Analysis of Different Inventory Control Techniques: A Case Study in a Retail Shop

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Abstract

The inventory of materials constitutes the most significant part of current assets and working capital in any organisation. A small saving in the inventory will mirror a crucial edge in benefit of the organisation. In Bangladesh, the retail shops generally face two types of inventory related problems which are either stock-out or overstock. As a result, most of the shops fail to maintain their product availability with lowest possible inventory cost. Through proper inventory control techniques, probability of stock-out as well as overstock situations in the retail shops can be minimised. The present paper is a case study of different inventory control techniques for efficient inventory management system of a retail shop of Bangladesh. The sole purpose of the study is to provide a guideline for inventory managers that will help them to ensure product availability at right quantity as and when required. Relevant data were collected from a renowned retail shop, namely, Pran RFL group, Bangladesh. This real case demonstration will certainly help the future researchers as well as the Bangladeshi manufacturers to maintain proper control & management of inventories.

Keywords: Inventory Control, Profit, Stock-out, Overstock, Retail Shop

Introduction

In Bangladesh, the number of small and big retail shops is increasing day by day. Authorities of these retail shops are used to run their business in traditional ways using little or more experience of inventory control system. With today's uncertain economy, companies are searching for alternative methods to keep ahead of their competitors by effectively driving sales and reducing unnecessary cost. Big retail companies do not stand a chance in today's environment if they do not have an appropriate inventory control & management plan intact. It is not only important for retail stores to manage inventories, but it also carries prominent importance for other companies. In fact, inventories pervade the business world. Maintaining inventories at right quantities is necessary for any company dealing with physical products, including manufacturers, wholesalers, and retailers. For the retail shops in Bangladesh, two inventory related problems, stock-out and overstock occur frequently. As a result, the shops fail to maintain their product availability with the lowest possible inventory cost. Lack of product availability severely affects the level of customer satisfaction which is the main driving force of any business. In order to overcome these problems, proper inventory control techniques are necessary.

Inventory control refers to a systematic approach, which ensures the continuous supply of required quantity and quality of inventory. Proper inventory control prevents unnecessary investment in inventories. Inventory control is the process of ensuring appropriate amount of stocks so as to be able to meet customer demand without delay. The aim of inventory management, thus, should be to avoid excessive and inadequate levels of inventories. Effective action should be made to place an order at the right time for overcoming stock-out situation. This effort also helps to achieve the right quantity at the right price and quality. According to Chase, Jacobs, and Aquilano (2008), inventory management is a set of the policies and controls that monitors levels of inventory and determine what levels should be maintained. The prime objective of the process is to make a trade-off between inventory investment and customer service (Heizer & Barry, 2011).

Inventory means the large stock piles of any item or resource used in organisation. Inventory may be of different types such as company's raw materials, work in process (WIP), finished goods, supplies used in operations etc. While inventories represent 25 to 50 percent of total assets in manufacturing firms, for wholesalers and retailers it goes up to 75 to 80 percent (Johson, Newell, & Vergin, 1974). This implies the necessity of inventory control in retail shops. A proper inventory control technique will reflect a vital margin in profit for the retail shops.

Lee and Kleiner (2001) stated that in order to manage inventory management successfully, "retailers should understand customer needs, vendor partnerships, technology, data integrity, and performance measurements". Proper warehousing of inventory is necessary so that when goods items are ordered, they are kept at the warehouse for the least time possible minimising holding cost of inventory. According to several researchers, with inventory in warehouse, an organisation has the advantage of timely delivery of products to the buyers and stock-outs are not experienced which severely affects the level of customer satisfaction. Another popular means of automated inventory control is vendor-managed inventory (VMI). Vendor-managed inventory implies that the vendor and retailer work closely together and share proprietary information.

For retailers it is critical to maintain a good inventory system. Retailer, having bad inventory system, will not be able to forecast demands with any kind of accuracy. Inaccuracy in forecasting demands might result in running out of stock. Stock-outs have been experienced adversely, leading to customer dissatisfaction. As a result, firms are changing their approach by employing economic order quantity (EOQ) and reorder point (ROP) for customer satisfaction. Analysis of safety stock is necessary in overcoming this problem. Inventory management need to be organised in a logical way so that the organisation can be able to know when to order and how much to order. Computing economic order quantity (EOQ) and reorder point (ROP) provides an effective solution. It allows firms to have minimal storage costs or zero within their warehouses since inventory is coming in and going out immediately.

