INSYTECH JOURNAL

Information System and Technology
JOURNAL
https://jurnal.umk.ac.id/index.php/insytech

The Application of EOQ Method, Safety Stock, and Reorder Point in Raw Material Management at PR Wido

Robby Adriansyah[1*], Fajar Nugraha[2], Eko Darmanto[3]

[1,2,3] Information System Study Program, Faculty of Engineering, Universitas Muria Kudus, Indonesia

Corresponding Author Email:201853033@std.umk.ac.id

https://doi.org/10.24176/insytech.v1i2.14509

Received: January 02, 2025
Revised: January 09, 2025
Accepted: January 13, 2025
Available online: February 01, 2025

Keywords:
Inventoty, Economic Order Quantity (EOQ), Safety Stock, Reorder Point

ABSTRACT

In the raw material inventory management process at PR Wido, no calculation method has been used. To decide on placing orders for upcoming raw materials, the owner only relies on estimates without any mathematical calculation of the stock quantity. This poses a risk of errors in forecasting the amount of raw material to purchase, which could result in stock shortages or excess stock. If a shortage occurs, the company may incur additional costs for urgent orders, and production could even be halted. On the other hand, if there is excess stock, the company would also have to bear extra costs for inventory storage. Therefore, the Economic Order Quantity (EOQ), Safety Stock, and Reorder Point methods are considered highly suitable for managing raw material stock. The EOQ method is used to determine the optimal order quantity with the lowest cost, the Safety Stock method is used to set the minimum stock level, and the Reorder Point method is used to determine when to reorder. This research employs the Prototype method. The analysis results are projected using UML (Unified Modeling Language) models and applied in a web-based application.

1. INTRODUCTION

Raw materials are one of the key elements that can impact the smoothness of the production process [1]. In the manufacturing industry, production activities are the most crucial. Any disruptions during the production process can affect the efficiency level of a company [2]. The company needs to manage its inventory efficiently to maintain stock in the most efficient way possible, ensuring the smooth operation of the company in terms of quantity, timing, and quality, while minimizing costs [3]. Good and efficient planning can help the company achieve profit. On the other hand, if the company conducts improper planning, it will lead to wasteful spending and increased costs [4].

The management of spare parts data at PT. Indako Trading Coy is still done manually by typing each spare part's data one by one, and searching for data takes a long time. Additionally, there is no system that predicts spare part stock. Common issues include stockouts and excess inventory. Therefore, a spare parts management system is created using the Reorder Point algorithm to ensure spare parts availability for customers and avoid overstocking in the warehouse [5].

PT. Abadi Jaya Manunggal memiliki banyak gudang untuk menyimpan suku cadang dan perlengkapan produksi. Pada pengelolaan data dan pencatatan persediaan masih manual, sehingga proses peenyusunan laporan menjadi lambat, sehingga mengakibatkan keterlambatan pihak manajemen dalam mengambil keputusan dan kesulitan membuat rencana pengadaan persediaan. Metode *Economic Order Quantity* (EOQ) dinilai mampu memperkirakan biaya pemesanan dan biaya penyimpanan untuk mengurangi belanja anggaran tahunan perusahaan serta dalam merencanakan pembelian bahan baku sehingga perusahaan bisa bekerja dengan lebih efisien dan efektif [6].

PT. Abadi Jaya Manunggal has multiple warehouses to store spare parts and production equipment. However, the inventory data management and record-keeping are still done manually, which results in slow reporting processes. This leads to delays in management's decision-making and difficulties in planning inventory procurement. The Economic Order Quantity (EOQ) method is considered capable of estimating ordering and holding costs to reduce the company's annual budget spending and aid in planning raw material purchases, enabling the company to operate more efficiently and effectively [7].

PT. Sinar Glassindo Jaya is a company engaged in the sales of Toto products. The company has not yet applied scientific calculations in inventory management, making it unable to predict the stock levels needed while waiting for new orders. Both excess and insufficient stock during the lead time can harm the company. Therefore, an appropriate solution to predict the available stock is by using the Economic Order Quantity (EOQ) method, which can help determine the Safety Stock for inventory protection and the Reorder Point to identify the optimal time to reorder [8].

