Jurnal Serambi Engineering JSE
Volume XI, No.1, Januari 2026 Hal 16630 - 16641
p-ISSN : 2528-3561
e-ISSN : 2541-1934

Optimizing Coil Raw Material Inventory for Pipe Manufacturing Using EOQ, Reorder Point and Safety Stock at PT. XYZ

Kemal Darma Nazidan*, **Isna Nugraha**

Industrial Engineering Department, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya
***Corresponding author:** 22032010049@student.upnjatim.ac.id

Received: November 20, 2025 Approved: December 3, 2025

Abstract
Steel coil raw material inventory plays an important role in ensuring the smooth production process. PT XYZ faces inventory instability, both in the form of shortages and excess stock, which causes production constraints and increases storage costs. This study aims to determine the most accurate forecasting method, calculate the economic order quantity, determine the reorder point, and determine the amount of safety stock so that inventory control is more optimal each month. The methods used include forecasting with Economic Order Quantity to predict raw material needs and calculations. Reorder Point and Safety Stock to determine the order quantity, optimal inventory, and the minimum point of raw materials for restocking. Based on the analysis results, the pattern of steel coil usage shows a seasonal trend. The forecasting results using the Weighted Moving Average method provide the smallest error rate with an MSE value of 5,856,347.80 and a MAD of 2,175.80. Through the application of the EOQ method, the optimal order quantity is 3039 tons, a reorder point of 3162 tons, and a safety stock value of 4,572.447 tons. The conclusion obtained from this study is that the forecasting and EOQ methods are able to increase the efficiency of inventory control and minimize the risk of shortages of coil raw materials every month at PT XYZ.
Keywords: *demand, forecasting, inventory, raw material, steel coil*

Abstrak
Persediaan bahan baku koil baja memiliki peran penting dalam memastikan kelancaran proses produksi. PT XYZ menghadapi ketidakstabilan persediaan, baik berupa kekurangan maupun kelebihan stok, yang menyebabkan hambatan produksi serta meningkatnya biaya penyimpanan. Penelitian ini bertujuan untuk menentukan metode peramalan yang paling akurat, menghitung jumlah pemesanan ekonomis, menentukan titik pemesanan kembali, serta menetapkan besarnya safety stock agar pengendalian persediaan pada tiap bulannya lebih optimal. Metode yang digunakan meliputi peramalan dengan Economic Order Quantity untuk memprediksi kebutuhan bahan baku dan perhitungan. Reorder Point dan Safety Stock untuk menentukan jumlah pemesanan, persediaan optimal, dan titik minimal bahan baku untuk di restock kembali. Berdasarkan hasil analisis, pola pemakaian koil baja menunjukkan tren musiman. Hasil peramalan dengan metode Weighted Moving Average memberikan tingkat kesalahan terkecil dengan nilai MSE sebesar 5.856.347,80 dan MAD sebesar 2.175,80. Melalui penerapan metode EOQ diperoleh jumlah pemesanan optimal sebesar 3039 Ton, reorder point sebesar 3162 ton, dan nilai safety stock sebesar 4.572,447 ton. Kesimpulan yang didapatkan dari penelitian ini adalah metode peramalan dan EOQ mampu meningkatkan efisiensi pengendalian persediaan serta meminimalkan resiko kekurangan bahan baku koil tiap bulannya di PT XYZ.
Kata Kunci: *bahan baku, koil baja, peramalan, permintaan, persediaan*

1. Introduction

The increasing interconnectedness between countries through trade and technology is a hallmark of economic development in the current era of globalization. Multinational corporations play a crucial role in the development of global industrial networks, and the rapid development of information technology facilitates cross-border transactions and the flow of information. This has intensified competition in a number of economic sectors, increased interdependence between countries, and fundamentally changed the structure of the global economy. However, globalization also has several disadvantages, such as economic disparities and the impact of industrialized countries' hegemony on poorer countries. However, by increasing competitiveness and leveraging their comparative advantages, developing countries like Indonesia have great potential to become more actively involved in the global market in this era [1]. In the production process, companies need raw materials to produce goods [2]. In companies engaged in the manufacturing sector, having stock is very important, this allows for continuous production and delivery of finished goods to customers [3]. Too much or too little raw materials can disrupt the balance between demand and availability, which may lead to slower production, insufficient inventory, and lost opportunities to generate income. Therefore, managing raw material stocks is very important to ensure sufficient stock availability to meet demand [4]. The raw materials used by companies to manufacture goods are delivered or purchased at specific times based on a purchasing schedule for each raw material (e.g., weekly, monthly, or yearly). Companies need to carefully manage every part of the production process to create better products and achieve satisfactory results. Therefore, companies need a plan or method to effectively address the issue of managing their raw material inventory [5].