Increasing number of items in the inventory is a problem and need enforcing strict controls. Verma (2010) gave some solutions like SIM (selective inventory management) which consists of Pareto analysis (ABC analysis), criticality analysis (VED analysis), movement analysis (FSN analysis) and availability analysis (SED, GOLF, SOS etc.) in satisfying the conflicting interests of determination of the appropriate quantity to be procured and minimum capital without any delay. According to Mitra, Pattanayak, and Bhowmik (2013), the priorities of the items change according to different inventory analysis techniques. The decision of selecting which technique will give benefits to them is up to the management.

Investigation of the reasons behind the inventory management inefficiency in firm is necessary. Mahant, Chouhan, and Yadav (2013) investigated the reasons behind the inventory management inefficiency in firm by implementation of ABC technique. A study on inventory management at Amara Raja Electronics Ltd. performed by Rambabu and Malyadri (2014) concluded that more concentration in the inventory management increased production, decreased level of shortages and made product available to the customer. In order to understand the nature of inventory management of the organisation, Jose, Jayakumar, and Sijo (2013) analysed different inventory control techniques like EOQ, safety stocks, ABC analysis, and FSN analysis. This analysis showed discrepancies in inventory control system of the firm. Mitra, Reddy, and Prince (2015) employed FSN analysis to control the inventory management system of an EMU coach manufacturing industry in India.

Kumar and Anas (2013) employed ABC analysis for the multiple products inventory management of scooters India Ltd. The objective of the study was to promote a better material management policy that would affect the company's profit. Chen, Hung, Fu and Peng (2012) developed an ABC analysis model for the multiple products inventory control. Ravinder and Misra (2014) focused on bringing multi-criteria ABC analysis center-stage in the textbooks. Traditionally, ABC analysis has been based on the single criterion - dollar value. But, the authors have suggested that other criteria should be considered like lead time, item criticality, durability, scarcity, reparability, stock ability, commonality, substitutability, number of suppliers, mode and cost of transportation, the likelihood of obsolescence or spoilage, and batch quantities imposed by suppliers etc. Hatefi, Torabi, and Bagheri (2014) presented a modified linear optimisation method that helps inventory managers to categorise the inventory items in the presence of both qualitative and quantitative criteria without any subjectivity.

Tahir and Choudhary (2011) developed a decision support system for the proper control & analysis of gas plant inventory. The authors applied three different analysis methods which were price-based analysis, quantity-based analysis, and ABC analysis. The research involves extension of the proposed decision support system to

a gas plant inventory and a comparative analysis is conducted for the former two methods to separate the critical parts on the basis of their price and quantity respectively. Sukhia, Khan, and Bano (2014) introduced economic order quantity (EOQ) model for reducing inventory related costs as well as stock-out problems in web based point of sale applications for supermarkets. In this research, simple moving average, linear regression, back propagation algorithms were used to determine the demand and EOQ model was applied on the forecasted demands. Afterwards a comparative analysis was conducted on the basis of costs generated by each demand forecasting technique for the selection of efficient technique for demand forecasting in retail industry. In the research work by Raphella, Nathan, and Chitra (2014), company's current forecasting model was identified and the authors recommended an inventory control model to solve the current issues. Firstly, ABC analysis technique for the inventory control system was applied to identify the most important multiple products and then economic order quantity & re-order point for each product was recommended to reduce the stock-out problem. Kumar, Lilhare, Sahu, Lal, Sinha, Khaparde, and Janghel (2016) applied HML analysis to manage inventory efficiently of steel plant in India. Data was collected from general store manager and other staff involved in inventory control operation of steel plant.

So far, a good number of research studies were conducted by different researchers in different times and they tried to cover all the aspects of materials management in public sector and private sector, industrial units, and retail shop. But, in the perspective of Bangladesh a small amount of work has been done on inventory management particularly in retail shop inventory management. The investment in inventories for retail shop constitutes about 70-80% of total assets and working capital in Bangladeshi retail shop. A small saving in the inventory will reflect a vital margin in profit of the organisation (Rambabu & Malyadri, 2014). The effectiveness of inventory control, to a great extent, influences the flexibility of the firm. Therefore, inefficient procedures may result in an unbalanced inventory, sometimes out of stock or overstocked, necessitating excessive investment. These inefficiencies ultimately will have an adverse effect on profits of the organisation. In this paper, four techniques like EOQ, ABC analysis, safety stock, and HML are analysed for smooth inventory management which will minimise the problems of overstock and stock-out and provide relative importance of inventory items.

