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Inventory Management Techniques for Grocery Shops in Bangladesh: A Study on a Grocery Shop in Khulna City

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Abstract

The purpose of this study is to highlight or identify the inventory management strategies used by Bangladeshi grocery stores. Data was collected using the purposive sampling approach as part of a descriptive, survey, and quantitative investigation. Effective inventory management is a crucial part of each and every business enterprise to control the risk of overstock as well as stock-out. Both overstock and stock-out of the product are harmful to enterprises for optimizing revenue because overstock leads to wastage of product; on the other hand, stock-out leads to the loss of a regular and potential customer. For a grocery shop, the use of proper inventory management techniques is more important than for any other small enterprise because, usually, a grocery shop deals with more than 100 types of different products. Through the proper use of inventory management techniques, the possibility of overstocking and stock-outs in grocery shops may be reduced to a great extent. This paper presents effective inventory management techniques for grocery shops in Bangladesh based on a grocery shop in Khulna city named Babul Store, Khulna. There are a number of inventory control approaches that can be used to maintain appropriate inventory management. The objective of the study is to suggest some guidelines to the inventory manager so that they can easily avoid overstocking and stock problems and make all the necessary goods available in the right quantity at the right time. All the necessary data were collected from a grocery shop in Khulna city named Babul Store, Khulna. This study will suggest some guidelines that will help develop inventory management software for further analysis. Future scholars and Bangladeshi grocery store owners will undoubtedly benefit from this real-world example of how to manage and regulate inventory properly.

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Introduction:

Grocery shops play a vital role in the total economy of Bangladesh. An oral interview was taken with some large grocery shop owners in Khulna city, where it was found that total sales per day are around 5 to 10 lack taka for some of the wholesale grocery shops. Their profit margin is, on average, 15% to 20% of total sales. But unfortunately, most of them are not using any inventory control techniques, which is why they are facing overstocking problems, which lead to wastage, as well as stock out problems, which lead to the diversion of regular or new customers. If a grocery shop fails to avail the product in the required quantity at the right time, it will affect the level of customer satisfaction to a great extent, which is the main driving force for a business enterprise. Inventory management is the process of organizing and managing the stock of products throughout the supply chain. The objective of inventory management is to reduce the cost of having inventory and get products into customers' hands faster as per the required quantity at the right time. Hatefi et al. (2014) having both quantitative and qualitative criteria present, classified several inventory items based on the ABC inventory system. An inventory management study of scooters in India was conducted by Kumar, A., & Shukla, A. C. (2022) adopting ABC analysis. In the steel plant, Kumar et al. (2016), carried out inventory management with the aid of HML analysis. The control system was put into action through ABC analysis, VED analysis, and EOQ after inventory management had been examined (Nirmala et al., 2022). An inventory control method for women's clothes was developed by Lee et al. The manufacturing sector was used by Mitra et al. to implement inventory management strategies utilizing ABC and HML models. Dangore and Ladhe (2022) focused on the ABC technique as a tool for inventory management. Dahiwale and Sangode (2019) used different inventory control techniques, including ABC, VED, Golf, HML, and SDE, to control inventory efficiently. Inventory management, in the words of Chase, Jacobs, and Aquilano (2008), is a collection of procedures and guidelines for assessing inventory levels and deciding on appropriate maintenance levels. The main goal of the process is to balance the investment in inventory with the quality of the customer experience (Heizer & Barry, 2011). In their discussion of inventory control methods for an effective inventory management system of a retail store in Bangladesh, Ahmed et al. (2017) not only recommend EOQ as a superior inventory control method but also call for additional research. Sridharan et al. (2021). This study offered a method that will lower the inventory level by 40% and reduce lost sales by 87% when compared to the current standard inventory management system. A simulation of inventory management systems in retail outlets is suggested (KV, Pandey & Polasi, 2022). For the inventory management of grocery stores in India, this paper offers various inventory control approaches and places a stronger emphasis on the EOQ. A lot of research was conducted in the field of inventory management techniques, including in the food industry, cloth industry, pharmaceutical industry, retail shops, women's cloth, and many other industries, but limited research on inventory management techniques was conducted in the field of grocery shops. So, this research shows different inventory control techniques in the field of grocery shops and uses four techniques, including ABC analysis, HML analysis, EOQ, and safety stock.

