# THE FORECASTING OF RAW MATERIAL INVENTORY IN SUPPORT OF THE CONTINUITY PRODUCTION PROCESS



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***ABSTRACT***

*This study aims to calculate the prediction of raw material inventory, the Economic Order Quantity (EOQ), safety stock, and reorder point in support of the continuity production process at a fence manufacturer, CV. Moderen Arsiteknis in Kupang city. Data were analyzed from records of the period 2013–2017 that consist of the annual demand of a product in quantity per unit of time (D), product order cost (S), unit cost (C), holding cost per unit as a fraction of product cost (H), and lead time (L). It is calculated from the forecasting of raw material demand and then computed the Economic Order Quantity (EOQ), safety stock, and reorder point for the next 3 years (2018-2020). The computation of demand forecasts, EOQ, safety stock, and reorder points is intended to smooth the continuity of the production process, reduce the risk of raw material shortages, and minimize the ordering cost and holding cost in CV. Modern Arsiteknis was discussed in the results section.*

***Keywords:*** *Forecasting; Economic Order Quantity; Safety Stock; Re-Order Point*

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## INTRODUCTION

Having an efficient inventory is one of the strategies for becoming lean manufacturers (Amirjabbari & Bhuiyan, 2014). According to Li (2007), inventory is defined as "the stock of any item or resource utilized in an organization" and it is one of the most important components of logistic processes (Mesjasz-Lech, 2011). Inventory management is critical for any company and has a direct impact on businesses (Plinere & Borisov, 2015; Xi & Sha, 2014). Inventory management is critical for the company because stock levels affect customer service and are required to ensure the continuity of the production process (Kourentzes et al., 2020; Mesjasz-Lech, 2011). Inventory management considers all activities involved in planning and controlling the inventory levels of raw materials, work-in-process items, and finished goods so that sufficient inventories are available (Mokhtari, 2018). Every company should effectively and efficiently control raw material inventories to obtain the required results (Lesmana et al., 2018).

According to Plinere and Borisov (2015), companies require inventory planning to avoid out-of-stock and overstock problems. Too large or too small inventories might pose issues for the firm. A shortage of inventory will stymie the manufacturing process, preventing customer demand from being met on time (Sofyan et al., 2017; Xi & Sha, 2014).

Overstock inventories will generate inventory costs (Plinere & Borisov, 2015). The higher the order quantity, the higher the inventory holding cost (Rizaldi et al., 2018). Excess inventory is a common driver of continually rising expenses (Kot & Grondys, 2011). Because corporate inventory is linked to cash flows, firms place a high value on the issue of how to keep inventory safe (Kourentzes et al., 2020; Zhong & Zhang, 2015). Optimizing inventory with the minimum cost can be determined through the Economic Order Quantity (EOQ), safety stock, and reorder time (Mekel et al., 2014).

Inventory management will lower inventory levels if firms properly estimate demand (Kot & Grondys, 2011; Mathew et al., 2013), as demand forecasting is the foundation of inventory management (Xi & Sha, 2014). Inventory management collaborates with the forecasting process to establish the EOQ, safety stock, and reorder point (Efrilianda & Isnanto, 2018; Inprasit & Tanachutiwat, 2018; Pang et al., 2019). Forecasting is a way to predict how much demand there will be for a specific stock-holding unit (Goltsos et al., 2022).

Forecasting is the activity of estimating the quantity of a product or service that customers intend to purchase due to irregular demand induced by an unpredictable level of demand (Gonzales & Gonzales, 2014; Martins & da Cruz, 2018). Forecasting is the art and science of predicting future occurrences by obtaining past data and projecting it forward using various mathematical models (Pang et al., 2019; Sofyan et al., 2017). Forecasting methods may be used in a variety of fields, including business, engineering and research, manufacturing, distribution and logistics, human resources, marketing, and sales (Martins & da Cruz, 2018). Companies utilize a variety of forecasting, including technological, economic, and product or service sales (Mathew et al., 2013). Forecasting raw material demand is one of the most significant activities in establishing the effectiveness of inventory management (Mesjasz-Lech, 2011). There is an association between accurate forecasting and fulfilling demand (Kourentzes et al., 2020). Successful businesses always create precise forecasts for product demand and then put them into production based on those forecasts (Xi & Sha, 2014). A forecasting model of demand, EOQ, safety stocks, and reorder point, should be used to reduce stock-out (Mathew et al., 2013). Forecasting Economic Order