Research Methodology

This paper is a case study of four different inventory control techniques for efficient inventory management system of a retail shop of Bangladesh. Although there are several control techniques for maintaining proper inventory management, here four different control techniques are applied which are discussed below.

ABC Analysis

Always Better Control (ABC) analysis (alternatively termed as "Selective Inventory Control") is widely used inventory categorisation technique for managing stocked material that should be managed differently. This technique is based on Pareto principle and works in dividing items into three categories A, B and C in order of their level of significance. *"A"* denotes items that are very expensive & require tight control, *"B"* items are important & require moderate control, *"C"* items are less important as compared to *"A"* and *"B"*. The main objective of this classification scheme is to draw managers' attention on the critical few (A-items) and not on the trivial many (C-items). Table 1 shows the approximate division of this technique. Annual consumption value of different items for ABC classification scheme is calculated as follows:

Annual consumption=Annual demand × Unit price …(1)

Table 1: Rules of ABC Analysis

Category	Percentage of items	Percentage value of annual usage	Control
Class A Items	About 20%	About 80%	Close day to day control
Class B Items	About 30%	About 15%	Regular review
Class C Items	About 50%	About 5%	Infrequent review

HML Analysis

The High, Medium & Low (HML) analysis is similar to ABC analysis except the difference is that in stead of Annual consumption value used in ABC classification cost per unit criterion is used in HML analysis. The items under this classification scheme are arranged in descending orders of their unit price. The classification of the items based on unit price is decided completely by the management. It helps managers to take decision on buying policies which means H & M items should not be ordered more than required quantity. The frequency of stock checking is also initiated by this method. Most valuable items require frequent stock checking.

Economic Order Quantity (EOQ)

In inventory management, two important costs are ordering costs incurred on communicating the order and holding cost required for carrying inventories. To minimise carrying cost, items should be ordered frequently in small lots which will in turn increase the ordering cost. As these two costs are opposite, an innovative model is required to make a balance between them. To minimise the total inventory cost, economic order quantity (EOQ) model helps the managers. It defines the optimum quantity that minimises the total cost (both ordering & holding costs) of stocked material. Economic order quantity (EOQ) & order frequency are calculated by using following formula:

$$EOQ = \sqrt{\frac{2DS}{H}} \quad \ldots(2)$$

where,

D = Demand per year (units)

S = Re-order cost/ Procurement cost

H = Carrying or holding cost/ unit/ year

$$n = D/EOQ \quad \ldots(3)$$

where,

D = Demand per year (units)

EOQ = Economic order quantity

Safety Stock (SS)

Safety stock is the stock held by a company in excess of its requirement for the lead time. Companies hold safety stock to guard against stock-out. As demand is uncertain, safety stock (SS) plays a vital role to satisfy demand if it exceeds the anticipated demand. Too much safety stock carried increases the holding cost of a supply chain. So, the key to the success of any supply chain is to make a balance between safety stock and level of customer satisfaction. Considering demand is constant, safety stock is calculated using the following formula:

$$SS = Z \times D \times \sigma_L \quad \ldots(4)$$

where,

D = Demand per year (units)

Z = Standard Normal Value

= Standard deviation of Lead Time

Data Collection & Calculation

Statistical Data from Selected Retail Shop

Necessary data for this study were collected from a renowned retail shop of Bangladesh named Pran RFL Group. Some data were collected by Interaction with personnel of the retail shop and direct observation and the remaining data were collected from turnover statements, monthly inventory statements and record file. The proposed methodology was applied on 40 different items. Table 2 shows the annual demand & unit price of 40 different items of the company. Based on the data, four inventory control techniques have been performed.