Ineffectiveness and inefficiency in raw material inventory can lead to various problems in the future. These problems can include excess or insufficient raw material inventory used in a factory's production process. Furthermore, there are issues such as the accumulation of raw material storage costs in the warehouse if the stock is unbalanced, which also impacts factory operations. One manufacturing company facing this challenge is PT XYZ. This company operates in the steel pipe production sector. The company is experiencing problems with ordering raw material inventory, specifically steel coils, which are ordered each month with extreme fluctuations. **Table 1** shows that orders in January were 8,754 tons, then in February the number of orders dropped to 2,741 tons. Then, in May, orders totaled 7,419 tons, then in June, the number dropped drastically to 142 tons. This indicates that raw material ordering is inefficiently aligned with monthly needs and experiences extreme fluctuations. Therefore, this research is needed to forecast the optimal and stable amount of raw materials ordered each month.

To address the aforementioned issues, implementing the EOQ method can be an effective and efficient solution. This method allows PT XYZ to calculate the optimal raw material order quantity, thereby minimizing total inventory costs. Ordering costs, which include administration and shipping costs, as well as storage and warehouse maintenance costs, can be more effectively managed with this method. Furthermore, the EOQ method helps the company design a more planned inventory strategy by determining the ROP. By knowing the appropriate reorder point, PT XYZ can ensure that raw materials are available on time before running out of stock. Determining optimal safety stock is also a crucial part of this solution, as it can be used to address unexpected demand fluctuations or delays in raw material deliveries from suppliers. By combining EOQ, ROP, and safety stock, companies can not only improve operational efficiency but also minimize the risk of production disruptions due to stock shortages. Calculations are then performed using Single Exponential Smoothing (SES) and a Weighted Moving Average (WMA) to compare the smallest error value to be taken.

Research conducted by [6], focused on determining gypsum requirements for the cement production process using Safety Stock, Single Exponential Smoothing and Weight Moving Average. While research conducted by [7], focused on the tofu cracker industry using EOQ, ROP, and Safety Stock. From the two studies above, it can be found that there is no research gap in the integration of forecasting & EOQ methods in one model. Therefore, this research was developed by combining all the methods contained in the two articles along with their cost analysis to provide more comprehensive benefits & analysis results. Based on this, this research aims to avoid waste and optimize for more balanced raw material ordering. This approach is expected to be able to support the operational sustainability of PT XYZ in a more stable, efficient, and productive manner, while providing a positive contribution to the company's long-term cost management.

2. Material and Methods

This study uses a descriptive quantitative approach that aims to provide an actual and systematic picture of the condition of steel coil raw material inventory at PT XYZ. By using the EOQ, ROP, and SS methods, this study attempts to predict raw material needs & calculations, to determine the order quantity, optimal inventory & minimum point for raw materials to be restocked.

Data Collection

a. Field Observation

Field observation is a data collection method aimed at understanding, observing, and interacting with people in their natural environment. Field observation is useful for systematically collecting data and developing various theories [8]. This observation allows for more valid and representative data on steel coil requirements, thus enhancing subsequent analysis.

b. Interviews

An interview is a technique for collecting and recording data, information, or opinions through direct or indirect conversation or question-and-answer sessions. An interview is a purposeful conversation. The conversation is conducted by two parties: the interviewer who asks questions and the interviewee who provides answers [9]. In this study, interviews were conducted with staff from the HSE department to obtain data on electricity and telephone costs, the Warehouse department to determine warehouse maintenance costs, and the PPIC department to obtain data on steel coil requirements and shipping costs incurred when shipping coils from abroad during the 2024 period.

c. Documentation Study

Documentation study is a data collection technique that does not directly address the research subjects. By using this document analysis, it is hoped that the required data will be truly valid. Documents that can be used as sources include photos, research reports, books relevant to the research, and other written data [10]. In this study, the documentation obtained was through historical coil ordering data contained in company reports.

Data Analysis

Data analysis in this study was conducted through the following stages:

a. Economic Order Quantity

Economic Order Quantity (EOQ) is one of the oldest and most widely recognized inventory control techniques [11]. Economic Order Quantity (EOQ) is an inventory management method that determines the number of orders or purchases that must be made and how much must be ordered to minimize total costs (the sum of ordering costs and holding costs). Therefore, to calculate the economic order quantity, it is necessary to consider the addition of ordering costs and holding costs, as well as the average inventory level [12]. Therefore, it can be concluded that the Economic Order Quantity (EOQ) method can be used to manage raw material inventory by determining the most economical order quantity using an inventory control method that minimizes all ordering and holding costs, thereby saving companies production costs [13]. By using the EOQ model, companies can calculate the quantity to order to achieve a balance between these two costs. (EOQ) is one of the oldest and most widely known inventory control techniques. This inventory control method answers two important questions: when to order and how much to order [14].

The EOQ calculation is as follows:

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

Description :
D : Quantity of materials required in units per year
S : Ordering cost per order
H : Storage cost per unit

b. Safety Stock

Safety Stock (SS), also known as buffer stock, is the amount of extra stock a business holds to prevent stockouts due to unforeseen events. Safety stock helps streamline the supply chain and protect against demand uncertainty and lead times. Safety stock is based on historical demand variability, lead times, and the business's importance to the supply chain [15]. The amount of safety stock depends heavily on the degree of variation in finished product demand and material availability. The higher the demand variability, the greater the safety stock requirement compared to when production demand is more stable. Safety stock techniques support operational planning in the face of demand and supply uncertainty and ensure promised service levels. Furthermore, optimal safety stock utilization can help companies reduce the risk of customer loss due to stockouts and increase customer confidence in continued product availability [16].

