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Vol. x, No. x, April 2024, pp. x-x p-ISSN: 2614-8897
DOI: 10.33387/jiko e-ISSN: 2656-1948

DECISION SUPPORT SYSTEM FOR OPTIMIZING FINISHED GOODS INVENTORY AT PT. HESED INDONESIA USING THE EOQ (ECONOMIC ORDER QUANTITY) METHOD

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(Received: dd mmm yyyy, Revised: dd mmm yyyy, Accepted: dd mmm yyyy)

Abstract

This study aims to design and implement a Decision Support System (DSS) to optimize the management of finished goods inventory at PT. Hesed Indonesia using the Economic Order Quantity (EOQ) method. In the manufacturing industry, one of the main challenges in the supply chain is maintaining the availability of finished goods at optimal levels to avoid overstocking which results in excessive storage costs and understocking, which can impede distribution processes. To address this challenge, the EOQ method is employed for its effectiveness in determining optimal order quantities, annual demand, and per-unit storage costs. This research adopts a case study approach with a quantitative methodology. The data collected includes annual demand for finished goods, ordering costs, and storage costs provided by the company. The processed data using the EOQ formula serves as the basis for developing a system capable of generating recommendations for optimal order quantities and ordering frequencies. The DSS is designed to deliver timely and accurate information to assist managerial decision-making regarding inventory control. The results demonstrate that the implementation of the EOQ-based DSS significantly reduces total inventory costs and enhances the company's operational efficiency. Moreover, the system facilitates data-driven decision-making and minimizes subjectivity in inventory management. With the implementation of this system, PT. Hesed Indonesia is expected to manage its finished goods inventory more effectively and adaptively in response to market demand fluctuations.

Keywords: *Decision Support System, EOQ, Finished Goods Inventory, Inventory Management, PT. Hesed Indonesia*

1. INTRODUCTION

Finished goods inventory management is one of the important elements in the world of manufacturing industry. The timely availability of goods can affect the smooth distribution process and the level of customer satisfaction [1]. If the amount of inventory is not managed optimally, two adverse possibilities will arise, namely overstock which causes an increase in storage costs, or stock shortages (stockouts) which can hinder the fulfillment of market demand [2]. Therefore, companies need appropriate and systematic methods in managing inventory to be efficient and effective.

Inventory or inventory is an asset in the form of goods stored by the Company to support the production, distribution and sales processes. Inventory includes raw materials to finished products, and serves an important function in maintaining operational continuity and meeting consumer needs [3]. PT Hesed Indonesia, as one of the manufacturing companies engaged in production, faces challenges in optimizing the management of finished goods inventory. To answer these challenges, the EOQ method can be the right solution. EOQ is an economical ordering quantity calculation method to minimize total inventory costs, including ordering costs and storage costs [4].

As technology develops, the need for a system that can help make decisions quickly and accurately becomes increasingly important. *Decision Support System* (*DSS*) is a reliable tool in the planning and strategic decision-making process related to inventory. By integrating the EOQ method into SPK, companies can automatically obtain optimal order quantity recommendations, so that inventory management

becomes more efficient, operational costs can be reduced, and service to customers increases [5].

The purpose of this research is to develop a decision support system that can calculate the need for the amount and frequency of ordering raw materials using the EOQ and POQ methods, and determine the most optimal method based on minimizing inventory costs [6]. The results of this study are expected to contribute as a basis for consideration for the Company in determining the right policies related to controlling raw material inventory [7].

2. RESEARCH METHOD

The main problem faced by PT Hesed Indonesia is that there is no structured and automated system to determine the optimal amount of inventory. This often leads to excess or shortage of stock which has a direct impact on the operational efficiency and logistics costs of the Company [8].