Table 2: Demand & Unit Price of Products

S. No.	Item Name	Demand per year	Unit cost (BDT)	SL. No.	Item Name	Demand per year	Unit cost (BDT)
1	King Chair	16000	600	21	Stool	12000	120
2	Garden Chair	15500	500	22	Paper Basket	6000	70
3	Relax Chair	2400	532	23	Net Gumla	1200	100
4	Deco Chair	4800	470	24	Hanger	12000	15
5	Queen Chair	2400	540	25	Glass Stand	1200	90
6	Table	5500	4,500	26	Raxin Roll	3000	9,500
7	Bucket 35 liter	1200	380	27	Rabbit Potty	2400	250
8	Bucket 30 liter	3600	280	28	Commode Chair	15000	600
9	Bucket 25 liter	4800	225	29	Mini Organiser	600	200
10	Bucket 20 liter	6000	180	30	Juice Jug	6000	80
11	Bucket 10 liter	6000	160	31	Centre Table	1200	700
12	Water filter	1200	900	32	Wardrobe	130	7,000
13	Jug	6000	100	33	Bookshelf	140	4,000

S. No.	Item Name	Demand per year	Unit cost (BDT)	SL. No.	Item Name	Demand per year	Unit cost (BDT)
14	Rack	2400	600	34	PVC Door (3*7) ft.	140	2,300
15	Bowl	42000	150	35	PVC Door (2.5*6) ft.	130	2,000
16	File Tray	6000	100	36	PVC Door (2.5*6.5) ft.	260	2,100
17	Mug	12000	50	37	PVC Door(2.5*7) ft.	110	2,300
18	Tiffin Carrier	80000	100	38	Water Tank 700 liter	70	5,600
19	Container Set	6000	350	39	Water Tank 1000 liter	130	7,800
20	Water Pot	70000	80	40	Water Tank 1500 liter	6	12,000

Computational Steps

To classify items under ABC classification scheme, annual usage/ consumption value is calculated through Eq. (1). Items are arranged in the descending order of their annual usage starting with the highest annual usage down to the smallest usage. Percentage annual usage of each item is obtained from annual usage values. Next step is to calculate percentage cumulative usage of forty items. The number of items is expressed into cumulative item percentages. Items are segregated into A, B and C categories following ABC classification rules which are shown in Table 3.

Table 3: ABC Analysis of Forty Items

S. No.	Item name	Annual Demand	Unit cost (BDT)	Annual usage (BDT)	% Annual Usage	% Cumulative Annual Usage	Classification category
1	King Chair	16000	9,500	2,85,00,000	22.99	22.99	A
2	Garden Chair	15500	4,500	2,47,50,000	19.96	42.95	A
3	Relax Chair	2400	600	96,00,000	7.76	50.71	A
4	Deco Chair	4800	600	90,00,000	7.26	57.97	A
5	Queen Chair	2400	100	80,00,000	6.45	64.42	A
6	Table	5500	500	77,50,000	6.25	70.67	A
7	Bucket 35 liter	1200	150	63,00,000	5.08	75.75	A
8	Bucket 30 liter	3600	80	56,00,000	4.52	80.27	A
9	Bucket 25 liter	4800	470	22,56,000	1.82	82.09	B
10	Bucket 20 liter	6000	350	21,00,000	1.69	83.78	B
11	Bucket 10 liter	6000	600	14,40,000	1.16	84.94	B
12	Water filter	1200	120	14,40,000	1.16	86.1	B
13	Jug	6000	540	12,96,000	1.05	87.15	B
14	Rack	2400	532	12,76,800	1.03	88.18	B
15	Bowl	42000	225	10,80,000	0.87	89.05	B
16	File Tray	6000	180	10,80,000	0.87	89.92	B
17	Mug	12000	900	10,80,000	0.87	90.79	B
18	Tiffin Carrier	80000	7,800	10,14,000	0.82	91.61	B
19	Container Set	6000	280	10,08,000	0.81	92.42	B
20	Water Pot	70000	160	9,60,000	0.77	93.19	B
21	Stool	12000	7,000	910000	0.73	93.92	B
22	Paper Basket	6000	700	8,40,000	0.68	94.6	B
23	Net Gumla	1200	100	6,00,000	0.48	95.08	B
24	Hanger	12000	100	6,00,000	0.48	95.56	B
25	Glass Stand	1200	50	6,00,000	0.48	96.04	C
26	Raxin Roll	3000	250	6,00,000	0.48	96.52	C