The safety stock calculation is as follows:

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

Description :
SS : Safety stock
Z : Number of standard deviations that provide a given service level

c. Reorder Point (ROP)

The Reorder Point (ROP) is a condition where a company is required to reorder desired raw materials so that the ordered materials can arrive on time. Calculating the reorder point is mandatory because this calculation includes the arrival time of the ordered materials, which is why the ordered materials are not always available on time, a term referred to as lead time [17]. The reorder point is based on the time required to request a purchase, order, and receive raw materials, plus a reserve to protect against stockouts. The reorder point is reached when the available quantity equals the estimated need, that is, when the amount of inventory available and any amount that will be entered into inventory equals the amount of inventory that will be used during the lead time and the amount of safety stock [18]. By calculating the reorder point correctly, there is no need to worry about stockpiling in the warehouse due to ordering too much material, or having to deal with customer disappointment due to stockouts [19].

The reorder point calculation is as follows:

$$ROP = d \times L \quad (3)$$

Description :
d : Daily use of raw materials
L : Lead time

d. Single Exponential Smoothing (SES)

The Single Exponential Smoothing (SES) method demonstrates an exponentially decreasing weighting of older observed values, meaning that newer values are given a relatively greater weight than older observed values [20]. The Single Exponential Smoothing method is preferred because, in some cases, sales history does not experience an increase or there is no trend. Furthermore, the percentage error (the difference between actual data and forecasted values) and the MSE (for calculating forecast error) obtained from the Single Exponential Smoothing method are smaller [21].

The calculation for single exponential smoothing is as follows:

$$F_t = \alpha . X_{t-1} + (1-\alpha) F_{t-1} \quad (4)$$

Description :
Ft : Forecasted value for period t
Xt-1: Actual value for the previous period (t-1)
Ft-1 : Forecasted value for the previous period (t-1)
α : Smoothing constant ($0 < \alpha < 1$)

e. Weight Moving Average (WMA)

The Weighted Moving Average (WMA) method is a calculation method that is the same as a simple moving average, but requires a weighting coefficient and is used when there is a trend in past data patterns. The weighting coefficient is based on intuition with a value of: $0 \leq CW \leq 1$. The Weighted Moving Average method is given a different weight for each available past historical data, with the assumption that the most recent or most recent historical data will have a greater weight than the older historical data because the most recent or most recent data is the most relevant data for forecasting [22]. The weighted moving average model is more responsive to changes, because data from new periods is usually given a greater weight. A weighted n-period moving average model,

Weighted Moving Average (n), is stated as follows [23]:

$$Ft = \frac{\sum(\text{Weighting for the period n})\ (\text{Actual demand in the period n})}{\sum(\text{Weighting})} \quad (5)$$

Description:
Ft: Forecast of demand for the next period

Types of Data Patterns

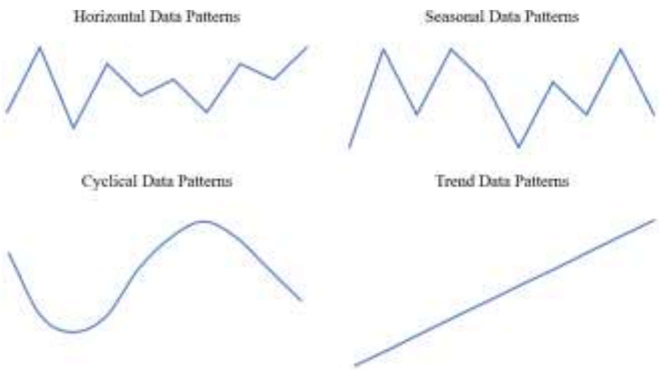

Fig. 1. Time Series Data Patterns
Source: 2025 Data Processing

The following explains the components of the pattern in Picture 1. First, a horizontal data pattern appears when data fluctuates steadily around an average. This type involves products whose sales do not increase or decrease over time. Second, a seasonal data pattern appears when data values are influenced by seasonal factors (for example, specific days of the week, month, or quarter). Third, a cyclical data pattern forms when influenced by long-term economic inaccuracies. Fourth, a trend data pattern appears when there is an increase or decrease in the amount of data over a long period of time. For companies, sales, gross domestic product, and other financial indicators follow a trend pattern over time. In this study, data patterns are used to understand the ordering behavior of steel coils over a year. Identifying data patterns helps

Jurnal Serambi Engineering JSE
Volume XI, No.1, Januari 2026 Hal 16630 - 16641
p-ISSN : 2528-3561
e-ISSN : 2541-1934

determine the most appropriate forecasting method. By understanding emerging patterns, companies can more accurately predict raw material needs.

