INVENTORY MANAGEMENT ACCORDING TO EOQ CONCEPT: A CASE OF TOZEN INDUSTRIAL CO., LTD

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ABSTRACT

The objective of this research was to analyze for the economic order quantity (EOQ) of rubber flexible coupling, which was the product with the highest annual demand, of Tozen Industrial Company Limited by using historical inventory data for 1 year. The group of informants consisted of 1) a factory manager, 2) a sales staff, 3) two warehouse staff, and 4) a purchasing staff. The research methods included 1) studying the existing inventory management information, and 2) analyzing for EOQ. After analyzing the rubber flexible coupling inventories for EOQ, it was found that the ordering cost, inventory carrying cost, EOQ, and the number of economic orders per year were 399 Baht/time, 4,322 Baht/unit/year, 10.99 unit/order, and 59.51 orders/year, respectively. The inventory costs of those in the existing inventory management environment were 175,355 Baht, while those under the EOQ condition were totally equal to 47,495 Baht, accounting for 72.91 percent cost reduction if such an EOQ concept was pursued.

Keywords: Inventory, Economic order quantity, Flexible coupling

INTRODUCTION

Thailand's economic growth is associated with growth in various sectors of industry. The construction and construction materials business group is an important industry group for the national economy. In 2021, investment in the construction sector expanded at a rate of 5.3 percent.[1] Some renowned products in this industry were pipes and connecting devices. [2]

Tozen Industrial Co., Ltd. is a manufacturer and distributor of industrial joints in various types, materials, and sizes. The company is located in Chachoengsao Province in Thailand. Its customers included both those who bought to use as materials for assembly or manufacture themselves from within and abroad, and those who purchased to maintain machines and tools. The company's best-selling products were flexible coupling products. The current material purchasing system was adjustable according to customer order quantities, which were conveyed from the sales department. This brought about uncertain purchasing planing as well as uncontrollable inventory cost.

The economic order quantity (EOQ) is a concept used to determine the order quantity that optimizes user's demand at the lowest inventory cost. It consists of 3 models. The most renowned model is the first one which has key assumptions of stable user's demand, constant unit cost, and one-time delivery.[3] [4] [5] The inventory cost, according to EOQ, is composed of two related costs: ordering cost and carrying cost. The ordering cost includes wages of purchasing and incoming goods inspection departments, cost of consumables, communication cost, stationery, office maintenance cost, and incoming transportation cost.

The carrying cost encompasses several expenses related to warehouse: investment, taxes, insurance, rent, inventory moving cost, cost of deteriorated products, loss, security and warehouse staff wages. EOQ of the first model can be calculated as the following formula. [4] [5]

$$\text{EOQ} = \sqrt{\frac{2DS}{H}}$$

where EOQ = Economic order quantity (or Q* in brief)
D = Annual demand
S = Ordering cost per time
H = Carring cost per unit per year
Q = Order Quantity per time

OBJECTIVE

To analyze for the economic order quantity (EOQ) of rubber flexible coupling at Tozen Industrial Company Limited.

METHODOLOGY

Key Informant Groups

1) The factory manager: to provide general information of the factory.
2) Sales Staff (1 person): to give information about sales amount and unit cost.
3) Warehouse Employee (2 persons): to inform the facts about carrying costs and general inventory management operations.
4) Purchasing Staff (1 person): to notify the purchased goods items and ordering costs

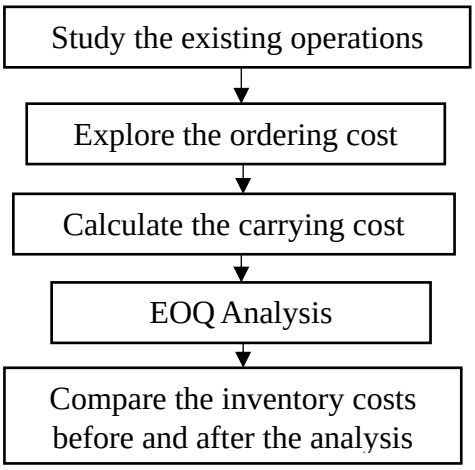
Research Instrument

Check Sheet

Research Procedures

1) Investigate the existing inventory management operations, historical ordering and sales data, and costs concerning ordering and warehousing by observing, interviewing the related informants, and studying from sales and ordering documents.
2) Analyze for the following values of the best-selling flexible coupling product item, TWINFLEX-S20-SCRE-THREAD-20A, using data from the past 1 year:
   a. Ordering cost including 1) wages of the purchasing and incoming goods inspection staff, 2) consumables, 3) communication, 4) stationery, 5) office maintenance, and 6) incoming transportation
   b. Carrying cost including 1) investment, 2) taxes, 3) insurance, 4) inventory moving cost, 5) cost of deteriorated products, 6) loss, and 7) security and warehouse staff wages (The warehouse belongs to the company owner, i.e., no rent applicable)
   c. EOQ
3) Compare the total inventory costs before and after the analysis.