Literature review

Bangladesh is seeing a daily increase in the number of grocery stores. The authorities of these grocery stores are accustomed to operating their businesses in a conventional manner, with little to no expertise in an inventory control system. Companies are looking for different strategies in the current economy's unpredictability to stay ahead of their rivals by successfully boosting sales and cutting wasteful expenses. If a large grocery chain does not have an effective inventory control and management strategy in place, they do not stand a chance in the current economy. Keeping track of stocks is crucial for other businesses as well as grocery stores. In reality, inventories are everywhere in business. Any business dealing with physical goods, including producers, wholesalers, and retailers, must maintain the proper levels of inventory.

Stock-outs and overstocks are two inventory-related issues that affect grocery stores often in Bangladesh. The result is that the stores are unable to maintain their product availability at the lowest possible inventory cost. Customer satisfaction, which is the main engine of any organization, is significantly impacted by a lack of product availability. Appropriate inventory control methods are required to solve these issues. Inventory management, in the words of Aquilano et al. (2008), is a collection of procedures and guidelines for assessing inventory levels and deciding on appropriate maintenance levels. According to Heizer and Barry (2011), the main goal of the process is to balance the investment in inventory with the quality of the customer experience. The term "inventory" refers to the enormous stockpiles of any resource or commodity employed in an organization. The company's raw materials, work-in-progress (WIP), finished goods, operational supplies, and other items may all be included in inventory. According to Vergin et al. (1974), while inventories make up 25 to 50 percent of a manufacturing company's total assets, they account for 75 to 80 percent of those assets for wholesalers and retailers. This suggests that grocery stores must have proper inventory management. The grocery stores will make a significant profit margin if they use an effective inventory control system. Inventory must be properly stored in order to keep holding costs to a minimum when goods are ordered and are retained in the warehouse for the shortest amount of time. Numerous studies have found that having inventory in a warehouse gives a company the advantage of prompt product delivery to customers and fewer stock-outs, which have a negative impact on customer satisfaction. Vendor-managed inventory, or VMI, is another widely used method of automating inventory control. Vendor-managed inventory suggests that the vendor and merchant collaborate closely and share confidential information. It is crucial for businesses to keep a robust inventory system in place. Retailers with poor inventory management won't be able to predict demand well at all. A shortage of supplies could happen if demand forecasts are inaccurate. The negative effects of stock outs have resulted in unhappy customers. Economic order quantity (EOQ) and reorder point are two strategies that businesses are using to change their strategy and increase customer happiness. For this issue to be solved, a safety stock analysis is required. So that the business can choose when and how much to order, inventory management needs to be organized logically. Finding the economic order quantity (EOQ) and reorder point is a practical solution. As a result of the quick inflow and outflow of inventory, it enables businesses to have zero or very low storage expenses in their warehouses. Various inventory analysis approaches result in distinct changes to the item values (Bhowmik et al., 2013). The management has the discretion to choose a technique that will help them.

It is vital to look at the causes of the company's ineffective inventory management. Through the use of the ABC technique, Yadav et al. (2013) looked into the causes of the ineffective inventory management in the company. Sijo et al. (2013) examined various inventory control approaches such as EOQ, safety stocks, ABC analysis, and FSN analysis in order to comprehend the nature of the organization's inventory management. For the leadership team of numerous item stocks at Scooters India Ltd., Kumar and Anas (2013) used the ABC method. An improved material management strategy that would impact the business's profitability was the study's main goal. An ABC analysis framework was created by Peng et al., (2012) for the numerous products in inventories. Multi-criteria ABC analysis was emphasized by Ravinder and Misra (2014) in their work to make textbooks more prominent. The sole criterion used to establish ABC analysis in the past has always been cash value. However, the authors have recommended that other factors, such as time to delivery, product importance, longevity, shortages, reparability, inventory capacity, uniformity, interchangeability, the number of suppliers, mode and cost of transportation, potential for becoming obsolete or spoilage, and batch quantities ordered by suppliers, should be taken into account. Inventory managers can categorize