Flowchart

The following are the stages of research carried out:

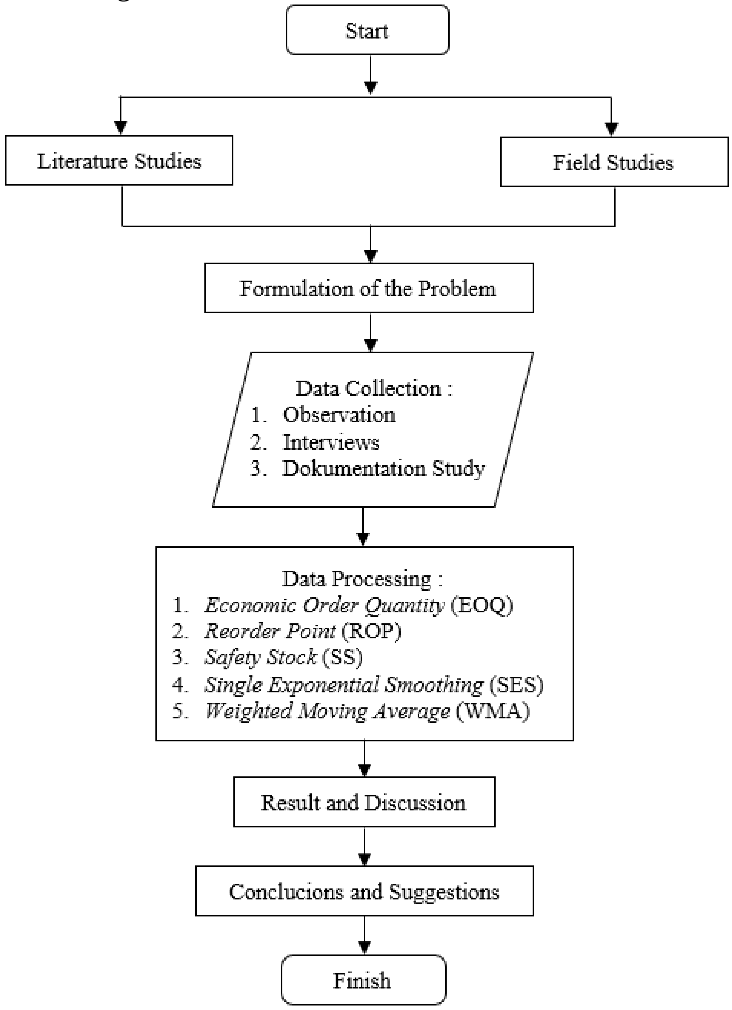

Fig. 2. Research Flowchart
Source: 2025 Data Processing

Fig. 2 shows a flowchart depicting the research stages, starting with identifying the problem based on existing phenomena through field studies and documentation studies. Then, the necessary data were collected through direct observation, interviews, and documentation studies. This research used the EOQ, ROP, SS, SES, and WMA methods to generate the improvement analysis.

3. Results and Discussion

a. Determining Data Patterns

Before forecasting, the first step is to identify data patterns. At this stage, steel coil ordering patterns are identified based on historical monthly data. The data is analyzed to determine whether there are trends, seasonality, or random fluctuations. The identified data patterns will form the basis for determining the most appropriate forecasting method. This process is crucial for forecasting results to accurately reflect actual demand conditions. Coil ordering data is presented in the following table.

Table 1. Steel coil order history data

Period	Month	Order (Tons)
1	January-24	8.754
2	February-24	2.741
3	March-24	2.070
4	April-24	2.153

Period	Month	Order (Tons)
5	May-24	7.419
6	June-24	142
7	July-24	891
8	August-24	4.811
9	September-24	1.204
10	October-24	793
11	November-24	6.322
12	December-24	1.170

Source: 2025, Data Processing

Determination of data patterns based on data in **Table 1** can be seen in **Fig. 3.**

Fig. 3: Steel Coil Usage Graph
Source: 2025, Data Processing

Fig. 3: Steel Coil Usage Graph shows that steel coil orders exhibit a seasonal pattern. This is because each month's steel coil orders have varying tonnages. Table 1 shows that from January to December 2024, PT XYZ ordered a total of 38,470 tons of raw materials.

b. Calculating Demand Forecasts

Once the resulting data patterns are identified, demand forecasting is performed. This stage focuses on using forecasting methods to predict future steel coil needs. The forecasting techniques used, based on the results of the data patterns, are a 3-month Weighted Moving Average and Single Exponential Smoothing with an α value of 0.1. The two methods are then compared to determine the lowest error rate. The forecasting results will be used as the basis for inventory planning.