Quantity, safety stock, and reorder point can help to decrease inventory costs (Inprasit & Tanachutiwat, 2018; Irmayanti, 2019; Zhong & Zhang, 2015).

The critical decision in an inventory system is determining how much and when to order (Mokhtari, 2018), and EOQ is a method for estimating the most efficient order quantity, allowing the organization to make more economical ordering and holding cost (Irmayanti, 2019). EOQ might assist in determining the optimum ideal order quantity at the lowest price offered by the organization (Gonzales & Gonzales, 2014). EOQ is the most cost-effective volume or the number of purchases (Lesmana et al., 2018). The fundamental concept of EOQ is based on the relationship between the purchase cost and stock level change according to the order quantity, as does the holding cost (Korponai et al., 2017; Mokhtari, 2018).

According to Amirjabbari & Bhuiyan (2014), reduced inventory will lead to uncertainty and stock-out. Therefore, safety stock is required to protect against these types of uncertainty. Effective management of safety stock, as one of the most significant drivers of inventory, has become a vital goal for lean and efficient inventory. The quantity of safety stocks necessary to achieve a specific level of customer service is determined by the degree of unpredictability demand (Beutel & Minner, 2012). By raising the safety stock, the probability of a shortage decreases while increasing the inventory costs (Korponai et al., 2017). Nevertheless, companies must pay the expenses of physical flow, storage, stock maintenance, and stock depletion to provide the best level of customer service (Kot & Grondys, 2011). An optimization safety stock may be based on such as cost minimization, which will improve market competitiveness and better satisfy the consumers' demands (Amirjabbari & Bhuiyan, 2014).

In supply chain management, the reorder point for an inventory system is critical (Nobil et al., 2020). Based on previous demand, reorder point will suggest when to place an order for certain items (Gonzales & Gonzales, 2014). The reorder point is the point at which items can be restocked and distributed on time (Efrilianda & Isnanto, 2018).

The purpose of this study was to calculate the prediction of raw material inventory by forecasting the Economic Order Quantity (EOQ), safety stock, and reorder point in support of the continuity production process. Therefore, a fence manufacturer, CV. Moderen Arsiteknis in Kupang City was chosen for this study. Thus far, the organization has simply estimated inventory by anticipating the requirement for raw materials based on prior periods' usage. Consequently, more accurate calculations are required since the optimal and efficient techniques of inventory control are crucial (Ikasari et al., 2018).

## LITERATURE REVIEW

### Inventory

Inventory is a type of asset that contains products possessed by the company to sell during a normal business period. Thus, inventory is the number of available items to fulfill client demand (Lesmana et al., 2018; Salu & Nyoko, 2018). Leseure (2010) listed several reasons why inventories are necessary: to meet anticipated demand; to smooth production requirements; to protect against stock-outs; to capitalize on order cycles; to hedge against price increases or to take advantage of quantity discounts; to permit operations; and to decouple components of the production-distribution system. Otherwise, it will result in production delays, shortages, and/or dissatisfied consumers.