Figure 1
Research Process



RESULTS

Results from investigating the existing inventory management operations

The historical sales information (between May 2023 – April 2024) of the best-selling product item "TWINFLEX-FCDE150P-200A" is shown in Table 1.

Table 1 Sales Information

Product Item	Unit Cost (Baht)	Annual Sales : D (Unit)
TWINFLEX-FCDE150P-200A	13,984	654

Results from analyzing the key values

A) Ordering Cost

The information for calculating the ordering cost was gathered. Because the total ordering cost was spent for overall product items, it should be discounted according to the amount of sales proportionately for using in this single product. After exploring the related information, it was found that the ratio between the TWINFLEX-FCDE150P-200A's sales and total sales is 0.1207 or 12.07%. Therefore, this percentage would be used in calculating the ordering cost and carrying cost. The ordering cost calculation sheet is shown in Table 2.

Table 2 Ordering Cost Calculation Sheet

Cost Item	Annual Cost (Baht)
1. Wages: 1 Ordering staff and 2 Incoming Goods Inspection Staff	648,000
2. Telephone and Internet Fee	32,364
3. Consumables	1,802
4. Stationery	300
5. Office Maintenance	18,450
Total Cost for Overall Product Items	**700,916**
No. of Overall Annual Purchase Order	**212 orders**
Overall Ordering Cost per order	**3,306.21**
Discounted Ordering Cost per order	**399**

B) Carrying Cost

The carrying cost of overall product items was calculated; then it was discounted for that of the TWINFLEX-FCDE150P-200A item proportionately in the similar procedures as those of the ordering cost calculation. The results are illustrated in Table 3.

Table 3 Carrying Cost Calculation Sheet

Cost Item	Annual Cost (Baht)
1. Depreciation	59,951
2. Taxes	26,000
3. Insurance	19,500
4. Inventory Moving Cost	16,500
5. Cost of Deteriorated Products	24,550
6. Loss	17,400
7. Wages	588,000
Total Cost for Overall Product Items	**751,901**
Discounted Carrying Cost	**90,754**
Average Inventory Level	**21 units**
Discounted Annual Carrying Cost per unit	**4,322**

C) EOQ

The results of EOQ analysis are shown in Table 4. The EOQ value was equal to 10.99, which implies that every order should be processed at 10.99 units at a time for the minimum inventory cost. The number of orders per year was 59.51 consequently.

Table 4 EOQ Calculation

Product Item	Unit Cost (Baht)	Annual Demand (Unit) (D)	Ordering Cost (Baht/order) (S)	Carrying Cost (Baht/Unit) (H)	Economic Order Quantity (EOQ)	No. of order per year (D/EOQ)
TWINFLEX-FCDE150P-200A	13,984	654	399	4,322	10.99	59.51

Results from comparing the total inventory cost

The results are depicted in Table 5. By pursuing EOQ concept, the annual inventory cost could be reduced by 72.91%.

Table 5 Inventory Cost Comparison

Product Item	Existing Operations (Baht/year)			EOQ Concept (Baht/year)		
	Annual Ordering Cost	Annual Carrying Cost	Total Inventory Cost	Annual Ordering Cost	Annual Carrying Cost	Total Inventory Cost
TWINFLEX-FCDE150P-200A	84,600	90,754	175,355	23,747	23,747	47,495
Cost Reduction	127,860 (or 72.91%)					

CONCLUSION AND FUTURE WORK

This study aimed to analyze for EOQ of rubber flexible coupling at Tozen Industrial Co., Ltd. From analysis, it was found that the ordering cost and carrying cost were 399 Baht/order and 4,322 Baht/unit respectively. EOQ had a value equal to 10.99 units, which suggested that total inventory cost would be optimized if the company ordered this product about 11 units/order equally every time. The results highlighted that total inventory cost could be decreased by 72.91% if following the application of EOQ concept.

The future research should be conducted as the following suggestions.

1) Apart from the EOQ concept, the future research should adopt the production forecasting concepts to be incorporated into the research process.
2) The study should be done with the other product items, in which the normal ordering or usage pattern of the products should be considered. The decision should be based on which EOQ model (i.e., 1st, 2nd, or 3th) would be the most appropriate.

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