merchandise with the inclusion of qualitative as well as quantitative criteria without the use of subjectivity according to a modified linear optimization approach (Hatefi, Torabi and Bagheri, 2014). A decision support system was created by Tahir and Choudhary (2011) for the efficient control and evaluation of energy station stocks. The researchers used price-based, quantity-based, and ABC evaluation as their three distinct analysis approaches. The economic order quantity (EOQ) approach was established by Bano et al. (2014) with the objective of decreasing stock-out issues and expenses associated with inventory in online point of sale applications for grocers. In this study, the demand was calculated using ordinary moving average, linear regression, and backward propagation techniques, and the expected requirements were then subjected to the EOQ models. In order to choose the most successful method for predicting demand in grocery businesses, an evaluation was then done based on the costs endured with every need-predicting method. The numerous crucial goods were determined using the ABC evaluation method for the system for managing inventory, and then suggestions for the best economic order quantity and reorder period for every item were provided to minimize the shortage issue. As a result, inadequate procedures could lead to an imbalanced stock that may be stocked up or completely out of stock and require unwarranted spending. The organization's profitability will ultimately suffer as a result of all of these inefficiencies. In this study, four strategies—EOQ, ABC analysis, safety stocks, and HML—are examined for efficient inventory management. These techniques will reduce the issues of overstock and stock-out as well as offer information on the relative significance of items on hand.

Research Methodology:

This paper analyzes the inventory management techniques of grocery shops in Bangladesh based on a grocery shop in Khulna city named Babul Store, Khulna. There are a number of inventory control approaches that can be used to maintain appropriate inventory management; however, only four are used here and are covered below.

ABC Analysis:

Always Better Control (ABC) is a widely used technique of inventory management that is also known as the 80-20 rule. This rule indicates that 80% of total consumption value is based on 20% of total items or products. In this technique, 'A' items denote the items that are fewer in number but require compacted inventory control. In this case, reorders ought to be kept frequently. 'B' denotes the items whose values are medium and require moderate inventory control, where the re-order level is less than 'A' but more than "B." 'C' items denote the items or products that are less expensive and require less attention for inventory control. Re-ordering is less frequent here. As there is no fixed percentage for this rule, an approximate percentage is considered to apply the techniques.

Table 01: Rules of ABC Analysis

Types of items	Percentage of item	Percentage value of annual usages	Types of control
Class 'A' items	30%	70%	Tight control
Class 'B' items	20%	20%	Average control
Class 'C' items	50%	10%	lower frequency of review

HML Analysis:

High, Medium, and Low (HML) analysis is based on the unit price of the product, whereas ABC analysis is based on annual consumption. In this method, products are categorized into three categories: products with a higher price, products with a medium price, and products with a lower price. According to their unit price, this classification system is set up in descending order. The quantity of both H and M items ordered shouldn't exceed what's necessary, and inventory monitoring for these things needs to be strict and regular.

Economic Order Quantity (EOQ):

Usually, two costs—the carrying cost and the order cost—are incurred in order to manage inventory effectively. These two costs are incurred in opposite directions. When one cost is increased, another cost is decreased. To order any products, the company has to pay the carrying cost. To minimize the carrying cost, the company has to order the products in small slats, which leads to an increase in order cost. To find a balance between these two costs, the most effective method is the economic order quantity (EOQ) method, which ensures a minimum inventory cost with an optimum quantity of orders.

The formula below is used to determine EOQ.