The dilemma of inventory management is that inventory is required, but it creates inventory expenditures (Plinere & Borisov, 2015). Due to corporate inventory being linked to cash flows, firms place a high value on the issue of how to keep inventory safe (Zhong & Zhang, 2015). An inventory control system may calculate the economic order quantity, safety stock, and reorder point (Efrilianda & Isnanto, 2018). Effective inventory management may guarantee that the proper quantity and quality of supplies are simply delivered on time (Pang et al., 2019)

**Demand forecasting**

Demand forecasting is the process of projecting the demand for goods or services for future periods, which is useful in many fields, notably inventory management (Benhamida et al., 2021). Most inventory systems have traditionally prioritized accurate forecasting approaches (Pang et al., 2019). Forecasting is the use of a model that has been created to estimate the future (Muqtadiroh et al., 2015). In general, forecasting is the prediction of a future event (Mathew et al., 2013). The essence of forecasting is estimating future occurrences based on previous patterns and applying policies to forecast based on past patterns (Lesmana et al., 2018; Yamit, 2003). Forecasting is a decision that informs about the existence of a certain phenomenon at a specific point in the future that is unknown at the time of its formulation (Kot & Grondys, 2011).

Demand forecasting is frequently dependent on time series data, which is the most prevalent sort of historical data (Benhamida et al., 2021). The judgment is made using a qualitative approach and advanced quantitative algorithms (Burinskiene, 2022). Forecasting techniques such as linear regression with a trend can be used to examine it (Pang et al., 2019). The Least Squares approach involves fitting two parameters, a and b, of a line equation ($y = ax + b$), where y is the forecast for period x (Martins & da Cruz, 2018).

**Economic Order Quantity**

Economic Order Quantity (EOQ) is a method for estimating the most efficient order quantity for a certain interval of time and purchasing frequency so that the organization may make more cost-effective purchasing and inventory costs (Irmayanti, 2019). Çalışkan, (2021:1) explained, "In the EOQ model, inventory holding cost consists of two parts: (i) a financial cost that is expressed as the opportunity cost of capital tied up in the form of physical items in the inventory and (ii) a warehousing cost that includes the costs of transportation and handling, heating and cooling, security, insurance, obsolescence, spoilage, taxes, rent, etc".

The Economic Order Quantity (EOQ) formula has been utilized in both engineering and business disciplines as a practical and particular application in presenting notions of cost tradeoffs, as well as a specific use in inventory management (Gonzales & Gonzales, 2014). According to Cargal (2003), the formula of Economic Order Quantity (EOQ) contains; the annual demand of a product in quantity per unit of time (D), product order cost (S), unit cost (C), and holding cost per unit as a fraction of product cost (H). There are some assumptions in using the EOQ model and these are as follows (Cargal, 2003; Pang et al., 2019):

1. The demand is known and constant.
2. The lead time is known and constant.
3. The receipt of inventory is instantaneous.
4. The purchase cost per unit is constant throughout the year.

5. Orders are placed so that stock-outs or shortages are avoided completely.

**Safety stock**

To provide the best possible customer service, businesses must pay the expenses of physical flow, storage, stock maintenance, and stock depletion (Kot & Grondys, 2011). Forecasting corporate safety stock might help to save inventory expenditures (Zhong & Zhang, 2015). The minimum and maximum stock inventory with the lowest cost supply chain is determined by safety stock (Efrilianda & Isnanto, 2018).

Additionally, according to Baroto (2002:84), "the risk of running out of inventory is induced by the following:

1. Greater demand
2. Additional lead time.
3. Excessive demand"

The following formula was used to calculate safety stock (Soares et al., 2019):

Safety stock = [Daily usage] x [Lead Time]

**Reorder Point**

Reorder point is one technique used to analyze stock control (Efrilianda & Isnanto, 2018). The reorder point is an important milestone for businesses to determine the best moment to order to avoid overstocking or shortages (Nobil et al., 2020). Based on previous demand, the reorder point will recommend when to place an order for certain goods (Haobenu et al., 2021). Due to the lead time, the reorder point also enables sufficient stock to be kept on hand to meet demand while the next order comes (Gonzales & Gonzales, 2014).