To formulate this problem mathematically, the Economic Order Quantity (EOQ) method approach is used. EOQ is a classic method in inventory management used to determine the most economical order quantity so that the total cost of inventory can be minimized. In this method, there are several variables and parameters that are used as the basis for calculation, including:

- D = Total demand for goods per year (in units)
- S = Ordering cost per order
- H = Storage cost per unit per year
- Q = Amount of optimal order quantity (EOQ)

The mathematical formula for calculating the EOQ value is as follows:

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

The formula is used to determine how many items should be ordered each time the company places an order, so that the total cost consisting of ordering costs and storage costs can be kept as low as possible (Andiana & Pawitan, 2018) .

After the optimal number of orders (EOQ) is obtained, the system can also calculate the number of ordering cycles per year with the formula:

$$N = \frac{D}{EOQ}$$

And the time between orders (cycle time) in days can be calculated by:

$$T = \frac{Tahun}{N}$$

Where one year is usually assumed to be 360 working days (depending on company policy).

This research method uses a quantitative approach with a descriptive-applicative research type. Data collection is done through direct observation of the inventory management process, interviews with warehouse staff, and documentation of historical data on ordering and using finished goods at PT Hesed Indonesia.

The Decision Support System is developed using software that is capable of performing EOQ calculations automatically. System inputs include annual demand data, ordering costs, and storage costs per unit. The resulting output is a recommendation for the optimal order quantity, order frequency, and time between orders. In addition, the system is also equipped with a simple user interface for easy use by non-technical staff.

With this method, the company is expected to obtain a system that not only facilitates the decision-making process in inventory management, but also directly contributes to logistics cost efficiency and improved operational performance.

3. TABLE AND FIGURE

This section describes the research results and discussions related to the implementation of the designed system. The absence of a policy regarding the maximum limit of raw material inventory also has an impact on the suboptimal utilization of storage space and causes an increase in total inventory costs [9]. Through needs analysis and a structured approach, this application is expected to provide an efficient solution in managing inventory data at PT Hesed Indonesia. The following are the stages of implementation and in-depth discussion of the workflow and benefits of the system being developed.

3.1 Needs Analysis

The first step in system development is to analyze the needs to understand the business processes that occur at PT Hesed Indonesia related to the management of finished goods inventory. Based on the results of observations and interviews with the warehouse and managerial staff, it is known that the existing inventory management system is still done manually using Microsoft excel. This causes less than optimal ordering decisions because they are not based on precise mathematical calculations such as the EOQ method. In addition, manual recording also results in the accumulation of documents, which hampers the data search process because it takes longer [10]. Therefore, the system needed is a system that is able to provide optimal order quantity recommendations automatically and accurately.

3.2 Data Collection

The data that needs to be collected are:

a. Goods demand data per year (D)
b. Ordering costs per transaction (S),
c. Storage costs per unit per year (H).

The data is collected from internal company documents such as order reports and warehouse costs. This data is the main parameter in the EOQ calculation for each finished goods item managed by the company.

3.3 System Design

This system is designed to increase the efficiency of the amount of costs incurred to meet ordering or order quantity needs by optimizing workflows that previously used manual methods. The process begins

with the admin inputting data into the system such as annual demand data, ordering costs per transaction, and storage costs per unit per year. After entering the data the system will be able to automatically calculate the EOQ results. If the admin wants to enter a large amount of data at once the system already has excel with a customized template. With this workflow, the calculation process that previously used manual methods and took longer is now more structured and efficient.

3.4 Implementation

The system that has been designed is then implemented in the form of a web application using the php programming language. The system interface allows users to enter requirement data, and the system automatically displays the results of EOQ calculations and ordering recommendations. The system is tested locally in the warehouse environment using real data from the company.

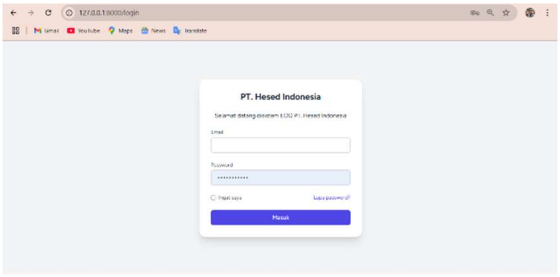

Figure 1. Login page menu

The EOQ system for PT Hesed Indonesia has been successfully built and run in a local web environment using the address 127.0.0.1:8000/login. The following figure shows the appearance of the system login page which is the entrance for registered users to access the features of the decision support system.

