Guideline for Reducing Total Inventory Cost by Finding the Economic Order Quantity A Case Study: Convenience Stores in Nakhon Pathom Province

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Abstract

This research is a guideline for reducing total inventory cost by finding the economic order quantity, case study of convenience stores in Nakhon Pathom province. This research aims to 1) to find the economic order quantity for product group A only. 2) to reduce the total inventory cost per year. The researcher used secondary data from the stores, which is data from January to December 2023, such as purchase information, sales information, expense information, salary information, product information, etc. This research has research methodology is 1) product grouping using ABC analysis theory, 2) finding the ordering cost, 3) finding the economic order quantity, 4) finding the total inventory cost. The results of the research found that 1) there are 945 products in total, 142 of which are product group A. The current order quantity for product group A is 29,440 units, and the order quantity for product group A by applying the EOQ theory is 23,890 units. Therefore, the order quantity exceeds the demand 5,550 units per year. 2) total inventory cost before using EOQ theory is 3,140,501 baht per year (3,234 units per purchase) and total inventory cost after using EOQ theory is 981,485 baht per year (1,250 units per purchase). Therefore, the guideline reducing total inventory cost by finding the economic order quantity, can reduce total inventory costs 2,159,016 baht per year, or 68.75 percent.

Keywords: cost reduction, economic order quantity, total inventory cost.

1. Introduction

Nowadays, doing business must adapt to the era of constant change and competition because the convenience stores business is important to life for consumption and use. The convenience stores in the provincial communities still do not have access to technology and software systems that are tools for managing inventory. Therefore, the convenience stores must always adapt in terms of technology that should be brought in to manage the business more conveniently and accurately.

The case study is a convenience store in Nakhon Pathom Province. The management of product ordering is based on the experience, expertise, and estimation of the employees. There is no use of technology to help run the business. The ordering of products for sale depends on

the store owner, with the employees reporting the number of products to be purchased each time. There is no criteria for calculating the appropriate amount of product ordering. Therefore, this research uses ABC Analysis to group the importance of all product items and uses the Economic Order Quantity (EOQ) theory to help reduce the total inventory cost.

1.1 Research Objective

1. To find the economic order quantity for product group A only.
2. To reduce the total inventory cost per year.

2. Methods

The calculation of Economic Order Quantity (EOQ) and Total Cost (TC) can be calculated as follows:

$$EOQ = \sqrt{\frac{2DS}{H}} \quad (1)$$

$$TC = \left[\frac{D}{Q}S + \frac{Q^*}{2}H\right] \quad (2)$$

EOQ = Economic Order Quantity (Q*)
D = Annual Order Quantity
S = Order Cost
H = Annual Holding Cost
Q = Order Quantity
TC = Total Inventory Cost

3. Results and Discussion

3.1 Product grouping using ABC analysis theory.

The results of the inventory grouping using ABC Analysis technique from the study found that there were 945 items in total, with a total product value throughout the year of 34,968,822 baht. The product grouping by purchase value using ABC Analysis, it was found that there were 142 items in Group A, or 50 percent of all items, with a total product value of 17,473,732 baht. There were 388 items in Group B, or 40 percent of all items, with a total product value of 13,983,180 baht. There were 415 items in Group C, or 10 percent of all items, with a total product value of 3,511,910 baht. Details are shown in Tab. 1

Table 1: Results of inventory grouping using ABC Analysis technique.

Group	Percentage of products	Number of items	Product value (baht)
A	50	142	17,473,732
B	40	388	13,983,180
C	10	415	3,511,910
Total		945	34,968,822

3.2 Finding the ordering cost.

The results of finding the cost of ordering products per time, the researcher used the data of the cost of ordering per time in the case study store from January to December 2023 to calculate the ordering cost equal to 617 baht per time. Details are shown in Tab. 2

Table 2: Ordering cost.

List	Annual Expenses (baht)
Procurement department wages	168,000
Warehouse department wages	195,000
Quality control department wages	159,000
Audit department wages	225,000
Communication expenses	21,576
Consumables expenses	3,831
Stationery expenses	2,080
Office equipment and maintenance expenses	13,700
Total expenses	788,187
Number of purchase orders (POs) per year	1,277
ordering cost	617

3.3 Finding the economic order quantity.

The results of finding the appropriate order quantity. The researcher took 142 items of Group A products of the case study store from January to December 2023 to calculate the appropriate order quantity. It was found that the order quantity throughout the year was 29,440 units and the order quantity for product group A by applying the EOQ theory is 23,890 units. Therefore, the order quantity exceeds the demand 5,550 units per year. Details are shown in Tab. 3

Table 3: Example of calculating the optimal order quantity (EOQ) for 142 products group A.