The raw material procurement planning at Grand Kartika Gunungsitoli is based solely on stock purchase estimates, which results in uncertain raw material inventory levels in the warehouse. This often leads to emergency purchases from suppliers. This situation negatively impacts consumers due to stockouts caused by the warehouse department's failure to regularly check inventory, which can harm the company. The

Economic Order Quantity (EOQ) method is considered effective in addressing raw material inventory management issues, while Safety Stock determines the minimum stock levels that must be maintained, and the Reorder Point defines the optimal time to reorder raw materials [9].

This research is conducted to calculate EOQ, Safety Stock, and Reorder Point for the raw material usage at PR Wido. The company is capable of producing more than 50,000 cigarette sticks daily, which consist of clove cigarettes and filter cigarettes. This level of production consumes an average of 8,000 kg of tobacco and 6,000 kg of cloves every month. Common issues include frequent raw material shortages or excess stock. By implementing these scientific calculation methods, it is hoped that the company can improve raw material management, determine the safe stock levels, and decide when to reorder raw materials.

2. RESEARCH METHODOLOGY

A. System Development Method

The Prototype method is a software development approach that allows interaction between the system developers and the system users, thus addressing any discrepancies between the developers and the users [10]. Here are the stages of the system development method used in this research.

1. Communication
   The initial stage to identify problems and gather information.
2. Planning
   This stage involves determining resources, system requirements specifications, and the system's objectives.
3. Modelling
   This stage describes the model of the system to be developed.
4. Construction
   This stage involves building the prototype and testing the developed system.
5. Delivery
   This stage focuses on obtaining feedback from users, which will be used as evaluation results.

B. System Design Method

The approach used in designing the system being built utilizes UML. UML (Unified Modeling Language) is a language that uses graphics to describe, explain, build, and document software development systems based on an object-oriented approach.

UML is chosen not just as a visual programming language, but because it can be directly linked to various programming languages. Additionally, it helps avoid ambiguity by limiting the use of excessive terminology and irrelevant details, which could lead to misunderstandings [11].

C. Raw Material Supplies

It serves as a storage place for materials that will be processed into finished products or goods. Raw material inventory is also considered a resource owned by the company to evaluate how effectively the company operates. The company needs to store and manage raw materials efficiently so that the production process can run smoothly without any obstacles [12].

D. *Economic Order Quantity* (EOQ)

It is a mechanism that can be utilized by a company concerning inventory, which is beneficial for maximizing stock in terms of both cost and inventory quantity [13]. To calculate EOQ, you can refer to equation 1.

$$EOQ = \sqrt{\frac{2 \times S \times D}{H}} \quad (1)$$

Explanation:
EOQ : *Economic Order Quantity*
S : Ordering cost
D : Total demand
H : Holding cost

E. *Safety Stock* (SS)

In the current situation, companies often face fluctuations in demand. To address inconsistent demand, companies typically maintain a certain level of stock as a reserve, known as safety stock [14]. To calculate Safety Stock, you can refer to equation 2.

$$SS = Z \times SD \quad (2)$$

Explanation:
SS : *Safety Stock*
Z : Standart normal deviation
SD : Standart deviation

Meanwhile, to find the standard deviation value, you can look at equation 3.

$$SD = \sqrt{\frac{\sum(x - y)^2}{n}} \quad (3)$$

Explanation:
SD : Standart deviation
x : Use of raw materials
y : Estimated raw material usage
n : Amount of data

F. *Reorder Point* (ROP)

It refers to the point at which inventory reaches a certain level, triggering the need to place an order [15]. To calculate the Reorder Point, refer to equation 4.

$$ROP = (U \times L) \times SS \quad (4)$$

Explanation:
ROP : *Reorder Point*
U : Number of uses per day
L : Lead time
SS : *Safety Stock*

3. RESULT AND DISCUSSION

A. Analysis

This stage begins with collecting data, which can be obtained through observation and interviews. Observation is carried out by directly observing the business processes at PR Wido. The data collected includes supplier data, raw material stock data, raw material usage data, and raw material purchase data. Interviews are conducted through direct question-and-answer sessions with the company owner regarding raw material management. In addition, a literature review is also conducted in this research by searching for reference sources from books, journals, literature, and other sources related to this research. The analysis results show that the owner only estimates raw material stock management. This is certainly very risky because there may be forecasting errors, leading to either excess or insufficient raw material stock.