Gonzales and Gonzales (2014) explained that "in determining the reorder point the following three factors need to be at hand:

1. Demand - Quantity of inventory used or sold each day
2. Lead Time - Time (in days) it takes for an order to arrive when an order is placed
3. Safety Stock - The quantity of inventory kept on hand in case there is an unpredictable event like delays in lead time or unexpected demand."

When a safety stock is maintained, then the reorder point is written as the following (Ikasari et al., 2018):

Reorder Point= [Daily usage x Lead time] + safety stock

**METHOD**

This is a quantitative study that is conducted at CV. Moderen Arsiteknis, a fence manufacturer in Kupang City. The object of this research is the main raw material, the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters, and the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters.

Data were analyzed from records of the period 2013-2017 that consist of the annual demand of a product in quantity per unit of time (D), product order cost (S), unit cost (C), holding cost per unit as a fraction of product cost (H), and lead time (L).

The purpose of this study is to obtain the projection of raw material demand and calculate the Economic Order Quantity (EOQ), safety stock, and reorder point for the next 3 years 2018-2020. The calculation of forecasting and EOQ was done using QM for Windows software version 5.2 while the calculation of safety stock and reorder point formula is as follows:

- Safety stock = [Daily usage] x [Lead Time]
- Reorder Point= [Daily usage x Lead time] + safety stock

## RESULTS AND DISCUSSION

Data of the annual demand of a product in quantity per unit of time (D), product order cost (S), unit cost (C), holding cost per unit as a fraction of product cost (H), and lead time (L) for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters and the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters is as follows:

1. The annual demand

   Table 1 and Table 2 elaborate on the inventory planning and the usage of raw materials each year from 2013 to 2017. Two sizes of raw materials indicated the same trend: stock-outs frequently occurred due to the high demand, which was greater than the planned inventory excluding 2016 and 2017.

**Table 1**
**Planned vs Demand of**
**the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters 2013 -2017**

| Year | Planned (bars) | Demand (bars) |
|---|---|---|
| 2013 | 1.500 | 1.700 |
| 2014 | 2.184 | 2.284 |
| 2015 | 2.808 | 2.920 |
| 2016 | 3.432 | 3.300 |
| 2017 | 3.120 | 3.000 |

Source : CV. Moderen Arsiteknis 2018

**Table 2**
**Planned vs Demand of the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters 2013 -2017**

| Year | Planned (bars) | Demand (bars) |
|---|---|---|
| 2013 | 1.248 | 1.353 |
| 2014 | 1.560 | 1.670 |
| 2015 | 2.496 | 2.603 |
| 2016 | 2.808 | 2.705 |
| 2017 | 2.925 | 2.825 |

Source : CV. Moderen Arsiteknis 2018

2. Product order cost

   Product order costs are the expenses made by the firm to transport raw materials from suppliers to the company's storage facility. This cost rises even further when the frequency of the raw materials ordered rises. Transportation expenses for raw materials are incurred by the firm from the time raw materials are ordered until they arrive at the company's warehouse. Raw material orders are processed every month. The cost of transportation from the supplier to the enterprise was Rp 90,000 for each order placed.

3. Unit cost

   Unit cost is the cost of purchasing a unit of raw material. The cost per unit was Rp. 80,000 for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters, and Rp. 85,000 for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters.

4. Holding cost per unit

   Holding costs are expenses incurred by the corporation as a result of the existence of raw materials in storage warehouses. Depreciation charges, raw material insurance costs, and raw material maintenance costs are all part of the holding costs. These expenses are variable costs that change according to the quantity of inventory of storage costs based on the period of storage and the number of raw materials stored. Each year, holding costs 10% of the average inventory value.

5. Lead Time

   Lead time is the amount of time required between the delivery of raw material orders to the supplier and the arrival of raw materials at the company's warehouse. The lead time required by CV. Modern Arsiteknis, which was two days, was caused by the factor of queuing with other competing firms while ordering. In this scenario, the firm must identify the proper time to reorder by establishing the reorder point so that there are no too-quick orders to amass raw materials and also not too late, resulting in the company running out of raw materials.