$EOQ = \sqrt{\frac{2AO}{C}}$

Where, A= annual consumption/demand (units), O= order cost/Re-order cost per order, C= carrying cost per unit/year

$n = \frac{A}{EOQ}$

Where, A= annual consumption/demand (units), EQO= economic order quantity

Safety Stock:

Usually, a company estimates a customer's demand for products, but the actual demand may exceed the estimated demand. In this situation, the company has to maintain a safety stock, but if the safety stock is greater than the requirement, the holding cost of inventory will be higher. It can be kept up-to-date by computing safety stock using the formula below.

SS= $Z \times D \times \sigma_L$

Where, D=demand per year (units)

Z = Standard Normal Value

σ_L= Standard deviation of lead time

Data Collection and Analysis:

Data was collected from a grocery shop in Khulna city named Babul Store, Khulna. Some other data was collected from the owners of the grocery shop through an oral interview.

Table 2: Annual Consumption/Demand & Unit Price of grocery Products

Sl. No.	Grocery Items	Annual Demand	Unit Price (BDT)	Sl. No.	Items name	Annual Demand	Unit cost (BDT)
1.	Soyabean Oil	164250	190	16.	Red Sugar	36500	150
2.	Ghee	18250	1350	17.	Corn Flour	36500	150
3.	Cashew Nut (Kaju Badam)	18250	1350	18.	Salt	164250	32
4.	Golden Raisins / Kismis	36500	650	19.	Turmeric Powder / Holud Gura	10950	470
5.	Lentil / Deshi Moshur Dal	164250	130	20.	Chinigura Rice	36500	134
6.	Almonds (Kath Badam)	18250	1050	21.	Atta	73000	65
7.	White Sugar	146000	130	22.	Najir Shail Rice	45625	96
8.	Miniket Rice	228125	78	23.	Maida/ Wheat Flour	54750	76
9.	Instant Noodles	43800	320	24.	Brown Amon Rice	54750	72
10.	Pasta	7300	1850	25.	Liquid Milk	32850	120
11.	Boot Dal / Anchor Dal	95812	80	26.	Mashkalai Dal	21900	180
12.	Milk Powder	10950	660	27.	Mustard Oil	14600	255
13.	Chili powder / Morich Gura	10950	590	28.	Khesari Dal	18250	120
14.	Mug Dal	36500	160	29.	Coriander Powder/ Dhoniyar Gura	7300	200
15.	Garam Masala	3650	1600	30.	Korpur (Camphor)	365	3600

The remaining dates were gathered from the monthly turnover and inventory statements. The suggested approach was used on 30 grocery products. In this study, Table 2 lists the annual consumption and unit cost for 30 various grocery items. In the study, four inventory control approaches were used based on the data that had been gathered.

Computation Stage:
In this stage, annual demand in units is calculated by multiplying regular demand in units by 365 days, and annual usage is calculated by multiplying annual demand in units per year by the cost per unit. Annual usages are arranged in descending order from highest to lowest value. Percentages and cumulative percentages are calculated by putting formulas in an Excel sheet. According to the ABC classification principles indicated in Table 3, grocery goods are divided into groups A, B, and C.

