APPLICATION OF THE ECONOMIC ORDER QUANTITY METHOD TO OPTIMIZE SUPPLY CHAIN MANAGEMENT IN CONTROLLING PRODUCT INVENTORIES

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Abstract

Toko Sri Bunga is an electronic store that obtains products from various suppliers then sells and delivers these products to consumers. The existing supplier and consumer management processes are conventional. This raises several problems related to product inventory, determination of minimal product stock, and high inventory costs. The purpose of this research is to optimize supply chain management (SCM) in inventory control at Sri Bunga shops using the Economic Order Quantity (EOQ) method. This method is used to obtain the most optimal calculation of the number of orders, inventory and storage costs. The results of this study based on the calculation of the EOQ method on one sample of LG 24 TL 520V-PT TV products for 6 months obtained optimal results for ordering 36 product units with a total inventory cost of IDR 1,014,935. The results of this study can be used as a reference for the development of SCM applications used in supplier and consumer management.

Keywords : EOQ, SCM, Sales, Inventory, Software.

INTRODUCTION

The development of an industry is inseparable from its ability to always maintain the effectiveness and efficiency of the business processes carried out including sales and inventory activities [1]. Inventory of goods plays an important role in the process of buying and selling activities in the company, [2]. Therefore, to overcome these problems, companies need to implement an appropriate management strategy [3] and inventory control is a system used by companies as a report for top management [4] . inventory is an important thing in the company, because it is a valuable asset that requires inventory control in order to minimize storage costs and also expedite the production and distribution process [5].

Sales is a thorough work aimed at developing plans aimed at meeting the needs and desires of buyers to generate sales profits [6]. Sales is a business or concrete step taken to move a product, whether it is goods or services, from producers to consumers as the target [7].

Supply chain management is a method used to achieve more efficient integration of suppliers, manufacturers, distributors, retailers and customers [8]. Supply chain management is an increasingly important concept in the era of free trade and globalization. In that era, competition was no longer product against product or company against company but rather supply chain against supply chain [9]. In implementing Supply Chain Management, a method is needed that can provide functions as expected, [10] therefore this research applies the EOQ method related to handling stock items, especially increasing the efficiency of inventory costs issued by the company [11] . This method was developed to minimize inventory costs because with an optimal number of orders, excess inventory capacity does not occur. So that inventory costs which include ordering and storage costs will be minimized [12]. The use of the EOQ method aims to analyze inventory control of TV LG 24 TL 520V-PT from January to June`[13].

Sri Bunga Toko Elektronik also orders stock items manually from distributors by looking at items that are empty/sold and then placing an order in an amount deemed sufficient by the shop owner. This is of course less effective and certainly has a less than optimal percentage of sales. Related to stock control, demand uncertainty and product supply processes that are not effective and efficient cause product stocks to run out. This caused Sri Bunga Toko Elektronik to suffer losses due to buildup and product damage. Therefore we need a tool to make it easier for Sri Bunga Toko Elektronik to report the optimal number of orders so that they can control inventory at Sri Bunga Toko Elektronik.

Based on the explanation above, the authors want to conduct research on the topic: Application of the Economic Order Quantity Method for Optimizing Supply Chain Management in Product Inventory Control.

RESEARCH METHODS

The research method used is the Research & Development research method used to test the effectiveness of a product.

This research starts from determining the problem, namely product stock control at the Sri Bunga Electronic Store which is located at Jl. Soekarno-Hatta No.8, Limo Kaum, Tanah Datar Regency.

This research began in April 2022 with the Research & Development research method. After all the data is obtained, an analysis is carried out to find a solution. From the problem formulation obtained, then the analysis results obtained are made to design a system that fits the needs of the existing problem.

After the analysis and design are complete, it will proceed to the implementation process and proceed to the testing stage of the system that has been made, whether it is as expected or not.

DATA COLLECTION

The following data were used in this study.

1. Product Order Data

The following is product purchase data 6 months ago, from April 2022 to September 2022.