S. No.	Item name	Annual Demand	Unit cost (BDT)	Annual usage (BDT)	% Annual Usage	% Cumulative Annual Usage	Classification category
27	Rabbit Potty	2400	4,000	5,60,000	0.45	96.97	C
28	Commode Chair	15000	2,100	5,46,000	0.44	97.41	C
29	Mini Organiser	600	80	4,80,000	0.39	97.8	C
30	Juice Jug	6000	380	4,56,000	0.37	98.17	C
31	Centre Table	1200	70	4,20,000	0.34	98.51	C
32	Wardrobe	130	5,600	3,92,000	0.32	98.83	C
33	Bookshelf	140	2,300	3,22,000	0.26	99.09	C
34	PVC Door (3*7) ft.	140	2,000	2,60,000	0.21	99.3	C
35	PVC Door (2.5*6) ft.	130	2,300	2,53,000	0.2	99.5	C
36	PVC Door (2.5*6.5) ft.	260	15	1,80,000	0.15	99.65	C
37	PVC Door(2.5*7) ft.	110	100	1,20,000	0.1	99.75	C
38	Water Tank 700 liter	70	200	1,20,000	0.1	99.85	C
39	Water Tank 1000 liter	130	90	1,08,000	0.09	99.94	C
40	Water Tank 1500 liter	6	12,000	72,000	0.06	100	C
Total		355516		12,39,69,800	100		

For HML analysis, all the items whose unit price value is above BDT 5000 are categorised as “H” items, items whose unit price lies between BDT 5000 and BDT 1000 are categorised as “M” items, and items whose unit price is below BDT 1000 are categorised as “L” items in this calculation, as shown in Table 4.

Table 4: HML Analysis of Forty Items

Item no.	Item name	Unit cost(Tk.)	Criteria
40	Water Tank 1500 liter	12,000	H
26	Raxin Roll	9,500	H
39	Water Tank 1000 liter	7,800	H
32	Wardrobe	7,000	H
38	Water Tank 700 liter	5,600	H
6	Table	4,500	M
33	Bookshelf	4,000	M
34	PVC Door (3*7) ft.	2,300	M
37	PVC Door(2.5*7) ft.	2,300	M
36	PVC Door (2.5*6.5) ft.	2,100	M
35	PVC Door (2.5*6) ft.	2,000	M
12	Water filter	900	L
31	Centre Table	700	L
14	Rack	600	L
28	Commode Chair	600	L
1	King Chair	600	L
5	Queen Chair	540	L
3	Relax Chair	532	L
2	Garden Chair	500	L
4	Deco Chair	470	L
7	Bucket 35 liter	380	L
19	Container Set	350	L
8	Bucket 30 liter	280	L
27	Rabbit Potty	250	L
9	Bucket 25 liter	225	L
29	Mini Organiser	200	L
10	Bucket 20 liter	180	L
11	Bucket 10 liter	160	L
15	Bowl	150	L
21	Stool	120	L
13	Jug	100	L
16	File Tray	100	L
18	Tiffin Carrier	100	L
23	Net Gumla	100	L
25	Glass Stand	90	L
30	Juice Jug	80	L
20	Water Pot	80	L
22	Paper Basket	70	L
17	Mug	50	L
24	Hanger	15	L

Economic order quantity and optimum order frequency per year for different components are calculated through Eqs. (2) & (3). Table 5 shows the calculation steps of EOQ analysis.

