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Improved Inventory Management System for a Jute Mill - A Case Study

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I. Introduction

In Operations Management, inventory refers to any scarceresource that remains idle in anticipation of satisfying afuture demand for it. [1]

An inventory is a stock or store of goods. [1] Inventorymanagement is an important concern for the managers in alltypes of businesses. Effective inventory management isessential for realizing the full potential of any value chine.[2] Inventory primarily arises because of differences in thetiming or rate of supply and demand and is used to balancethese. Inventory may also occur due to economic batch sizesfor an operation, WIP, product seasonality and investmentfor new product ranges. [3]

Holding inventory is often interpreted as carrying an assetbut also means carrying risk in terms of obsolescence,deterioration and quality faults [4]. In financial termsinventory impacts the balance sheet, cash flow and profitand loss accounts. Operationally inventory affectsproduction efficiencies and on-time delivery. In his book"The Goal" Goldratt [5] identifies inventory as a keycomponent for measuring business performance in amanufacturing environment.

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Inventory represents an important decision variable at allstages of product manufacturing, distribution and sales. [6]In the above sense, the term covers not only materials invarious stages of processing one is likely to see in a factorybut all the human and nonhuman resources maintained butnot currently used by an organization in order to meetanticipated demand for its products and services. [1]

II. Objectives

The objectives of the project work were:

a) To study the present inventory management systemof the Eastern Jute mills, Khulna.
b) To figure out the limitations and drawbacksassociate with the existing inventory managementsystem of the Eastern Jute mills, Khulna.
c) To suggest some methods to prosecute theinventory management system of the Eastern Jutemills, Khulna.

III. Why Inventoryis Necessaryfora Jute Mill

Jute is the main raw material in a Jute Mill. But Raw Jute isnot available throughout the year. It is only available June toSeptember. So the whole demand of the jute throughout theyear is stocked by purchasing the Raw Jute in this timeperiod. So an effective inventory management system canplay a vital role in a jute mill to make the mill profitable.

IV. Objectives of Inventory Management

The objective of inventory management is to achievesatisfactory levels of customer service while keepinginventory costs within reasonable bounds. So inventoryproblem involves the formulation of decision rules thatanswer two important questions:

a) When is it necessary to place an order (or set up forproduction) to replenish inventory?
b) How much is to be ordered (or produced) for theeach replenishment [1]?

The decision rules must aim at satisfying anticipateddemand minimum cost or maximum profit [1].

V. Functions of Inventory

The functions of inventory are described as follows: [7]

a) To meet the anticipated customer demand.
b) For smooth production requirements.
c) To protect against stock outs: Delayed deliveriesarid unexpected increases in demand increase therisk of shortages.
d) To hedge against price increases: Occasionally, afirm will suspect that a substantial price increase isabout to made and purchase larger-than-normalamounts to avoid the increase, the ability to storeextra goods also allows a firm to take advantage ofprice discounts for larger orders.
e) To permit operations: The fact that productionoperations take a certain amount of time means thatthere will be generally being some work-in-processinventory.
f) To prevent stock out. Stock out means running outof the inventory of a stock keeping unit. [9]

VI. Steps Followed to Completethe Project Work

a) At first, the rules and principle of the inventorymanagement system was studied intensively to gainthe proper managerial knowledge about inventorymanagement.
b) Secondly, a close look on the inventorymanagement system of Eastern Jute Mills, Khulnawas given by collecting data of purchasing goodsfor the production, having discussion with theconcerned personnel and visiting the Eastern JuteMills of Khulna to observe how goods are kept.
c) Thirdly, the drawbacks associated with theinventory management system of Eastern Jute Millof Khulna were figured out by means of case study.
d) Lastly, some suggestions were given to meet theanticipated demand and to eliminate the drawbacksand to maintain the inventory management systemof Eastern Jute Mills of Khulna with moreefficiently.