B. Planning

1. Business Use Case Diagram

Figure 1 represents the depiction of the business process flow for raw material management that occurs at PR Wido.

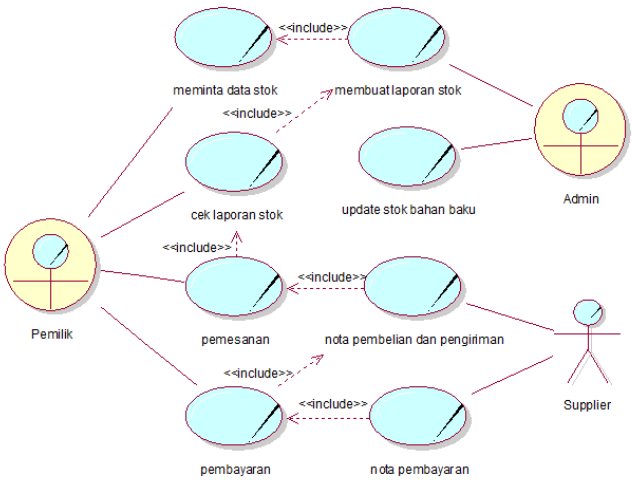

Figure 1. Business Use Case Diagram of The Application of EOQ Method, Safety Stock, and Reorder Point in Raw Material Management at PR Wido.

2. System Use Case Diagram

The actors involved in the system and the activities performed within the system are depicted through the system's use case. This can be seen in Figure 2.

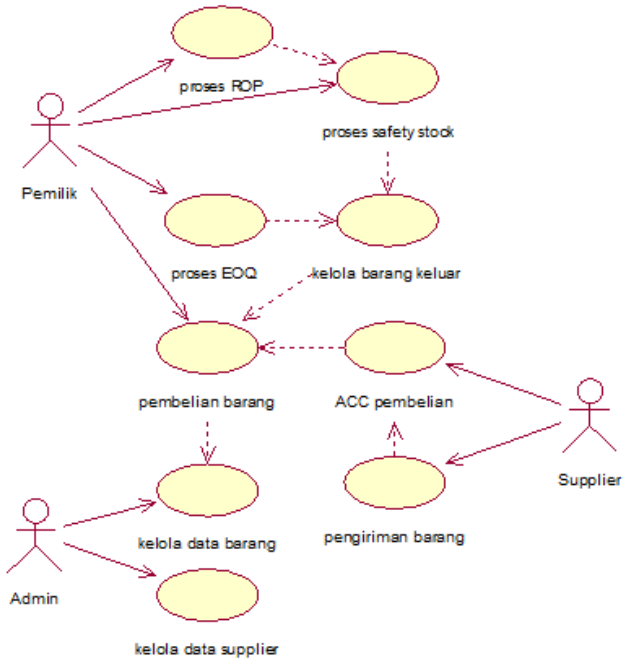

Figure 2. System Use Case Diagram of The Application of EOQ Method, Safety Stock, and Reorder Point in Raw Material Management at PR Wido.

3. Class Diagram

The interaction between the classes within the system is depicted through the class diagram. This can be seen in Figure 3.

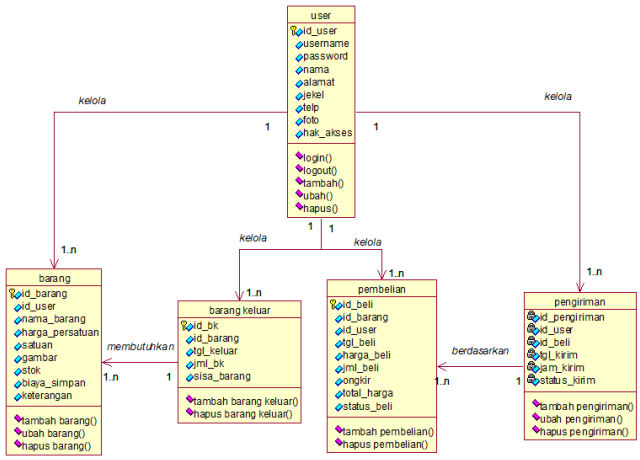

Figure 3. Class Diagram of The Application of EOQ Method, Safety Stock, and Reorder Point in Raw Material Management at PR Wido.