Table 2. Calculation of Steel Coil Forecasting Results

Month	Single Exponential Smoothing (α = 0,1)		Weight Moving Average (3 Month)	
	Xt	St	Xt	St
January-24	8.754	8.754	8.754	
February-24	2.741	8.754	2.741	
March-24	2.070	8.153	2.070	4.522
April-24	2.153	7.544	2.153	2.321
May-24	7.419	7.005	7.419	3.881
June-24	142	7.047	142	3.238
July-24	891	6.356	891	2.817
August-24	4.811	5.810	4.811	1.948
September-24	1.204	5.710	1.204	2.302
October-24	793	5.259	793	2.269
November-24	6.322	4.813	6.322	2.773
December-24	1.170	4.964	1.170	2.762

Source: 2025, Data Processing

- Single Exponential Smoothing (value α = 0,1)

$$MSE = \sum \frac{(Xt - St)^2}{n}$$

$$= 19.821.441,25$$

MAD $= \sum \left|\frac{Xt - St}{n}\right|$

$= 3.795,42$

- Weight Moving Average (3 Month)

MSE $= \sum \frac{(Xt - St)^2}{n}$

$= 5.856.347,80$

MAD $= \sum \left|\frac{Xt - St}{n}\right|$

$= 2.175,80$

Based on the results of the forecasting measurement, the single exponential smoothing forecasting technique with an alpha of 0.1 yielded a Mean Square Error (MSE) of 19,821,441.25 and a Mean Absolute Deviation (MAD) of 3,795.42. Meanwhile, the 3-month Weighted Moving Average forecasting technique yielded a Mean Square Error (MSE) of 5,856,347.80 and a Mean Absolute Deviation (MAD) of 2,175.80.

c. Safety Stock Calculation

The next step is to calculate the safety stock value by determining the amount of safety stock. Calculating safety stock can help companies manage inventory when there is a shortage. Cost savings occur in steel coil raw materials, thereby increasing company productivity. In the production process, if raw material inventory is too large compared to company needs, it will increase storage and maintenance costs and may lead to unsustainable quality declines, resulting in losses. In reality, consumer demand is sometimes uncertain. Therefore, determining the appropriate safety stock is crucial to mitigate losses due to stock shortages. Calculating the safety stock value requires a standard deviation, where the data used to calculate the standard deviation are the estimated inventory (A) and the actual inventory (B). A breakdown of these values is presented in **Table 3**.

Table 3: Safety Stock Processing Results

Month	Inventory Estimates (A)	Actual Inventory (B)	A - B	(A - B)2
January-24	3.206	8.754	- 5.548	30.780.304
February-24	3.206	2.741	465	216.225
March-24	3.206	2.070	1.136	1.290.496
April-24	3.206	2.153	1.053	1.108.809
May-24	3.206	7.419	- 4.213	17.749.369
June-24	3.206	142	3.064	9.388.096
July-24	3.206	891	2.315	5.359.225
August-24	3.206	4.811	- 1.605	2.576.025
September-24	3.206	1.204	2.002	4.008.004
October-24	3.206	793	2.413	5.822.569
November-24	3.206	6.322	- 3.116	9.709.456
December-24	3.206	1.170	2.036	4.145.296
∑	38.472	38.470	2	92.153.874

Source: 2025 Data Processing

Average monthly inventory $= \frac{\sum B}{n} = \frac{38.470}{12} = 3.205,83$ tons per month

$$SD = \sqrt{\frac{\sum (A - B)^2}{n}}$$

$$= \sqrt{\frac{92.153.874}{12}}$$

$= 2771,18$

Assuming a service level of 95%, this means that the company serves 95% of total demand, and the remaining 5% represents the possibility of excess stock. Furthermore, the normal distribution of Z values in the area under the 95% normal curve (or 1-0.05) yields a value of 1.65. Therefore, the safety stock equation is:

SS = Z x SD

= 1.65 x 2771.18

= 4,572.44 tons

Jurnal Serambi JSE Engineering Volume XI, No.1, Januari 2026 Hal 16630 - 16641 p-ISSN : 2528-3561 e-ISSN : 2541-1934

Based on the calculation, the average monthly steel coil inventory is 3,205.83 tons, and the safety stock of steel coil raw materials for one year is 4,572.44 tons, with a service level of 95%. The company has set a goal of achieving a 95% service level because service level is a key factor in ensuring customer loyalty. Based on the research, implementing safety stock is a solution to mitigate the impact of supply chain uncertainty. Regular inventory management is key to a company's profitability.

d. Ordering Costs

- Telephone Costs

Telephone costs are a company's routine expense for communication with raw material suppliers. This communication is necessary for the ordering process, shipping confirmation, and other logistics coordination. Although not significant, telephone costs still constitute a significant portion of the total ordering cost. Therefore, these costs must be accurately calculated in inventory analysis.

Table 4. Telephone Cost Data

Month	Telephone Cost	Month	Telephone Cost
January-24	240.000	July-24	240.000
February-24	240.000	August-24	240.000
March-24	240.000	September-24	240.000
April-24	240.000	October-24	240.000
May-24	240.000	November-24	240.000
June-24	240.000	December-24	240.000
Total			2.880.000

Source: 2025, Data Processing

- Shipping Costs

Shipping costs are the costs a company incurs to transport raw steel coils from overseas. The amount varies monthly depending on the order quantity and logistics rates. This cost is a major component of ordering costs due to its relatively large amount. Effectively managing shipping costs will help a company reduce total inventory costs.