Table 5: EOQ Calculation

Item No.	Item name	Demand per year	Holding cost/unit/year	Ordering cost/order	EOQ	Optimal order no. /year
1	King Chair	16000	12	1,800	2190	7
2	Garden Chair	15500	12	2,250	2410	6
3	Relax Chair	2400	8	957.6	758	3
4	Deco Chair	4800	12	1,438.20	1072	4
5	Queen Chair	2400	8	972	763	3
6	Table	5500	12	2,700	1573	4
7	Bucket 35 liter	1200	2	1,162.80	1181	1
8	Bucket 30 liter	3600	8	856.8	878	4
9	Bucket 25 liter	4800	8	1,377	1285	4
10	Bucket 20 liter	6000	8	1,101.60	1285	5
11	Bucket 10 liter	6000	2	979.2	2424	2
12	Water filter	1200	2	1,350	1273	1
13	Jug	6000	2	300	1342	4
14	Rack	2400	8	900	735	3
15	Bowl	42000	8	2,250	4861	9
16	File Tray	6000	2	300	1342	4
17	Mug	12000	2	300	1897	6
18	Tiffin Carrier	80000	2	3,000	15492	5
19	Container Set	6000	8	1,050	1255	5
20	Water Pot	70000	2	2,400	12961	5
21	Stool	12000	8	900	1643	7
22	Paper Basket	6000	2	210	1123	5
23	Net Gumla	1200	8	75	150	8
24	Hanger	12000	2	45	735	16
25	Glass Stand	1200	8	67.5	142	8
26	Raxin Roll	3000	8	2,850	1462	2
27	Rabbit Potty	2400	12	375	387	6
28	Commode Chair	15000	8	216	900	17
29	Mini Organiser	600	8	120	134	4
30	Juice Jug	6000	2	240	1200	5
31	Centre Table	1200	8	525	397	3
32	Wardrobe	130	8	420	117	1
33	Bookshelf	140	8	360	112	1
34	PVC Door (3*7) ft.	140	12	1,035	155	1
35	PVC Door (2.5*6) ft.	130	12	900	140	1
36	PVC Door (2.5*6.5) ft.	260	12	1,134	222	1
37	PVC Door(2.5*7) ft.	110	12	1,035	138	1
38	Water Tank 700 liter	70	12	2,520	171	1
39	Water Tank 1000 liter	130	12	4,212	302	1
40	Water Tank 1500 liter	6	12	720	27	1

To determine safety stock, lead time (maximum & minimum) is collected from the shop manager which varies between two and eight days. Demand is assumed to be constant and the desired cycle service level (CSL) is assumed to be 95%, hence the Z value is 1.645. Safety stock calculation is portrayed in Table 6.

Table 6: Safety Stock Calculation

Item no.	Item name	Demand per year	σ_L	Z value	Safety stock
1	King Chair	16000	0.006001	1.645	158
2	Garden Chair	15500	0.006001	1.645	153
3	Relax Chair	2400	0.006001	1.645	24
4	Deco Chair	4800	0.006001	1.645	47
5	Queen Chair	2400	0.006001	1.645	24
6	Table	5500	0.006001	1.645	54
7	Bucket 35 liter	1200	0.006001	1.645	12
8	Bucket 30 liter	3600	0.006001	1.645	36
9	Bucket 25 liter	4800	0.006001	1.645	47
10	Bucket 20 liter	6000	0.006001	1.645	59
11	Bucket 10 liter	6000	0.006001	1.645	59
12	Water filter	1200	0.006001	1.645	12
13	Jug	6000	0.006001	1.645	59
14	Rack	2400	0.006001	1.645	24
15	Bowl	42000	0.006001	1.645	415
16	File Tray	6000	0.006001	1.645	59
17	Mug	12000	0.006001	1.645	118
18	Tiffin Carrier	80000	0.006001	1.645	790
19	Container Set	6000	0.006001	1.645	59
20	Water Pot	70000	0.006001	1.645	691
21	Stool	12000	0.006001	1.645	118
22	Paper Basket	6000	0.006001	1.645	59
23	Net Gumla	1200	0.006001	1.645	12
24	Hanger	12000	0.006001	1.645	118
25	Glass Stand	1200	0.006001	1.645	12
26	Raxin Roll	3000	0.006001	1.645	30
27	Rabbit Potty	2400	0.006001	1.645	24
28	Commode Chair	15000	0.006001	1.645	148
29	Mini Organiser	600	0.006001	1.645	6
30	Juice Jug	6000	0.006001	1.645	59
31	Centre Table	1200	0.006001	1.645	12
32	Wardrobe	130	0.006001	1.645	2
33	Bookshelf	140	0.006001	1.645	2
34	PVC Door (3*7) ft.	140	0.006001	1.645	2
35	PVC Door (2.5*6) ft.	130	0.006001	1.645	2
36	PVC Door (2.5*6.5) ft.	260	0.006001	1.645	3

Item no.	Item name	Demand per year	σ_L	Z value	Safety stock
37	PVC Door(2.5*7) ft.	110	0.006001	1.645	1
38	Water Tank 700 liter	70	0.006001	1.645	1
39	Water Tank 1000 liter	130	0.006001	1.645	2
40	Water Tank 1500 liter	6	0.006001	1.645	0

Result and Discussion

From the classification result of ABC analysis shown in Table 7, "A" classes are those which constitute 20% of total items and occupies 80.26% of total value usage per annum. "B" classes are those which constitute 40% of total items and occupy 15.31% of total value usage per annum. And, "C" classes are those which constitute 40% of total items and occupy 4.43% of total value usage per annum. As the existing retail shop has not put different degree of control among the three categories of items, this implies lack of inventory control technique. This analysis has shown what level of control should be imposed on different items.