The figure shows the login interface which is designed in a simple and responsive manner. At the top is the company name "PT Hesed Indonesia", followed by the welcome message "Welcome to PT Hesed Indonesia's EOQ system" as an affirmation of the application context. The login form consists of two main inputs, namely *Email* and *Password*, as well as additional features "Remember me" and "Forgot password?" links for user convenience.

After the user enters valid credentials and presses the "Login" button, the system verifies the login information and directs the user to the main page to access the EOQ calculation menu, data input, and reports. This process ensures that only authorized users can use the system, in line with information security principles.

The implementation of this login page is an important part of the system, because it serves as an access authorization filter, while providing a professional and easy-to-use initial experience for warehouse staff and management involved in inventory management.

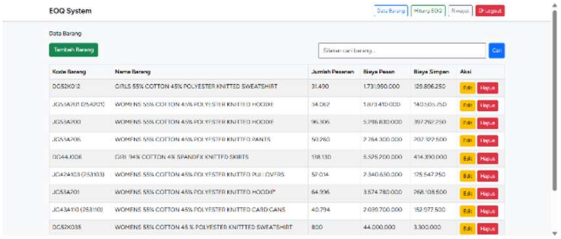

Figure 2. Item data and item input

In addition to the login page, the EOQ system that has been built also provides a main page that displays item data. The figure shows the interface of the *"Item Data"* page, which is the section that displays all information on inventory items that will be calculated for the optimal order quantity using the EOQ method.

On this page, users can view a list of goods in the form of a table consisting of several columns, including:

a. Item Code: a unique code for product identification,
b. Item Name: complete product description,
c. Order Quantity: total product demand per year,
d. Order Cost: the cost of each order,
e. Storage Cost: estimated storage cost per unit per year.

At the top of the page, there is an "Add Item" button to enter new data, as well as a search feature with input fields and a "Search" button to facilitate users in searching for specific items.

Each row of item data is equipped with two action buttons, namely the "Edit" button (in yellow) which is used to update item data, and the "Delete" button (in red) to remove items from the list. The system design is responsive and easy to use by non-technical users such as warehouse staff or production planning.

Through this page, all data needed for the EOQ calculation process can be inputted and managed quickly and efficiently. This data will be the main input to the EOQ calculation process and displayed in the recommendation results in other parts of the system.

3.5 Testing And Trial

In addition, the EOQ calculation results from the system were validated with manual calculations to ensure accuracy. The test results show that the system can provide recommendations for ordering quantities that are more optimal than the previous approach, and can reduce the number of inefficient orders.

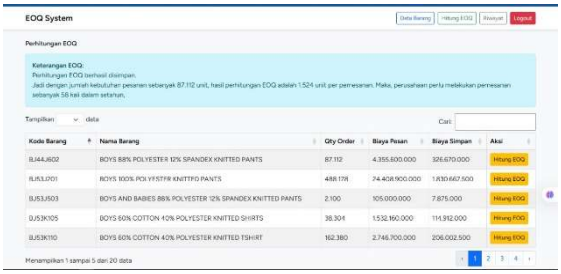

Figure 3. EOQ Calculation

In the testing phase, the system is tested to ensure the EOQ calculation functionality runs well according to the given parameters. The figure displays the *EOQ Calculation* page which is the core part of the decision support system. On this page, users can see the calculation results directly based on input data in the form of annual demand, ordering costs, and storage costs.