NO	Month	Many Orders
1	January	10 Units
2	February	20 Units
3	March	15 Units
4	April	35 Units
5	May	40 Units
6	June	45 Units

Source: Sri Bunga Elektronik

Table 1. Product Order Data for LG 24 TL 520V-PT

2. Enter variable data

The following is the input data used to calculate the EOQ method.

Input Variables	Mark	Information
Telephone Fees	IDR 60,000	6 Times Order
Shipping costs	IDR 600,000	6 Times Order
Electricity cost	IDR 3,600,000	6 months
Maintenance costs	IDR 1,080,000	6 months

Source: Sri Bunga Elektronik

Table 2. Determination of Input Value

PROCESS ANALYSIS

In the EOQ process the author has several input and output variables. Input and output variables at Sri Bunga Toko Elektronik which can be defined in the following table:

Function	Variable	Information
Inputs	Telephone Fees	This is the input variable
	Shipping costs	This is the input variable
	Electricity cost	This is the input variable
	Warehouse Maintenance Costs	This is the input variable
Output	Quantity Yield	Is an output variable that will later display the results of the EOQ process

Table 3. SPK EOQ method variables

Manual Calculation

At this stage the data that has been obtained will be analyzed using the Economic Order Quantity method to find out the optimal amount of stock for purchasing products in the future. Where the formula used is:

$$EOQ = \sqrt{\frac{2*D*Co}{Ch}}$$

Where:
EOQ: Optimum quantity
D: Request

Co: Order fee

Ch : Storage fee

1. Determine the value of each variable, the input values are in table 3
2. Calculation process

The following is the formula and calculation process for the following stages:

Inventory Cost Formula

$$\frac{D}{Q}C_o + \frac{Q}{2}C_h$$

Information :

D = Annual Demand (D)

Co = Order Cost (Co)/Order Cost per order

Ch = Cost of storage (Ch) / Cost of transportation / storage per unit

Q = Quantity ordered (Q)

EOQ = The optimal number of units ordered

A. Finding Value D = Total Products Purchased = 165 Units

B. Find Co Value = (Telephone Cost + Shipping Fee) / Purchase Order Amount = (Rp 60,000 + Rp 600,000) / 6 = Rp 110,000

C. Find the value of Ch = (Electricity Cost + Pet Cost) / Order Amount

Find the value of Ch = (Rp. 3,600,000 + Rp. 1,080,000) / 165 = Rp. 28,363.63

D. Average Supply (Q/2) = 10 / 2 = 5

e. Total Storage Cost ((Q/2)* Ch) = 5 * 28,363.63 = 141,818.18

F. Order Size (D/Q) = 165 / 10 = 16.50

G. Total Order Cost ((D/Q)*Co) = 16.50 * 110000 = 1,815,000

H. Total Fees (Total Order Fees + Total Storage Fees) = 1,815,000 + 141,815 = 1,956,818

The following is the calculation of the EOQ process using the table:

	Q	Average Inventory (Q/2)	Total Storage Fee ((Q/2)* Ch)	Order Size (D/Q)	Total Order Fee ((D/Q)*Co)	Total cost
Message 1	10	5	141,818.18	16.50	1,815,000	IDR 1,956,818
Order 2	20	10	283,636.36	8.25	907,500	IDR 1,191,136
Order 3	15	7.5	212,727.27	11.00	1,210,000	IDR 1,422,727
Order 4	35	17.5	496,363.63	4.71	518,571.43	IDR 1,014,935
Order 5	40	20	567,272.72	4.13	453,750	IDR 1,021,023
Order 6	45	22.5	638,181.81	3.67	403,333.33	IDR 1,041,515

Table 4. EOQ Process with Tables

From the results of the process above, it can be seen that the EOQ formula and process are as follows:

$$EOQ = \sqrt{\frac{2*D*Co}{Ch}} = \sqrt{\frac{2*165*110000}{28364}} = 35.77$$

By using the EOQ method, it is known that the optimal order for TV 24 TL 520V-PT products is 36 items, with a total inventory cost of IDR 1,014,935.