4. Table Relation

The result of the database design forms a relationship between tables. This can be seen in Figure 4.

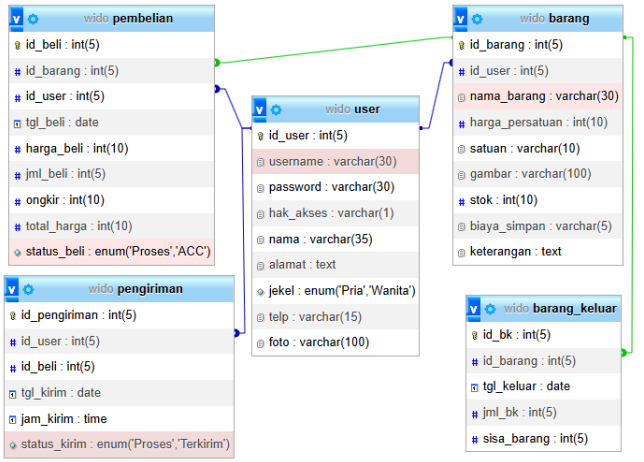

Figure 4. Table Relation of The Application of EOQ Method, Safety Stock, and Reorder Point in Raw Material Management at PR Wido.

C. Implementation

1. Purchase Page

In the purchase page, the owner can add, edit, and delete purchase data. The owner can make a purchase by selecting "Add New Data" and then filling in the purchase details. The data used includes item details, item price, quantity purchased, shipping cost, and total payment. This can be seen in Figure 5.

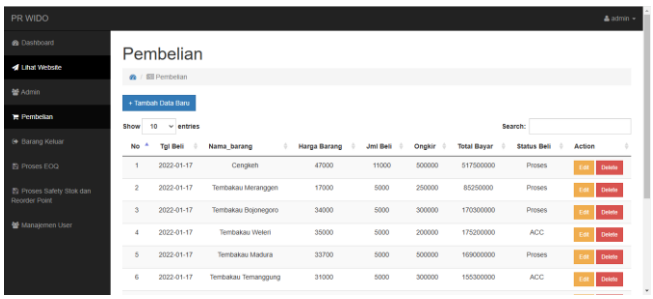

Figure 5. Purchase Page.

2. Goods Out Page

On the goods out page, the owner can add, edit, and delete goods-out data. The owner can manage the goods-out data by selecting "Add New Data." The data used includes item details, quantity used, and remaining stock. This can be seen in Figure 6.

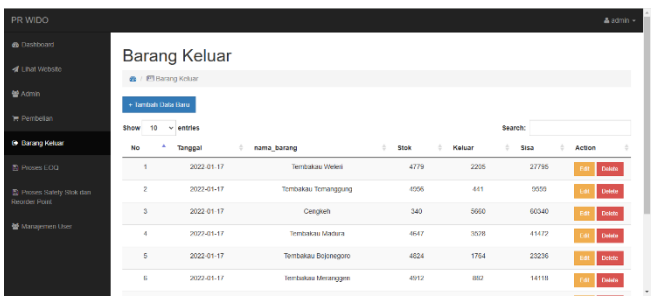

Figure 6. Goods Out Page.

3. EOQ Process Page

In the EOQ process page, the owner can view the EOQ calculation results performed by the system by selecting the time period to be calculated and then pressing the "Show EOQ Results" button. The data used in the EOQ calculation process includes usage quantity, shipping costs, and holding costs. This can be seen in Figure 7.