The system displays a notification in the form of an EOQ statement in the form of a narrative sentence explaining the calculation results. For example in the figure, if the total annual requirement is 87,112 units, then the EOQ calculation results show that the optimal quantity of orders is 1,524 units per order. The system also automatically calculates the number of ordering cycles required, in this case 58 times a year. This information is very helpful in strategic decision-making because it combines the mathematical approach of EOQ with easy-to-understand visualizations.

In addition, the table below the notification area displays a complete list of items along with important attributes such as item code, item name, quantity needed (Qty Order), ordering cost, and storage cost. On each row of data, there is a "Calculate EOQ" button that allows users to perform individual calculations for each item.

Tests were conducted using actual data from the company and compared the results with manual calculations using the EOQ formula. The test results show that the system is able to provide accurate and consistent results with the calculation formula. In addition, the system provides operational convenience for users, because the calculation process that usually takes time can now be done with just one click.

Through this test, it can be concluded that the system works well, both in terms of calculation logic, user interface, and reliability in saving calculation results into the system. This shows that the system is ready to be used in an operational context within PT Hesed Indonesia.

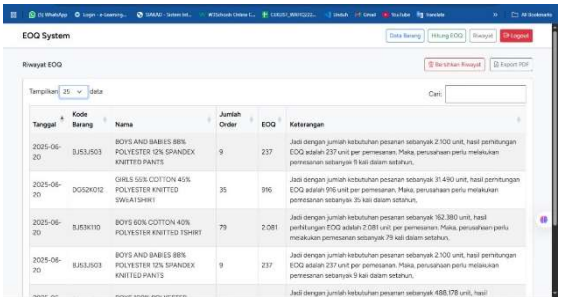

Figure 4. EOQ calculation result and its description

In addition to testing the EOQ input and calculation features directly, the system also provides an EOQ History page as a complementary feature that allows users to review all EOQ calculation results that have been performed. The following figure shows the appearance of the page which functions as an automatic log or archive of the finished goods ordering decision-making process.

This page displays a table containing columns Date, Item Code, Item Name, Order Quantity, EOQ, and Remarks. The "Description" column presents descriptive information that explains the results of the EOQ calculation and how many times the company should place an order in a year. For example, if the annual requirement is 2,100 units and the EOQ calculation result is 237 units, the system automatically calculates that the company needs to place an order 9 times a year.

This feature is very helpful in the context of **verifying test results** because it allows users to compare calculation histories between items quickly and systematically. In the trial, various combinations of data with varying demand values, ordering costs, and storage costs were inputted to test the consistency of the system calculations. All results were successfully saved and can be exported into PDF format via the Export PDF button, and can be cleaned manually with the Clear History feature.

From the results of this test it can be concluded that the system is not only able to perform EOQ calculations accurately, but also store the results in a structured manner. This is an added value in terms of audit trail and decision data security, because all processes carried out are well documented and can be reviewed at any time by authorized users.

3.6 Maintenance

After implementation and testing, the system enters the maintenance phase. Maintenance activities include minor bug fixes, adjustments to system parameters according to actual data changes, and feature enhancements based on user feedback. The system is flexible for further development, such as integration with the demand forecasting module or connection to the company's inventory system in real-time.

4. RESULT AND DISCUSSION

Based on the results of the research and implementation that has been carried out, it can be concluded that the application of the Decision Support System (SPK) with the Economic Order Quantity (EOQ) method is proven to make a real contribution to the management of finished goods inventory at PT Hesed Indonesia. This system is able to automatically calculate the most economical order quantity based on historical demand data, ordering costs, and relevant storage costs. The EOQ calculation results generated by the system show effectiveness in reducing total inventory costs and improving the efficiency of the decision-making process, compared to the manual method previously used by the company. In addition, the implementation of an application-based system also makes it easier for users to input, update, and monitor item data in a systematic and structured manner. With a simple interface and easy-to-understand features, this system not only improves the accuracy of calculations, but also speeds up the work process of warehouse staff in determining ordering policies. This research shows that combining a mathematical approach with an integrated information system can provide practical and applicable solutions for companies in facing the challenges of modern and efficient inventory management.

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