Table 3: ABC analysis of Thirty Grocery Items

Sl. No	Grocery Items	Annual Demand	Unit Price (BDT)	Annual Usages	% Annual Usage	% Cumulative Annual Usage	Category
1.	Soyabean Oil	164250	190	31207500	10.33	10.33	A
2.	Ghee	18250	1350	24637500	8.16	18.49	A
3.	Cashew Nut (Kaju Badam)	18250	1350	24637500	8.16	26.64	A
4.	Golden Raisins / Kismis	36500	650	23725000	7.85	34.5	A
5.	Lentil / Deshi Moshur Dal	164250	130	21352500	7.07	41.56	A
6.	Almonds (Kath Badam)	18250	1050	19162500	6.34	47.91	A
7.	White Sugar	146000	130	18980000	6.28	54.19	A
8.	Miniket Rice	228125	78	17793750	5.89	60.08	A
9.	Instant Noodles	43800	320	14016000	4.64	64.72	A
10.	Pasta	7300	1850	13505000	4.47	69.19	A
11.	Boot Dal / Anchor Dal	95812	80	7664960	2.54	71.73	B
12.	Milk Powder	10950	660	7227000	2.39	74.12	B
13.	Chili powder / Morich Gura	10950	590	6460500	2.14	76.26	B
14.	Mug Dal	36500	160	5840000	1.93	78.19	B
15.	Garam Masala	3650	1600	5840000	1.93	80.12	B
16.	Red Sugar	36500	150	5475000	1.81	81.94	B
17.	Corn Flour	36500	150	5475000	1.81	83.75	B
18.	Salt	164250	32	5256000	1.74	85.49	B
19.	Turmeric Powder / Holud Gura	10950	470	5146500	1.7	87.19	B
20.	Chinigura Rice	36500	134	4891000	1.62	88.81	B
21.	Atta	73000	65	4745000	1.57	90.38	B
22.	Najir Shail Rice	45625	96	4380000	1.45	91.83	C
23.	Maida/ Wheat Flour	54750	76	4161000	1.38	93.21	C
24.	Brown Amon Rice	54750	72	3942000	1.3	94.51	C
25.	Liquid Milk	32850	120	3942000	1.3	95.82	C
26.	Mashkalai Dal	21900	180	3942000	1.3	97.12	C
27.	Mustard Oil	14600	255	3723000	1.23	98.36	C
28.	Khesari Dal	18250	120	2190000	0.72	99.08	C
29.	Coriander Powder/ Dhoniyar Gura	7300	200	1460000	0.48	99.57	C
30.	Korpur (Camphor)	365	3600	1314000	0.43	100	C
	Total			302092210	100		

HML Analysis:
For the HML analysis, all grocery items with unit prices over BDT 1000 are classified as "H" items; those with unit prices between BDT 200 and BDT 660 are classified as "M" items; and those with unit prices below BDT 200 are classified as "L" items in this computation, as shown in Table 4.

Table 4: Analysis of 30 Grocery Items Using HML

Sl. No	Grocery Items	Annual Demand	Unit Price (BDT)	HML Category
1.	Korpur (Camphor)	365	3600	H
2.	Pasta	7300	1850	H
3.	Garam Masala	3650	1600	H
4.	Ghee	18250	1350	H
5.	Cashew Nut (Kaju Badam)	18250	1350	H
6.	Almonds (Kath Badam)	18250	1050	H
7.	Milk Powder	10950	660	M
8.	Golden Raisins / Kismis	36500	650	M
9.	Chili powder / Morich Gura	10950	590	M
10.	Turmeric Powder / Holud Gura	10950	470	M
11.	Instant Noodles	43800	320	M
12.	Mustard Oil	14600	255	M
13.	Coriander Powder / Dhoniyar Gura	7300	200	M
14.	Soyabean Oil	164250	190	L
15.	Mashkalai Dal	21900	180	L
16.	Mug Dal	36500	160	L
17.	Red Sugar	36500	150	L
18.	Corn Flour	36500	150	L
19.	Chinigura Rice	36500	134	L
20.	Lentil / Deshi Moshur Dal	164250	130	L
21.	White Sugar	146000	130	L
22.	Liquid Milk	32850	120	L
23.	Khesari Dal	18250	120	L
24.	Najir Shail Rice	45625	96	L
25.	Boot Dal / Anchor Dal	95812	80	L
26.	Miniket Rice	228125	78	L
27.	Maida/ Wheat Flour	54750	76	L
28.	Brown Amon Rice	54750	72	L
29.	Atta	73000	65	L
30.	Salt	164250	32	L

EOQ analysis:

Economic order quantity and optimum order frequency per year for different components are calculated by using the formula mentioned earlier.