Table 5. Shipping Cost Data

Month	Number of Messages per Month	Cost per Order
January-24	1x	Rp. 3.630.437.000
February-24	1x	Rp. 1.136.665.000
March-24	1x	Rp. 858.465.000
April-24	1x	Rp. 892.887.000
May-24	1x	Rp. 3.076.789.000
June-24	1x	Rp. 58.891.000
July-24	1x	Rp. 369.520.000
August-24	1x	Rp. 1.995.232.000
September-24	1x	Rp. 499.326.000
October-24	1x	Rp. 328.875.000
November-24	1x	Rp. 2.621.876.000
December-24	1x	Rp. 485.240.000
Total Cost in a Year		Rp. 15.954.203.000

Source: 2025, Data Processing

e. Storage Costs

- Electricity Costs

Electricity costs are part of the storage costs that arise from energy use in warehouse facilities. Electricity use is related to operations such as lighting, transportation equipment, and supporting machinery. The amount of electricity costs per month affects the total annual storage costs. Therefore, controlling electricity consumption can significantly impact warehouse efficiency.

Table 6. Electricity Cost Data

Month	Electricity Cost	Month	Electricity Cost
January-24	Rp. 456.618.000	July-24	Rp. 354.213.000
February-24	Rp. 368.219.000	August-24	Rp. 323.440.000
March-24	Rp. 254.555.000	September-24	Rp. 298.436.000

Month	Electricity Cost	Month	Electricity Cost
April-24	Rp. 236.628.000	October-24	Rp. 363.595.000
May-24	Rp. 362.974.000	November-24	Rp. 354.687.000
June-24	Rp. 319.543.000	December-24	Rp. 316.600.000
Total			Rp. 4.009.508.000

Source: 2025, Data Processing

- Warehouse Maintenance Costs

Warehouse maintenance costs include replacement of cleaning equipment, storage rack maintenance, and other facility maintenance. These costs are necessary to maintain the warehouse in a suitable and safe condition for storing raw materials. Routine maintenance helps prevent facility damage that could disrupt operational processes. With proper maintenance management, storage efficiency can be improved.

Table 7. Warehouse Maintenance Cost Data

Month	Maintenance Cost
January-24 – June-24	Rp. 20.000.000
July-24 – December-24	Rp. 20.000.000
Total	Rp. 40.000.000

Source: 2025, Data Processing

f. Calculation of Ordering Cost and Holding Cost
- Order Cost =
- Telephone Cost : Rp. 2.880.000
- Ordering Cost : Rp. 15.954.203.000 +

Total : Rp. 15.957.083.000
- Inventory Cost =
- Electricity Cost : Rp. 4.009.508.000
- Warehouse Maintenance Cost : Rp. 40.000.000 +

Total : Rp. 4.049.508.000

g. Calculation of Order Cost and Holding Cost
- Order Fee Each Time You Order (S)

$$= \frac{\text{Total Order Cost}}{\text{Order Frequency}} = \frac{\text{Rp. } 15.957.083.000}{12} = \text{Rp. } 1.329.756.917$$

- Storage Cost Per Unit of Raw Material (H)

$$= \frac{\text{Total Order Cost}}{\text{Total Raw Material Requirements}} = \frac{4.049.508.000}{38.470.000} = \text{Rp. } 105.264 \text{ per Kilogram}$$

h. Average Purchase of Raw Materials

Average purchase of raw materials (Q) is calculated based on company policy :

$$= \frac{\text{Total Raw Material Requirements (D)}}{\text{Order Frequency}} = \frac{38.470.000 \text{ Kg}}{12} = 3.205.833 \text{ Kg}$$

So, the average amount of steel coil raw material purchases per month is 3.205.833 kg.

i. Total Inventory Cost

Total raw material requirements (D) = 38.470.000 kg
Average raw material purchases (Q) = 3.205.833 kg
Ordering cost per order (S) = Rp. 1.329.756.917
Holding cost per kilogram (H) = Rp. 105.264
The calculation of Total Inventory Cost (TIC) is as follows:
TIC = (D/Q x S) + (Q/2 x H)
TIC = (38.470.000/3.205.833 x 1.329.756.917) + (3.205.833/2 x 105.264)
TIC = Rp. 15.957.083.000 + Rp. 168.729.402.456
TIC = Rp. 184.686.485.456

j. Economic Order Quantity (EOQ) Calculation

Economical Raw Material Purchases:
Total raw material requirements (D) = 38.470.000 kg
Ordering cost per order (S) = Rp. 1.329.756.917
Holding cost per kilogram (H) = Rp. 105.264
Therefore, the economical raw material purchase amount can be calculated using the EOQ method, namely:

$$Q^* = \frac{\sqrt{2DS}}{H} = \frac{\sqrt{2 \times 38.470.000 \times 1.329.756.917}}{105.264}$$

= 3039 Tons

Frequency of Raw Material Purchase :

$$F = \frac{D}{Q*} = \frac{38.470 \text{ Tons}}{3039 \text{ Tons}} = 12$$

So, the frequency of ordering raw materials is 12 times a year.

k. Total Inventory Cost

Total raw material requirements (D) = 38.470.000 kg
Ordering cost per order (S) = Rp. 1.329.756.917
Holding cost per kilogram (H) = Rp. 105.264
Most economical average raw material purchase (Q*) = 3039 tons
Calculation of Total Inventory Cost (TIC):
TIC = (D/Q* x S) + (Q*/2 x H)
TIC = (38.470/3039 x 1.329.756.917) + (3039/2 x 105.264)
TIC = Rp.16.883.086.080 + Rp.159.948.648
TIC = Rp.17.043.034.728

l. Reorder Point

PT. XYZ, which produces steel pipes, has a 30-day lead time (L) for ordering steel coil raw materials. This is based on an average working day (t) of 365 days per year. Before calculating the ROP, the raw material usage rate per day must be calculated as follows:

D = D/t
= 38.470.000 /365
= 105.397 Kilogram

So the reorder point (ROP) is as follows:
ROP = d x L = 105.397 x 30 = 3.161.910 Kilogram
So, the company must reorder raw materials when the raw materials are at 3,161,910 kilograms.

