body Shell items of an EMU Coach

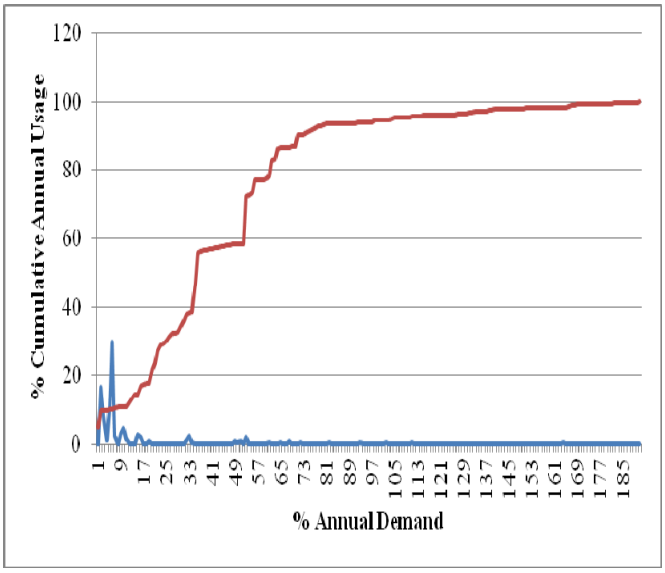

Fig 4: FSN Analysis of Furnishing Stage items of an EMU Coach

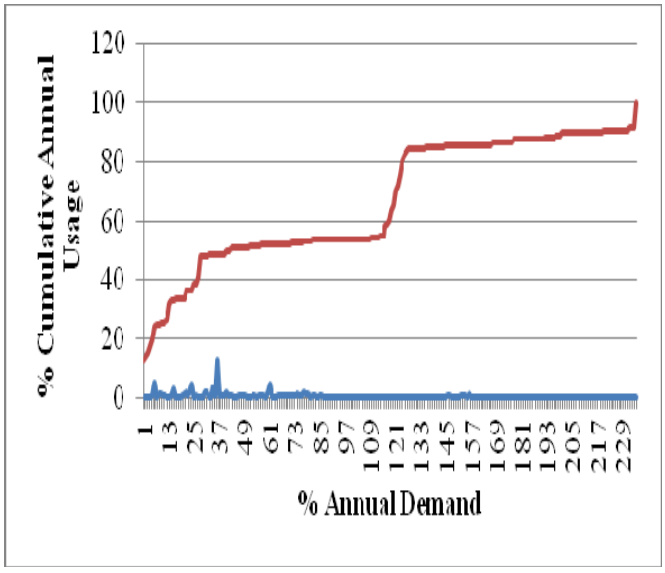

Fig 5: FSN Analysis of Completion Stage items of an EMU Coach

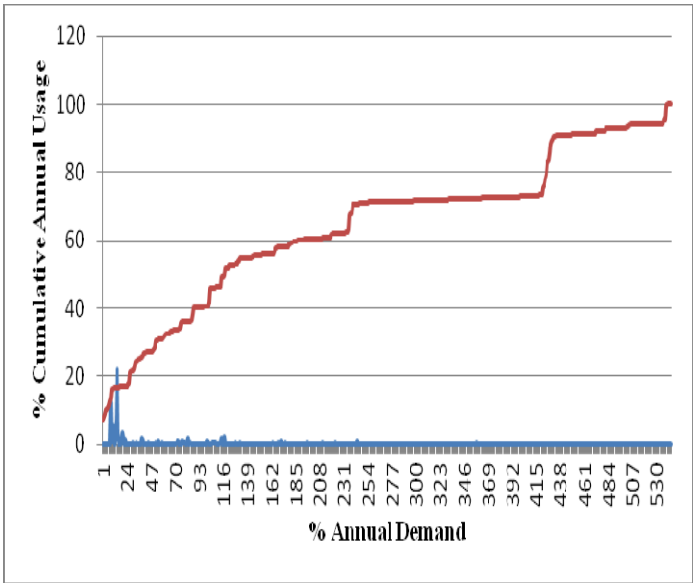

Fig 6: FSN Analysis of the items of an EMU Coach.

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IV. ANALYSIS

From the FSN analysis of the bogie items we have found that about 2% of the items which contribute towards 2% of the total annual usage are classified as 'F' class items. About 13% of the items which contribute towards 41% of the total annual usage are classified as 'S' class items and about 15% of the items which contribute towards 57% of the total annual usage are classified as 'N' class items

From the FSN analysis of the body shell items we found that about 2% of the items which contribute towards 1% of the total annual usage are classified as 'F' class items. About 19% of the items which contribute towards 22% of the total annual usage are classified as 'S' class items and about 80% of the items which contribute towards 77% of the total annual usage are classified as 'N' class items.

From the FSN analysis of the furnishing items we have found that about 3% of the items which contribute towards 10% of the total annual usage are classified as 'F' class items. About 14% of the items which contribute towards 26% of the total annual usage are classified as 'S' class items and about 83% of the items which contribute towards 64% of the total annual usage are classified as 'N' class items.

From the FSN analysis of the completion stage items we have found that 3% of the items which contribute towards 25% of the total annual usage are classified as 'F' class items. About 8% of the items which contribute towards 14% of the total annual usage are classified as 'S' class items and about 89% of the items which contribute towards 61% of the total annual usage are classified as 'N' class items.

From the analysis of Final items in an EMU coach we have found that about 2% of the items which contribute towards 17% of the total annual usage are classified as 'F' class items. About 12% of the items which contribute towards 19% of the total annual usage are classified as 'S' class items and about 86% of the items which contribute towards 64% of the total annual usage are classified as 'N' class items.

From the graphs it has been observed that the graph showing the FSN 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.

V. 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 case study discusses FSN analysis method of inventory control analysis of an Electric Multiple Unit manufacturing industry.

From the above study we have found that the priorities of the items changes according to different inventory analysis techniques. The management of the company decides which process to follow taking into account their budget, supply, demand, inventory carrying capacity etc.

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