Table 5: shows the EOQ analysis and computation phases

Sl. No	Grocery Items	Annual Demand	unit Price (BDT)	Carrying cost/unit	Order cost/order	EOQ	n	N (Round)
1	Soyabean Oil	164250	190	25	25000	18124.569	9.0622845	9
2	Ghee	18250	1350	10	300	1046.4225	17.440375	17
3	Cashew Nut (Kaju Badam)	18250	1350	25	1245	1348.2211	13.536356	14
4	Golden Raisins / Kismis	36500	650	20	20000	8544.0037	4.2720019	4
5	Lentil / Deshi Moshur Dal	164250	130	20	23500	19646.565	8.3602402	8
6	Almonds (Kath Badam)	18250	1050	20	6000	3309.0784	5.5151307	6
7	White Sugar	146000	130	25	15000	13236.314	11.030261	11
8	Miniket Rice	228125	78	20	9000	14328.73	15.920811	16
9	Instant Noodles	43800	320	10	5300	6813.8095	6.4281222	6
10	Pasta	7300	1850	12	8000	3119.8291	2.3398718	2
11	Boot Dal / Anchor Dal	95812	80	20	25000	15476.757	6.1907027	6

12	Milk Powder	10950	660	15	14000	4521.0618	2.4219974	2
13	Chili powder / Morich Gura	10950	590	15	15000	4679.7436	2.3398718	2
14	Mug Dal	36500	160	15	16000	8824.2091	4.136348	4
15	Garam Masala	3650	1600	18	6000	1559.9145	2.3398718	2
16	Red Sugar	36500	150	20	13500	7019.6154	5.1997151	5
17	Corn Flour	36500	150	8	8400	8754.9986	4.1690469	4
18	Salt	164250	32	10	4000	11462.984	14.32873	14
19	Turmeric Powder / Holud Gura	10950	470	10	7300	3998.3747	2.7386128	3
20	Chinigura Rice	36500	134	25	8400	4952.5751	7.3699034	7
21	Atta	73000	65	12	4300	7233.0261	10.092595	10
22	Najir Shail Rice	45625	96	12	9000	8272.6961	5.5151307	6
23	Maida/ Wheat Flour	54750	76	12	12000	10464.225	5.2321124	5
24	Brown Amon Rice	54750	72	10	7000	8754.9986	6.2535704	6
25	Liquid Milk	32850	120	10	10000	8105.5537	4.0527768	4
26	Mashkalai Dal	21900	180	20	14000	5537.1473	3.9551052	4
27	Mustard Oil	14600	255	12	6400	3946.3063	3.6996621	4
28	Khesari Dal	18250	120	12	7000	4614.2894	3.9551052	4
29	Coriander Powder / Dhoniyar Gura	7300	200	16	11000	3168.2014	2.3041465	2
30	Korpur (Camphor)	365	3600	12	1800	330.90784	1.1030261	1

Results and Discussion:

ABC Analysis:

From the ABC analysis of thirty grocery items shown in Table 3, "A"-class grocery items are those that capture 33.33% of total items, and the percentage of value usage is 69.19%. "B"-class grocery items are those that occupy 36.67% of the total items, and the percentage of value usage is 21.19%. "C"-class grocery items are those that capture 30% of total items, and the percentage of value usage is 9.62%. As per the collected information, the shop owner has not applied any inventory controls among the three categories of items; this shows a lack of inventory management technique. This analysis shows the level of inventory control that should be imposed on the different grocery items. ABC analysis results are shown in Table 6.

Table 6: Result of ABC Analysis

Types of items	No. of items	% Of items	Value Consumed (BDT)	% Of value usages
A	**10**	**33**	209017250	**69.19%**
B	**11**	**37**	64020960	**21.19%**
C	**9**	**30**	29054000	**9.62%**

Analysis of HML:

High, medium, and low (HML) analysis helps to categorize grocery products into three categories based on the unit price of the items. From Table 4 we found that among the selected 30 grocery items, 6 items are found in high unit price, 7 medium priced items, and 17 low priced items. This analysis shows 6 items whose unit price is high should be given high importance for stock checking and inventory management, 7 items whose unit prices are medium should be given average importance for stock checking and inventory management, and the other 13

items that are in 'L' category need fewer stock checking than the 'H' and 'M' category items. HML analysis results are shown in table no 7.