Companies are advised to consistently implement the best forecasting method, the Weighted Moving Average, to predict raw material needs more accurately and stably each month. The use of the EOQ method also needs to be strengthened to ensure that raw material orders are always at the most economical level, allowing companies to optimally reduce ordering and storage costs. Furthermore, determining adequate safety stock is crucial to address demand uncertainty and potential delays in raw material deliveries that often occur during the import process. Periodic inventory cost evaluations are also necessary to identify cost components that can still be optimized, including electricity costs, warehouse maintenance costs, and ordering costs. Overall, companies are encouraged to expand the use of historical data, conduct sensitivity tests, and develop more adaptive and integrated inventory control systems to support smooth operations and improve long-term efficiency.

4. Conclusion

Based on the results of research on steel coil inventory control at PT XYZ, it can be concluded that the Weighted Moving Average (WMA) method is the most accurate forecasting technique, with an MSE value of 5,856,347.80 and a MAD of 2,175.80, thus successfully answering the research objective of determining the best forecasting method. The EOQ calculation results indicate an economic order quantity of 3,039 tons with an ordering frequency of 12 times per year, while the ROP point is 3,161,910 kg. Furthermore, a safety stock value of 4,572.44 tons is required to anticipate demand uncertainty and relatively long import lead times. These findings address the research questions regarding forecasting methods, optimal order quantities, reorder points, and safety stock requirements.

Although the analysis results indicate that the application of EOQ, ROP, and safety stock can improve inventory control efficiency, this study has several limitations. These include the use of only one year of data, which does not reflect long-term demand patterns. It also fails to consider other costs such as the risk of material damage, import price fluctuations, and potential delivery delays. Furthermore, the study has not yet conducted a sensitivity test to assess changes in results when demand, costs, or lead times fluctuate.

Companies are advised to use the WMA method for forecasting raw material requirements to achieve more accurate raw material requirements. The EOQ method should be implemented to ensure more economical ordering. Safety stock should be maintained to address demand fluctuations. Inventory cost evaluations should be conducted regularly. Overall, companies need to implement a more efficient and adaptive inventory system.

For further research, it is recommended to use a longer historical data set to more accurately identify demand patterns, develop advanced analyses, and incorporate risk cost and supply uncertainty components to generate more comprehensive and adaptive inventory control recommendations tailored to the company's operational conditions.

5. Acknowledgment

The author would like to express his gratitude to all parties who have helped make this research possible. In particular, he would like to thank the management of PT XYZ for their cooperation and willingness to provide the sales data that served as the basis for our research. Furthermore, he would like to express his gratitude to the administrative team who helped make this research possible by providing the necessary facilities and resources. Any contribution is invaluable to the completion of this research.

6. References

[1] Purba, B., Sihombing, A. E., Nasution, N. F., & Siagian, A. P. (2023). Dampak Globalisasi Dalam Mempengaruhi Ekonomi Nasional Melalui Pandangan Ekonomi Politik. EKONOMIKA45: Jurnal Ilmiah Manajemen, Ekonomi Bisnis, Kewirausahaan, 10(2), 402-414.

[2] Ratningsih, R. (2021). Penerapan Metode Economic Order Quantity (EOQ) untuk Meningkatkan Efisiensi Pengendalian Persediaan Bahan Baku pada CV Syahdika. Jurnal Ekonomi Dan Manajemen Akademi Bina Sarana Informatika, 19(2), 158–164.

[3] Tuzzahrah, A. N., Voutama, A., & Ridha, A. A. (2023). Analisa Website Prodi Sistem Informasi Unsika Berdasarkan Prinsip Dan Paradigma Interaksi Manusia Dan Komputer. Jurnal Ilmiah Matrik, 25(2), 108–115.

[4] Fole, A., Ihwan Safutra, N., Alisyahbana, T., Almuhajirin, Y., & Nisa Safitri, K. (2024). Peningkatkan Efisiensi Rantai Pasok melalui Material Requirement Planning untuk Bahan Baku dalam Produksi Lemari: Studi Kasus CV. Indo Mebel. Jurnal Teknik Ibnu Sina (JT-IBSI), 9(01), 11–21

[5] Masengi, T., & Palandeng, I. D. (2023). Analisis Pengendalian Persediaan Bahan Baku Tepung Pada Toko Roti Acong Menggunakan Economic Order Quantity. Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi, 11(4).