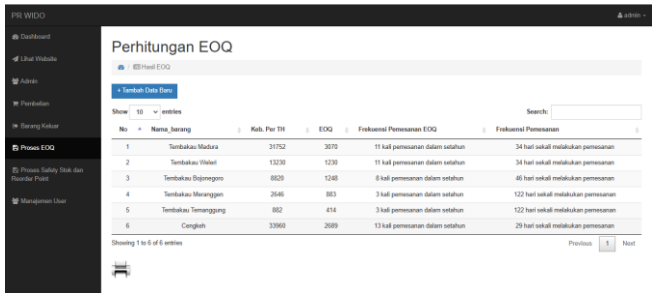

Figure 7. EOQ Process Page.

4. Safety Stock and Reorder Point Process Page

In the safety stock and reorder point process page, the owner can view the calculation results for safety stock and reorder point performed by the system by selecting the time period to be calculated and then pressing the "Show Safety Stock and Reorder Point Results" button. The data used in the safety stock and reorder point calculation process includes the usage quantity. This can be seen in Figure 8.

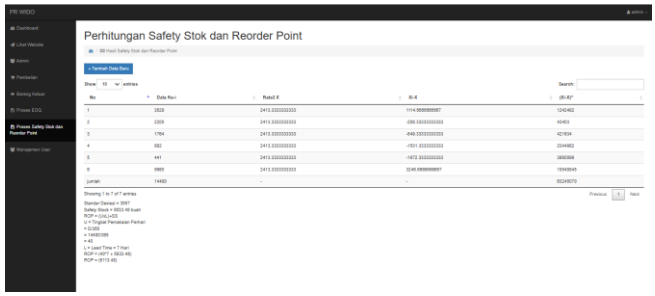

Figure 8. Safety Stock and Reorder Point Processing Page.

D. Black Box Testing

Black Box testing is a type of testing that examines the results of an application's execution based on the input provided (test data) to ensure that the application's functions meet the established criteria (requirements) [16]. This can be seen in Table 1.

Table 1. Black Box Testing.

No	Menu Tested	Test Description	Expected Result	Conclution
1	Purchase	Add purchase	Data saved successfully	Valid
2	Goods Out	Add goods out	Data saved successfully	Valid
3	EOQ Process	Select the time period to be calculated	Display EOQ calculation result	Valid
4	Safety Stock and Reorder Point Process	Select the time period to be calculated	Display Safety Stock and Reorder Point calculation result	Valid

4. CONCLUSION

The research conducted has successfully developed a web-based application system by combining the EOQ, Safety Stock, and Reorder Point calculation methods. EOQ is used to determine the optimal ordering point, Safety Stock is used to identify the safe inventory level, while the Reorder Point is used to determine the reorder threshold. The creation of this application is expected to assist the company in managing raw material inventory more efficiently, thereby helping to increase the company's profitability.

BIBLIOGRAPHY

[1] Amrillah Azmi Fahma, Zahroh, and Endang Wi Goretti Maria NP, "Analisis Metode Economic Order Quantity (EOQ) Sebagai Dasarpengendalian Persediaan Bahan Baku Pembantu(Studi Pada PG. Ngadirejo Kediri - PT. Perkebunan Nusantara X)," *J. Adm. Bisnis*, vol. 33, no. 1, pp. 35–42, 2016.

[2] R. A. Fauzi and R. Hartono, "Analisis Pengendalian Persediaan Bahan Baku Benang Pada Produk Underwear Dengan Metode EOQ (Studi Kasus pada PT. Indonesia Wacoal)," *J. Ilm. Binaniaga*, vol. 14, no. 1, p. 1, 2019, doi: 10.33062/jib.v14i1.302.

[3] S. Utomo, R. B. Agung, and B. Muslim, "Rancang Bangun Aplikasi Persediaan Bahan Baku PVC Compound Menggunakan Metode EOQ Berbasis Web," *J-SISKO TECH (Jurnal Teknol. Sist. Inf. dan Sist. Komput. TGD)*, vol. 5, no. 2, p. 174, 2022, doi: 10.53513/jsk.v5i2.5674.