VII. Data Collection and Calculation

a) Lead Time Calculation

- Estimate the required items = 4 days
- Advertisement = 7 days
- Item verification = 7 days
- Item preparing = 7 days
- Tender receiving time = 10 days
- Tender verification for comparative statements =14 days
- Get order = 4 days
- Order preparing = 25 days
- Inspection the ordering products = 5 days
- Deliver the products = 5 days

In total = 88 days
So, Lead time = 88 days

VIII. Determination of Inventory Related Cost

Holding Cost: The holding cost includes handling,insurance, taxes, carrying cost of goods or raw materials.

- Bank interest on the money invested in inventory =9%
- Depreciation: Batching to batching = 0.50%,Preparing to winding = 0.95% , Beaming =0.05%,Weaving = 4%, Finishing = 1%, Jute to jute = 0.5%
- Insurance = 0%
- Expense of running mills = 14%

So, Total holding cost C_H = 30%

Shortage cost: This Cost arises when the Actual demandcan't be met by the existing stock.

Lower ordering costs: If you buy a larger quantity of an itemless frequently, the ordering costs are less than buyingsmaller quantities over and over again. (The costs of holdingthe item for a longer period of time, however, will begreater.) [8]

In Case of Eastern Jute Mills, Shortage cost is Totally Zero. This is because the actual demand is alwaysmet by the existing stock.

Ordering cost: This cost takes place by ordering fromoutside supplier or by producing the items internally.

- Cost of publicity and advertisement = 95000 Taka
- Cost due to the telephone calls= 60000 Taka
- Postage and telegram = 5000 Taka

So, Ordering cost, CR = 160000 Taka

IX. Equations of Optional Replenishment

Table 1 : Necessary equations of the optional replenishment system

Description	Equation
Safety stock	$B = zS_D\sqrt{\frac{t}{2}} + L$
Maximum inventory	$M = D\left(\frac{t}{2} + L\right) + B$
Reorder point	$R = D_L + B$
Holding cost	$C_H = c_H\left(\frac{M+B}{2}\right)$
Order size when L<t	$Q_i = M - Q(T_i)$
Order size when L>t	$Q_i = M - [Q(T_i) + O(T_i)]$

M = Maximum inventory, B = Safety stock, R = Reorder point, C_H = Cost of holding 1 unit per unit time, C_H =Holding cost, z = Number of standard deviation away fromthe mean, S_D = Daily standard deviation, D = Demand perday, D_L = Lead time demand, L = Lead time, t = Reviewperiod, Q_t= Order size, $Q(T_i)$ = Inventory on hand atreview time, $O(T_i)$ = Inventory ordered but not received.

X. Identifying Critical Inventory Items with ABC Analysis

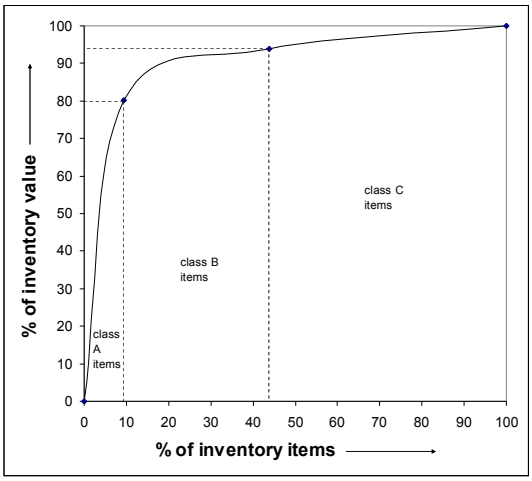


Figure 1 : ABC analysis showing relationship between percentage ofinventory items and percentage of inventory value