[6] Raodah, Yanasim, N., & Erniyani. (2024). Penentuan safety stock bahan baku gypsum pada proses pembuatan semen. JTTI, 5, 1–9

[7] Wahid, A., & Munir, M. (2020). Economic Order Quantity Istimewa pada Industri Krupuk “Istimewa” Bangil. Journal of Industrial View, 2, 1–8.

[8] Morissan. (2017), Riset Kualitatif. Jakarta: Kencana

[9] Fauzi, S. N. M. (2021). Penerapan Metode Mengubah Teks Wawancara Menjadi Karangan Narasi Untuk Meningkatkan Kemampuan Berbahasa Inggris Siswa Kelas Viii A Mts Negeri 2 Purbalingga Semester Gasal Tahun Pelajaran 2019/2020. Language : Jurnal Inovasi Pendidikan Bahasa Dan Sastra, 1(1), 1–13.

[10] Maryam B.G. (2016), Pengantar Metode Penelitian. Sleman: Kanisius

[11] Laoli, S., Zai, K. S., & Lase, N. K. (2022). Jurnal EMBA. Penerapan Metode Economic Order Quantity (EOQ), Reorder Point (ROP), Dan Safety Stock (SS) Dalam Mengelola Manajemen Persediaan Di Grand Katika Gunung Sitoli, 10, 01–05

[12] Pinem, K. F., Mulyawan, B., & Perdana, N. J. (2021). Implementation Of Minimum Stock Determination Using Prediction And Economic Order Quantity (EOQ) method. Jurnal Ilmu Komputer Dan Sistem Informasi, 9(1), 148

[13] Ningrat, N. K., & Gunawan, S. (2023). Pengendalian Persediaan Bahan Baku Untuk Meningkatkan Efisiensi Biaya Persediaan Dengan menggunakan metode EOQ (Economic Order Quantity) di UMKM Kerupuk Nusa Sari Kecamatan Cimaragas Kabupaten Ciamis. Jurnal Industrial Galuh, 5(1), 18–28

[14] Buulolo, Y., Dinata, M. S., Mendrofa, Iwan, J. B., Gea, J., & Harefa, I. (2024). Pengendalian Persediaan Barang Dagang Menggunakan Metode Economic Order Quantity (EOQ) Pada Toko Besi Sadarman Di Kota Gunungsitoli. Jurnal Ekonomi Bisnis, Manajemen Dan Akuntansi (Jebma), 04, 01–12.

[15] Nafi, N. A., & Islami, M. C. P. (2025). Analisis Perhitungan Dalam Optimalisasi Manajemen Inventori Pada Pengadaan Bahan Baku dengan Metode Safety Stock di PT ABC. *Jurnal Serambi Engineering*, *10*(1).

[16] Christyani, E. Z., & Susanti, A. (2025). Management Inventory Produk Cat Menggunakan Metode Safety Stock Dan Reorder Point Pada TB Gamping Pilihan Sukoharjo. Jurnal Ilmiah Manajemen, Ekonomi Dan Akuntansi, 5(2), 112–126.

[17] Farhana, N., Yahya, W. F., & Mubarok, K. (2025). Jurnal Teknik Industri (JATRI). Analisis Safety Stock Dan Reorder Point Persediaan Produk Wheel-Grinding 4" DI PT XYZ, 3(1), 01–09.

[18] Sholehah, R., Marsudi, M., & Budianto, A. G. (2021). Analisis Persediaan Bahan Baku Kedelai Menggunakan EOQ, ROP Dan Safety Stock Produksi Tahu Berdasarkan Metode Forecasting Di PT. Langgeng. Journal of Industrial Engineering and Operation Management, 4(2)

[19] Fathurrohman, L. R., & Nugraha, A. A. (2025). Penerapan Pengendalian Persediaan Menggunakan Metode Safety Stock Dan Reorder Point Untuk Meningkatkan Efisiensi Biaya Persediaan Barang Jadi. Indonesian Accounting Literacy Journal, 5(2), 210–227.

[20] Nuryani, E., Rudianto, Budiman, R., & Lazuwardi, E. (2022). JSiI (Jurnal Sistem Informasi) . Peramalan Persediaan Obat Menggunakan Metode Single Exponential Smoothing, 9(2), 01–07.

[21] Mico, A. D., Arifianto, D., & Maryami, A. (2021). Peramalan Penjualan Batu Gamping Pada "UD Eko Joyo" Menggunakan Single Exponential Smoothing Dan Double Exponential Smoothing. Jurnal Smart Teknologi, 01, 01–09.

[22] Ekasari, L., Sapri, S., & Alinse , R. T. . (2021). Application of Weight Moving Average Method in Forecasting Drug Inventory Application at Dermayu Health Center. Jurnal Komputer, Informasi Dan Teknologi, 1(2), 330–335.

[23] Setiawan, I. (2021). Rancangan Bangun Aplikasi Peramalan Persediaan Stok Barang Menggunakan Metode Weighted Moving Average (WMA) pada Toko Barang XYZ. Jurnal Teknik Informatika, 13(3), 1–9.