## Demand forecasting

From the past data, the forecasting calculations of the raw material demand in the coming years were based on the demands in Table 3 and Table 4. The calculation of forecasting was done using QM for Windows software version 5.2.

According to forecasting, the raw material required for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters in 2018 (X = 3) was 3057.6 bars, in 2019 (X = 4) was 4404 bars, and in 2020 (X = 5) was 4852.8 bars. As for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters, in 2018 (X = 3) was 3588 bars, in 2019 (X = 4) was 4048.2 bars, and in 2020 (X = 5) was 4852.8 bars.

The raw material demand forecasting data are utilized as demand estimates for the following three years, allowing Economic Order Quantity (EOQ), reorder point, and safety stock for 2018-2020 to be determined assuming the ordering cost and holding cost are the same or unchanged each year.

**Table 3**
**Forecasting of the raw material demand for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters**

| Measure | Value |
|---|---|
| Regression line | |
| Demand(y) = 2608,8+ 448,8 * Time(x) | |
| Statistics | |
| Correlation coefficient | ,918 |
| Coefficient of determination (r^2) | ,843 |
| Forecast | |
| x = 3 | 3057.6 |
| x = 4 | 4404 |
| x = 5 | 4852.8 |

Source: calculation by QM for windows 2018

**Table 4**
**Forecasting of the raw material demand for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters**

| Measure | Value |
|---|---|
| Regression line | |
| CDemand(y) = 2207,4 + 460,2 Time(x) | |
| Statistics | |
| Correlation coefficient | ,96 |
| Coefficient of determination (r^2) | ,921 |
| Forecast | |
| x = 3 | 3588 |
| x = 4 | 4048.2 |
| x = 5 | 4508.4 |

Source: calculation by QM for windows 2018

## Economic Order Quantity

Economic Order Quantity (EOQ) computation is required to determine the most cost-effective quantity of raw materials ordered and the number of ordering frequencies (Soares et al., 2019). The data on raw material demand, ordering cost, holding cost, and unit cost are required for EOQ computation. In 2018, the demand obtained from raw material demand forecasting data in Table 3 was 3057.6 per year, the ordering cost was Rp. 90,000, the unit cost, which is the purchase price of 1 unit of raw materials, is Rp. 80,000, and the holding cost was 10% of the unit cost, which was Rp. 8,000. From these data, the EOQ calculation for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters period of 2018 using QM for Windows software version 5.2 can be seen in Table 5.

**Table 5**
**Economic Order Quantity calculation for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters (2018)**

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| Demand rate(D) 262,29 | 3057,6 | Optimal order quantity (Q*) | |
| Setup/ordering cost(S) | 90000 | Maximum Inventory Level (Imax) | 262,29 |
| Holding/carrying cost(H)@10% | 8000 | Average inventory | 131,15 |
| Unit cost | 80000 | Orders per period(year) | 11,66 |
| | | Annual Setup cost | 1049160,0 |
| | | Annual Holding cost | 1049160,0 |
| | | Total Inventory (Holding + Setup) Cost | 2098319,0 |
| | | Unit costs (PD) | 244608000 |
| | | Total Cost (including units) | 246706300 |

Source: calculation by QM for windows 2018

The EOQ calculation for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters for the 2018 period yielded Q* = 262.29, rounded to 263 bars, while the frequency of orders in 1 year (2018) was 11.66, rounded to 12 times. This indicated that to fulfill the demands and get the most optimal ordering cost and holding cost, 263 bars of raw materials per order must be purchased at a frequency of 12 times a year or once a month.

By using the same calculation approach, the EOQ for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters for the 2019 period was 315 bars with a purchasing frequency of 14 times, and for the 2020 period, the EOQ was 331 bars with a purchasing frequency of 15 times.