[4] P. M. Palupi, L. Korawijayanti, and R. Handoyono, "Penerapan Metode Economic Order Quantity (EOQ) Untuk Meningkatkan Efisiensi Biaya Persediaan Bahan Baku (Studi Kasus pada PT Nusamulti Centralestari)," *J. Unimus*, vol. 1, pp. 426–435, 2018.

[5] I. N. Dalimunthe and S. Suendri, "Implementation of the ROP (Reorder Point) Algorithm on the Parts Stock Management Information System at PT Indako Trading Coy Web based," *Sistemasi*, vol. 13, no. 1, p. 386, 2024, doi: 10.32520/stmsi.v13i1.3910.

[6] W. Mahmudi, "Rancang Bangun Sistem Persediaan Gudang Pada Pt Abadi Jaya Manunggal Menggunakan Metode EOQ (Economy Order Quantity)," *Konf. Ilm. Mhs. UNISSULA 2*, vol. 51, no. 9, p. N-258-"N-260", 2019.

[7] F. Setiawan, "Perancangan Aplikasi Pengendalian Persediaan Barang Dengan Metode Safety Stock Dan Reorder Point(Studi Kasus : PT. Airlangga Jaya Mandiri)," *J. Ilmu Komput. dan Pendidik.*, vol. 2, No. 2, no. 2, pp. 401–408, 2024, [Online]. Available: https://journal.mediapublikasi.id/index.php/logic/article/view/2863/2412

[8] D. Ryando and W. Susanti, "Penerapan Metode Economic Order Quantity (EOQ) untuk menentukan Safety Stock dan Reorder Point (Studi Kasus : PT. Sinar Glassindo Jaya)," *J. Mhs. Apl. Teknol. Komput. dan Inf.*, vol. 1, no. 1, pp. 76–84, 2019, [Online]. Available: http://www.ejournal.pelitaindonesia.ac.id/JMApTeKsi/index.php/JOM/article/view/400

[9] S. Laoli, K. S. Zai, and N. K. Lase, "Penerapan Metode Economic Order Quantity (Eoq), Reorder Point (Rop), Dan Safety Stock (Ss) Dalam Mengelola Manajemen Persediaan Di Grand Katika Gunungsitoli," *J. EMBA*, vol. 10, no. 4, pp. 1269–1273, 2022.

[10] S. Pressman, Roger, *Rekayasa Perangkat Lunak. Pendekatan Praktisi. Edisi 7*. Yogyakarta: Andi, 2012.

[11] L. P. Sumirat, D. Cahyono, Y. Kristyawan, and S. Kacung, DASAR-DASAR Rekayasa Perangkat Lunak. 2023.

[12] E. Herjanto, Manajemen Operasi, Edisi Ketiga Revisi. Jakarta: Gramedia, 2020.

[13] J. Heizer and B. Render, *Manajemen Operasi : Manajamen Keberlangsungan dan Rantai Pasokan. Edisi 11.* Jakarta: Salemba Empat, 2015.

[14] N. Itsna R, I. Nirwana A, R. Widya P, and M. Bastomi, "Analisis Metode Economic Order Quantity, Safety Stock, Reorder Point, dan Cost of Inventory dalam Mengoptimalkan Manajemen Persediaan Umkm Bakso Pedas," *Indones. J. Contemp. Multidiscip. Res.*, vol. 2, no. 1, pp. 29–44, 2023, doi: 10.55927/modern.v2i1.2750.

[15] I. P. Aji, T. Akbar, and Z. Rahmawati, "Analisis Pengendalian Persediaan Bahan Baku Kayu Jati Pada PT. XYZ Dengan Metode Economic Order Quantity, Safety Stock, dan Reorder Point," *Musytari Neraca Manajemen, Akuntasi, Ekon.*, vol. 8, no. 5, 2024.

[16] B. A. Priyaungga, D. B. Aji, M. Syahroni, N. T. S. Aji, and A. Saifudin, "Pengujian Black Box pada Aplikasi Perpustakaan Menggunakan Teknik Equivalence Partitions," *J. Teknol. Sist. Inf. dan Apl.*, vol. 3, no. 3, p. 150, 2020, doi: 10.32493/jtsi.v3i3.5343.