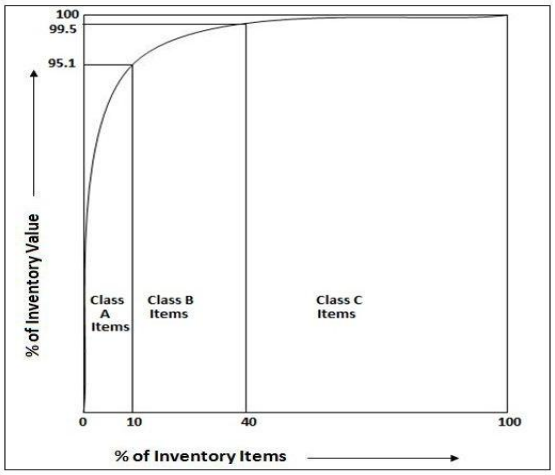
As figure shows, class A typically represents only about 20percent of the items but account for 80 percent of the dollarusage. Class B items account for another 30 percent of theitems but only 15 percent, of the dollar usage. Finally, 50percent of the items fall in class C, representing a mere 5percent of the dollar usage.

Table 2 : ABC analysis for annual demand of Eastern Jute Mills

Total number of items = 10

SL	Raw materials	Unit	Amounts	Per unit price	Total price
				(Taka)	(taka)
1.	Raw Jute	Tons	7260	43467	315570420
Total Class of A items =					315570420
2.	Baling hoops	Kg	44928	74	3324672
3.	Paperboard tubes	Pieces	1320	729	962280
4.	Jute batching oils	Litter	221748	46	10200408
Total Class of B items =					14487360
5.	Baling pins	Kg	2400	84	201600
6.	Baling buckles	Kg	4800	78	374400
7.	Polythin Sheet	Kg	630	143	90090
8.	Emulsifier	Kg	432	260	112320
9.	Starch	Kg	20364	40	814560
10.	Dyes Chemicals	Kg	90	493	44370
Total Class of C items =					1637340

Figure 2 : ABC analysis for the annual demand of the EasternJute Mills



Total price of 10 items = 315570420 + 14487360 +1637340 = 331695120 Taka Now,

Total number of Class-A items = 1

% of Class-A items = $\frac{1}{10} \times 100$ = 10 %

Total price of Class-A items = 315570420 Taka

% of price of Class-A items = $\frac{315570420}{331695120} \times 100$ = 95.1 %

Total number of Class-B items = 3

% of Class-B items = $\frac{3}{10} \times 100$ =30 %

Total price of Class-B items = 14487360 Taka

% of price of Class-B items = $\frac{14487360}{33169512 0} \times 100$ = 4.4%

Total number of Class-C items = 6

% of Class-C items = $\frac{6}{10} \times 100$ = 60 %

Total price of Class-C items = 1637340 Taka

% of price of Class-C items = $\frac{1637340}{331695120} \times 100$ =0.50 %

XI. Sample Calculation for Itemno-1 (RawJute) for1 Year Review Period

Unit price, b = 43467 taka
Annual demand = 7260 tons
Percentage of value invested in inventory, f =30%
Service level = 85%
So, z= 1.0364 (from normal distribution curve)
Daily Standard deviation, SD = 9.45
Lead time, L = 88 days
There is one holiday is a week in Eastern jute mills andgenerally there are 52 weeks in a year.
So, number of working days in a year in Eastern jutemills =365 – (1×52) days = 313 days
Review period, t = 313 days

Demand per day, D = $\frac{7160}{313}$ = 23.19 tons.

Safety stock, B = ${}_{z}S_{D}$=1.0364 × 9.45 × $\sqrt{\frac{313}{2} + 88}$ = 153

Maximum stock, M = D ($\frac{t}{2} + L$) + B = 23.19 $\frac{313}{2}$ + 88) +153 = 5823

Reorder point, R = (lead time demand, DL) + B

= $\frac{7260}{313} \times 88 + 153 = 2194$

So, holding cost, $C_H = c_H$ ($\frac{M+B}{2}$) = b × f × ($\frac{M+B}{2}$) ($\frac{M+B}{2}$) = 43467 × 0.3 × ($\frac{5823+153}{2}$) = 38996419 Taka