DESIGN

System design uses use case diagrams that describe the modeling of the system description to be made. The use case diagram describes the interaction between one or more actors and the system being created.

UML is a very reliable tool in the world of object-oriented system development [14]. This is because UML provides a visual modeling language that allows system developers to create a blueprint for their vision in a standard

form, easy to understand and equipped with an effective mechanism [15].

Use Case Diagram is a modeling to describe an interaction between one or more actors with the information system to be created [16]. Use Case Diagram is something or process that represents things that can be done by an actor in completing a job [17].
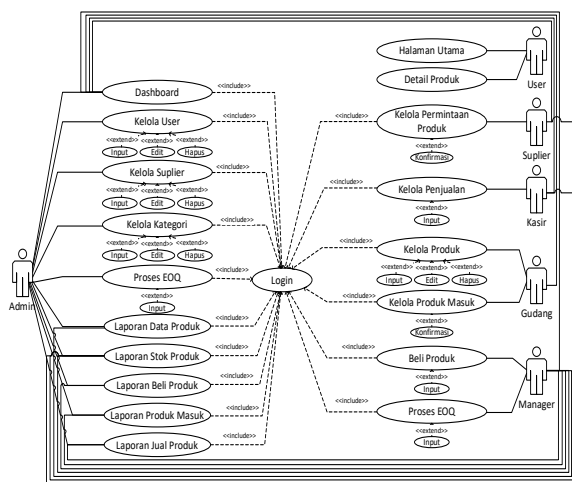

Figure 1. Use case diagram

In the use case diagram there are 6 users who can interact with the system. Admins, managers, suppliers, cashiers, warehouses and users can perform activities in the system to operate the system.

SYSTEM IMPLEMENTATION

The following is the result of the implementation of the supply chain management (SCM) program design at Toko Sri Bunga.

a. Login Form

This page is used to perform login access so that users can access the work page.

Figure 2. Registration Form

b. Administrator

The admin main page can be seen after logging into the system.
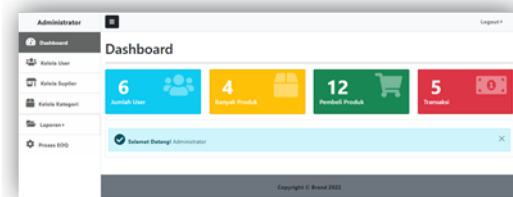

Figure 3. Dashboard Page Display

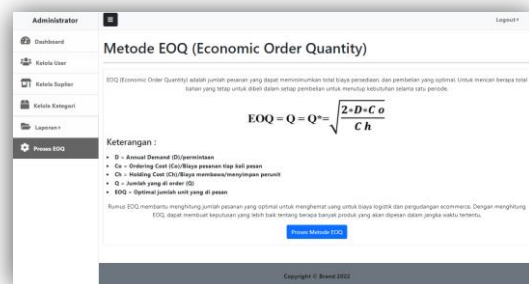c. EOQ process

This page is an overview of the EOQ process.

Figure 4. EOQ Process Page

d. Manage Supplier Data

This page is a supplier management page.

Figure 5. Supplier Data Management Page

CONCLUSION

With the SCM system at the Sri Bunga Elektronik Store, one can make and view sales, product inventory at the Sri Bunga Elektronik Store. Application of the Economic Order Quantity method at Sri Bunga Elektronik stores by looking at inventory data and minimizing storage costs and inventory ordering costs so that the order frequency can be determined for one period, so that product demand can be fulfilled optimally. The amount of inventory costs incurred using the Economic Order Quantity method with the most optimal total cost value is IDR 1,014,935 . The way to determine the optimal order stock from the data that has been obtained is the number of requests (D) for 6 months of 165 units, with an order cost (CO) value of Rp. 110,000 and a holding cost (CH) of Rp. 28,363. then performed calculations using the EOQ formula and obtained optimal stock ordering results, namely 36 units.

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