List	Product code	Demand (unit)	Ordering Cost (baht)	Holding Cost (baht)	Economic Order Quantity (unit)
		D	S	H	EOQ
1	DR-006	739	617	124	86
2	DR-001	779	617	104	97
3	DR-003	641	617	121	81
4	DR-002	749	617	104	95
5	DR-004	724	617	104	93
6	DR-007	719	617	102	94
7	BD-002	732	617	96	98
8	BD-003	736	617	93	100
9	BD-001	769	617	88	104
10	NC-001	694	617	97	95

3.4 Finding the total inventory cost.

The researcher used data 142 products of Group A products from January - December 2023 to calculate the total inventory cost. The results of the calculation of the total inventory cost before using EOQ theory was 3,140,501.0 baht, details as shown in Tab. 4

Table 4: Example of calculating the total inventory cost before using EOQ theory for 142 products group A.

List	Product code	Unit price (Baht)	Demand (unit)	Purchase quantity per time (units)	Ordering Cost (Baht)	Holding Cost (baht)	Total Inventory Cost (baht)
1	DR-006	540	735.0	21.0	21,720.2	2,049.3	23,769.5
2	DR-001	450	747.0	22.0	21,855.1	1,811.3	23,666.4
3	DR-003	528	710.0	18.0	21,979.8	1,760.9	23,740.7
4	DR-002	450	675.0	21.0	22,014.1	1,759.5	23,773.6
5	DR-004	450	681.0	21.0	21,279.3	1,707.8	22,987.1
6	DR-007	445	663.0	20.0	22,189.0	1,637.6	23,826.6
7	BD-002	416	674.0	21.0	21,514.4	1,578.7	23,093.2
8	BD-003	403	656.0	21.0	21,632.0	1,529.4	23,161.4
9	BD-001	383	611.0	22.0	21,574.6	1,541.6	23,116.1
10	NC-001	420	883.0	20.0	21,417.5	1,545.6	22,963.1
Total					3,051,347.4	89,153.6	3,140,501.0

The researcher used data 142 products of Group A products from January - December 2023 to calculate the total inventory cost. The results of the calculation of the total inventory cost after using EOQ theory was 981,485.0 baht, details as shown in Tab. 5

Table 5: Example of calculating the total inventory cost after using EOQ theory for 142 products group A.

List	Product code	Unit price (Baht)	Demand (unit)	Purchase quantity per time (units)	Ordering Cost (Baht)	Holding Cost (baht)	Total Inventory Cost (baht)
1	DR-006	540	735.0	86.0	5,303.8	5,340.6	10,644.4
2	DR-001	450	747.0	97.0	4,956.8	5,019.8	9,976.6
3	DR-003	528	710.0	81.0	4,884.4	4,918.3	9,802.7
4	DR-002	450	675.0	95.0	4,866.3	4,916.3	9,782.5
5	DR-004	450	681.0	93.0	4,805.0	4,812.8	9,617.8
6	DR-007	445	663.0	94.0	4,721.1	4,810.5	9,531.5
7	BD-002	416	674.0	98.0	4,610.2	4,688.3	9,298.6
8	BD-003	403	656.0	100.0	4,542.7	4,634.5	9,177.2
9	BD-001	383	611.0	104.0	4,563.9	4,580.7	9,144.5
10	NC-001	420	883.0	95.0	4,508.9	4,588.5	9,097.4
Total					490,033.5	491,451.5	981,485.0

The results of the comparison of the total inventory cost before and after Economic Order Quantity of the case study store. The researcher brought 142 items of Group A products from January - December 2023. It was found that total inventory cost before using EOQ theory is 3,140,501 baht per year and total inventory cost after using EOQ theory is 981,485 baht per year. Therefore, the guideline reducing total inventory cost by finding the economic order quantity, can reduce total inventory costs 2,159,016 baht per year, or 68.75 percent. Details are shown in Tab. 6

Table 6: Example of calculating the difference between before and after using EOQ theory.

List	Product code	Total Inventory Cost (baht)	
		Before using EOQ theory	After using EOQ theory
1	DR-00006	23769.48	10644.37
2	DR-00001	23666.37	9976.58
3	DR-00003	23740.69	9802.72
4	DR-00002	23773.60	9782.52

List	Product code	Total Inventory Cost (baht)	
		Before using EOQ theory	After using EOQ theory
5	DR-00004	22987.06	9617.76
6	DR-00007	23826.58	9531.51
7	BD-00002	23093.17	9298.56
8	BD-00003	23161.40	9177.22
9	BD-00001	23116.14	9144.53
10	NC-00001	22963.05	9097.44
Total		3,140,501.0	981,485.0
Difference		2,159,016.	

4. Conclusion

This research is a guideline for reducing total inventory cost by finding the economic order quantity, case study of convenience stores in Nakhon Pathom province. This research aims to 1) to find the economic order quantity for product group A only. 2) to reduce the total inventory cost per year. The researcher used secondary data from the stores, which is data from January to December 2023, such as purchase information, sales information, expense information, salary information, product information, etc. The results of the research found that

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