Table 3 : Holding cost for raw materials for 1 year review period

SL	Raw materials	Unit	Unit price (b)	Annual demand	Holding Cost (C_H) Taka
1	Raw Jute	Tons	43467	7260	38996419
2	Baling hoops	Kg	74	44928	411877
3	Baling pins	Kg	84	2400	24885
4	Baling buckles	Kg	78	4800	46215
5	Paper board tubes	Pieces	729	1320	119192
6	Jute batching oils	Litter	46	221748	1258808
7	Polythin Sheet	Kg	143	630	11111
8	Emulsifier	Kg	260	432	13845
9	Starch	Kg	40	20364	100518
10	Dyes Chemicals	Kg	493	90	5472
Total Holding Cost =					40988342

1 year review period has been taken under consideration.

Now, total holding cost = 40988342 Taka.

So, total incremental cost,

TIC = $C_H + C_R$

= (40988342 + 160000) Taka

= 41148342 Taka

XII. Result

ABC analysis is obtained for the annual demand. In case ofthe annual demand, Class- A item is the raw jute whichcovers 10 percent of total raw materials and holds about 95percent of total value. Class- B holds the 30 percent of totalitems and covers around the 3.5 to 4.5 percent of total valueand Class- C holds 60 percent of total items and coversaround the 0.5 percent of total value. The total incrementalcost of the 1 year review period is 41148342 Taka. Thisincremental cost is the summation of the entire three unitsand it has been calculated based on the annual demand ofthe Eastern Jute Mills.

XIII. Suggestion

Here are some suggestions to improve the existing inventorymanagement system of the eastern Jute Mills.

a) Especially Raw Jute (Class- A item) should be putunder extreme high control because only the RawJute holds around 95 percent of inventory

value. Ifthe wastage of the raw jute can be minimized, itwill be possible to minimize the total holding cost.

b) It is necessary to provide the more space to storethe raw jute. If more spaces are provided and arenot stored more compactly, the wastage will beminimized. The raw jute should be process beforestorage. It can minimize the total wastage and canminimize the total holding cost.

c) By proper maintenance and replacement of parts,these machines can perform as close to a new one.It is necessary to install the new or automaticmachineries to decrease the loose of raw materials.

d) In today's business environment, even small andmid-sized businesses have come to rely oncomputerized inventory management systems. [10]So the inventory management of the mill should berelied on the computerized inventory managementsystem. A computerized inventory managementsystem is more accurate and reliable.

But if the inventory management system is estimated by 2review period (July to December and January to June) in ayear, it will be easier process and can be made manyimportant decisions quickly.

XIV. Discussion

For studying the entire inventory management system of theEastern Jute Mills, the inventory related data has beencollected from the Hessian unit, Sacking unit and CBC unit.Each unit has some individual needs and produces theindividual products. The overall requirements of the annualdemand of the Eastern Jute Mills have also been collected.The motive of this work is to adopt a suitable inventorymanagement system which will serve as a model. From thepresented data, total inventory costs for 1 year review havebeen figured out.

XV. Conclusion

The Depreciation and wastage is high in Eastern Jute Millswhich leads to a greater holding costs and finally greaterincremental cost. By close observation, it is seen that theraw jute is under loose control that leads the greaterdepreciation and wastage of raw jute. There are spaces tostock the raw jute. But the spaces are not sufficient. Byclose observation, it is seen that the Raw Jute is stored inmore compactly that can leads to more wastage. Normallyhuge amount of jute is bought at a time because it isavailable in June to September. Technology used in jutemanufacturing sector did not change much. Most of themachines in jute mills are old and have passed the usualfunctional period. Due to the use of extreme old machine,the operation can't be performed smoothly and the materialsare being loosen at a considerable rate. The expense ofrunning mill is about the 14 percent which also added withthe holding cost. The old machineries take huge amount ofpower but can't provide sufficient performance. Because ofthis reason the expense of running mill is high. Eastern JuteMills estimates its Inventory management system for every1 year (July to June). It is more complex to estimate the totalinventory at a time.

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