International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 02 | Feb-2016 www.irjet.net p-ISSN: 2395-0072

Analysis of Safety Stock

Utkarsh Sharan[1]

M.Tech, Dept. of Mechanical Engineering, NIT Jamshedpur, Jharkhand, India

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Abstract – *for my final year M.Tech project, I have taken the data from TAYO ROLLS LTD, a roll manufacturing industry located in Jamshedpur, India. I have taken the data from inventory department. My aim is to find the optimum value of safety stock keeping demand constant. Firstly, ABC analysis was carried out and A class items were taken for the purpose. Then sales data was analyzed and simulation was carried out to find the optimum value of safety stock which minimizes total inventory costs. Costs due to over demand and under supply are considered simultaneously*

***Key Words*: contribution margin, holding cost, profit loss, random numbers, sales probability**

1. INTRODUCTION

Safety stock, also called buffer stock, is a term used for extra stock that is maintained to relieve the risk of stock-out due to uncertainties in demand and supply. Safety stock acts as buffer stock in case sales are greater than planned and supplier in unable to deliver the additional units at expected time. The amount of safety stock an organization chooses to keep will affect its business. Too much safety stock will result into high holding cost of inventory. Too less safety stock will result into lost sales and thus higher rate of customer turnover. As a result, finding right balance between too much and too less safety stock is very important. Normally industries don't waste their time and money on research relating to optimum value of safety stock, that should be kept, and carry the losses. In this paper, we are going to analyze, what the value of safety stock we should keep to minimize the cost associated with it.

2. Problem Description

The purpose of this paper is reaching excellence in material requirement planning with analyzing sales data in long term determination of safety stock. The project was required because:

- Manufacturing managers face increasing pressure to reduce inventory across supply chain. However in complex supply chain it is not very obvious where to hold safety stock to minimize safety stock and provide a high level of service to final customer
- There is a need of strong inventory model with a good formulation in order to achieve a more systematic approach.
- Besides, determination of order amount and reorder points are done manually and stock level is quite high.

3. Methodology

The steps taken to solve the above problem are:

- Classify the 250+ raw materials based on ABC analysis
- Take the A-class items for further study
- Study the monthly sales data of an year
- Propose a desired sales data on the basis of random number principle
- When supply > demand, calculate holding cost
- When demand > supply, calculate contribution margin
- Finally Monte Carlo simulation is performed to minimize the

4. Assumption

Neglecting demand fluctuation

5. Case Study

The data have been collected from TAYO ROLLS LTD, a roll manufacturing industry located in Jamshedpur, India.

After the ABC analysis of stock items of inventory, we got two items under A-category. They are graphite electrode and grinding wheel. Following study is done pertaining to grinding wheel. Similar study can be done related to graphite electrode.

Table -1: Sales Data

Sales Data				
Date	Sales	probability	Cum. Prob.	Range of Random Numbers
Sept/14	6	0.0833	0.083	00-08
Oct/14	9	0.125	0.208	09-20
Nov/14	6	0.0833	0.292	21-29
Dec/14	7	0.097	0.389	30-38
Jan/15	4	0.055	0.443	39-44
Feb/15	3	0.0417	0.485	45-48
Mar/15	0	0	0.485	48-48
April/15	8	0.11	0.595	49-59
May/15	5	0.0694	0.665	60-66
June/15	7	0.0972	0.762	67-76
July/15	10	0.1389	0.903	77-90
Aug/15	7	0.097	1	91-100

Now based on random number theory, new sales figure can be estimated

Table -2: Estimated Sales Figure

Estimated sales for next year		
Day	Random number	Estimated sale
Sept/15	50	8
Oct/15	68	7
Nov/15	80	10
Dec/15	12	9
Jan /16	90	10
Feb/16	22	6
March/16	35	7
April/16	76	7
May/16	25	6
June/16	11	9
July/16	02	6
Aug/16	95	7

5.1 Formula and Calculation

When demand is greater than stock value, then profit loss due to lack of sales is calculated by contribution margin (C.M) for unit ton of roll produced.

C.M. = total sales –total variable cost
C.M. per ton = C.M./amount of roll produced in tons
Total sales =18498 lacks
No. of tons produced in an year is 10365
Total variable cost include material, salaries and overheads
Material cost = Rs 5920.66 lacks
Salaries cost = Rs 2149.89 lacks
Overheads-
Fuel oil = Rs 2468.37 lacks
Power = Rs 2201.24 lacks
Conversion Charges = Rs 1280.70 lacks
Handling Charges = Rs 262.83 lacks
Total variable cost = Rs 14283.69 lacks

C.M per ton = Rs 40151 per unit

Based on predicted sales figure, desired stock level can be calculated.

When stock level of inventory in greater than demand then holding cost is calculated which depends on number of units, inventory cost of unit item and sales probability for that month.

Holding cost = n x v x r

Where,

n= no .of units left in inventory

v= inventory value of unit item

r= rate at which bank charges interest per month

Inventory value = Rs 163600.15

Bank interest rate = 18%

Holding cost (per unit) = Rs 29448

The holding cost and profit loss are multiplied by the monthly sales probability to get the monthly cost associated with stocking items.

			Stock level				
month	probability	demand	6	7	8	9	10
Sep /15	0.083	8	6689	3345	0	2453	4906
Oct/ 15	0.125	7	5019	0	3681	7362	11043
Nov /15	0.083	10	13378	10034	6689	3345	0
Dec/15	0.097	9	11684	7789	3895	0	2857
Jan/ 16	0.055	10	8833	6625	4417	2208	0
Feb/ 16	0.0417	6	0	1228	2456	3684	4912
Mar/16	0.0	7	0	0	0	0	0
Apr/16	0.11	7	4417	0	3239	6479	9718
May/16	0.0694	6	0	2044	4087	6131	8175
June/16	0.0972	9	11708	7805	3903	0	2862
July /16	0.1389	6	0	4090	8180	12271	16361
Aug /16	0.097	7	3895	0	2856	5716	8569
TOTAL COST			**65623**	**42960**	**43403**	**49649**	**69403**

5.2 Result

As the minimum value is Rs 42960, which comes under stock level of 7 units. So we should maintain safety stock of 7 units every month.

3. CONCLUSIONS

This paper considers carious factors to optimize safety stock. This procedure can be applied in industries. Even though it is a practical model, the paper can be modified. Fluctuations in demand can be considered for future work in this paper.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to my guide and H.O.D. Dr. Amaresh Kumar without whom this work was not possible. I would also thank Mr. Sailen Ghosh, the head of inventory department of TAYO ROLLS for providing me valuable data. At last I would like to say thanks to Dr. Aanjaney Pandey, who helped me beyond the boundaries.

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