Table 7: Result of HML analysis

Classification of grocery items	No. of items	% Of items
H	6	20%
M	7	23.33%
L	17	56.67%

Economic Order Quantity (EOQ):

Total annual demands and economic order quantity (EOQ) of thirty grocery items were calculated in Table 5, where it is found that annual demand is fluctuating to a great extent from EOQ. But economic order quantity ensures maximum orders with a minimum carrying cost. It is found that the grocery shop is not using the EOQ model for managing inventory, and the inventory management of the grocery shop is not satisfactory. EOQ may help the grocery shop control overstock problems with a minimum order cost.

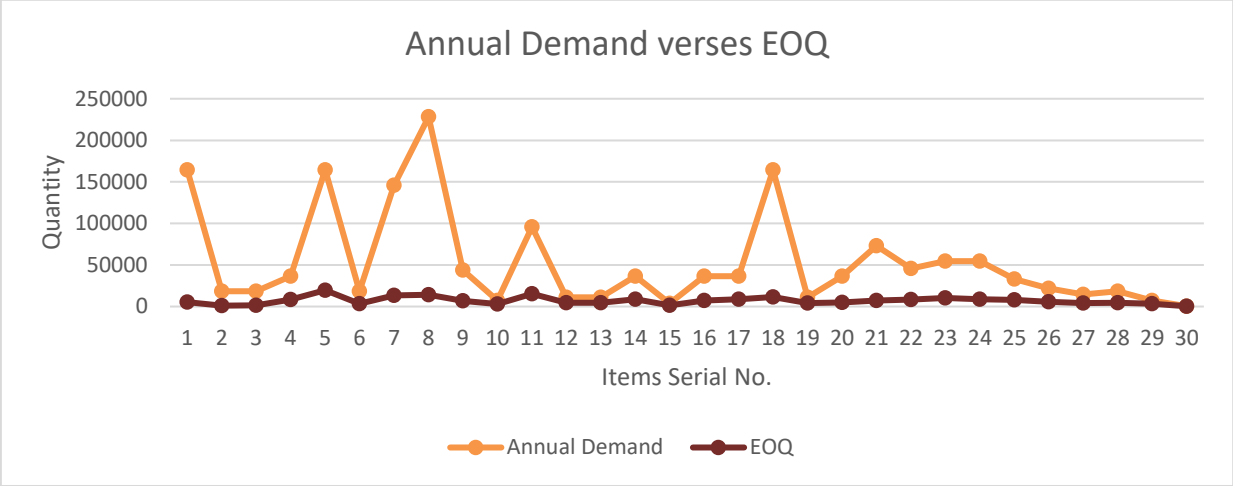

Figure 1: Comparison between EOQ & annual Order Quantity

Conclusion and Further Study:

Both of the competing goals of inventory management—to provide the greatest possible item availability while maintaining a low inventory cost—have presented grocery store managers with ongoing challenges, as emphasized during this research. There are no inventory management procedures used in the grocery store establishment. Requests are put in before using the EOQ approach or verifying that there is adequate inventory. The grocery store's inventory control method is inefficient, which leads to short supply, surplus stock, and unanticipated problems. This paper's study of several inventory management methods offers hope for a solution to these issues. Grocery shop owners in Khulna city manage their inventory based on their experience and face overstock and understock problems. To solve the problems and to increase revenue and profit margin they must use a proper inventory management technique in this competitive world for sustaining. For managing inventory connections, a variety of methods are available, including ABC, HML, EOQ, FSN, and VED analysis. Despite the fact that the literature has a variety of inventory management approaches, only three techniques—ABC, HML, and EOQ—have been examined in this study. To manage inventory, other methods can be utilized, such as VED evaluation. Proper forecasting is very necessary for inventory management, which can be found in the EOQ model. Further study may be needed to find the optimal inventory management technique.

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