Table 7: Result of ABC Analysis

Item classification	No. of items	% of items	Consumed value (BDT)	% of value usage
A	8	20%	99500000	80.26%
B	16	40%	18980800	15.31%
C	16	40%	5489000	4.43%

The EOQ and the number of orders purchased per year have been calculated for the 40 components in the retail shop. The calculated EOQ has been compared with the number of units of each component purchased in the organisation which is shown in Fig. 1. It is found that there is a variation in the calculated EOQ and current ordering policy of the retail shop. This is because the shop place order frequently when demand arises without managing EOQ. So, the number of units ordered is small while number of orders is high. It is understood that the company is not following EOQ for purchasing the materials & therefore the inventory management is not satisfactory. The EOQ will help the shop to prevent the problem of overstock and reduce the ordering cost. Results of safety stock depicted in Table 6 shows when the retail manager should reorder to avoid stock-out and how much the manager can hold the inventory in reserve stock per annum.

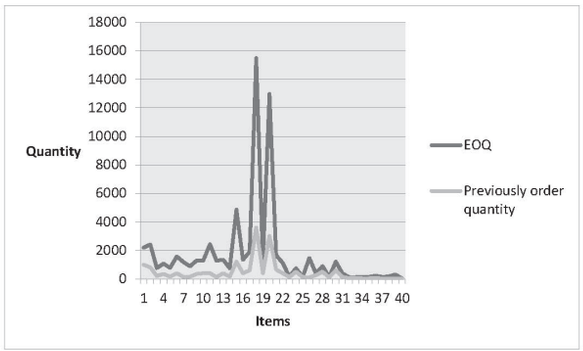

Fig. 1: Comparison between EOQ & Order Quantity

HML categories were done to find out items according to their unit price to give relative importance. Table 8 shows that among the selected 40 items of the retail shop, 5 items are found high priced, 6 are found to be medium priced items, and 29 are found to be low priced items. HML analysis will help the manager to provide relative importance of items, decide the frequency of stock checking of items, exercise control on purchase and buying polices. This analysis shows "H" and "M" category items should be given extra care in comparison to "L" category items.

Table 8: Result of HML Analysis

Categories	No. of items	% of items
H	5	12.5%
M	6	15%
L	29	72.5%

Conclusion and Further Research

As stated throughout this study, retail manager has been continually challenged by the two conflicting objectives of inventory management to ensure maximum items availability while keeping inventory cost low. The retail shop does not follow any inventory control techniques. Orders are placed without calculating EOQ technique and checking Safety Stock. Out of stock, overstock, and unpredictable issues are faced by the retail shop because

of ineffective inventory management system. The analysis of different inventory control techniques in this paper can bring a promising result in overcoming these problems.

The retail shop should have tighter control to 'A' class items rather than 'B' and 'C' classes items as 'A' class items have the highest consumption of BDT value. Safety stock should be maintained to reduce the probability of stock-out of items. EOQ can be an appropriate technique to lower the overstock and minimise total inventory cost. Using EOQ, the ordering frequency of the shop can be reduced substantially which in turn will reduce total ordering cost annually. High priced items should be checked more frequently than low priced items. Excess supply than the required order quantity should not be accepted for high priced and medium priced items. 'H' and 'M' categories of items should be purchased by skilled person and relative importance for handling these items should be given properly.

Although there are various types of inventory control techniques in the literature, in this paper only four types of inventory control techniques such as ABC analysis, EOQ, safety stock, and HML analysis have been analysed. Other inventory management techniques like VED analysis can be used to control inventory. Proper forecasting technique plays a vital role in inventory management. Forecasted demand from the appropriate forecasting technique can be used in EOQ model. Further study can be taken place to find out optimal inventory control technique.

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