For the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters, the demand rate obtained from raw material demand forecasting results in 2018 is 3588 per year, the ordering cost was Rp. 90,000, the unit cost, which was the purchase price of 1 unit of raw materials, was Rp. 85,000, and the holding cost was 10% of the unit cost of Rp. 8,500.

Table 6 shows the computation of EOQ for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters using QM for Windows software version 5.2 for the year 2018.

**Table 6**
**Economic Order Quantity calculation for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters (2018)**

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| Demand rate(D) | 3588 | Optimal order quantity (Q*) | 275,65 |
| Setup/ordering cost(S) | 90000 | Maximum Inventory Level (Imax) | 275,65 |
| Holding/carrying cost(H)@10% | 8500 | Average inventory | 137,82 |
| Unit cost | 85000 | Orders per period(year) | 13,02 |
| | | Annual Setup cost | 1171499 |
| | | Annual Holding cost | 1171499,0 |
| | | Total Inventory (Holding + Setup) Cost | 2342998 |
| | | Unit costs (PD) | 304980000 |
| | | Total Cost (including units) | 307323000 |

Source: calculation by QM for windows 2018

The EOQ calculation for Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters for the 2018 period yielded Q* = 275.65, or rounded to 277 bars, while the frequency of orders in 1 year (2018) was 13.02, or rounded to 13 times. This indicated that to fulfill the demands and get the most optimal ordering cost and holding cost, 277 bars of raw materials per order must be purchased at a frequency of 13 times a year.

Using the same calculation approach, the EOQ for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters for the 2019 period was 293 bars with a 14-time purchasing frequency and 309 bars with a 15-time purchasing frequency for the 2020 period.

## Safety Stock

Safety stock calculations anticipate a rise in demand, stock-outs at suppliers, and late orders for raw materials resulting in a longer lead time (Baroto, 2002).

In 2018, 3057.6 bars per year or 254.8 bars per month are required for the raw material of the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters. If 26 working days are considered, the raw material daily usage is 9.8 bars. The lead time required to order raw materials was two days. So the safety stock is calculated as follows:

Safety stock = [Daily usage] x [Lead Time]

= 9.8 x 2
= 19.6 bars
≃ 20 bars

Using the same procedure, the safety stock of the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters was obtained in 2019 as many as 29 bars and 2020 as many as 32 bars.

For the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters, in the year 2018, the required raw material was 3588 bars per year or 299 bars per month. If the number of working days was considered to be 26, the daily usage of raw material was 11.5 bars. The lead time for raw materials took two days. The safety stock calculation is thus as follows:

Safety stock = [Daily usage] x [Lead Time]
= 11.5 x 2
= 23 bars

Using the same method, safety stock for the Rectangular Hollow 40 mm x 60 mm x 60 mm x 2 mm x 6 meters was obtained as many as 26 bars in 2019 and as many as 29 bars in 2020.

By considering safety stock, the risk of raw material stock-out due to delays in raw material delivery is reduced, ultimately ensuring the continuation of the manufacturing process.

**Reorder Point**

The reorder point will suggest when to make an order (Haobenu et al., 2021). Based on the preceding calculation, the raw material daily usage for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters in 2018 was 9.8 bars per day, with a lead time of 2 days and a safety stock of 20 bars, thus the reorder point calculation is as follows:

Reorder Point= [Daily usage x Lead time] + safety stock
= [9.8 x 2] + 20
= 39.6 bars
≃ 40 bars

Using the same procedure, the reorder point for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters was obtained in 2019 with as many as 58 bars and in 2020 with as many as 64 bars.

The raw material daily usage for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters in the 2018 period was 11.5 bars per day, with a lead time of 2 days and a safety stock of as many as 23 bars, so the reorder point calculation is as follows:

Reorder Point= [Daily usage x Lead time] + safety stock
= [11.5 x 2] + 23
= 46 bars

Using the same method, the reorder point for the Rectangular Hollow 40 mm x 60 mm x 60 mm x 2 mm x 6 meters was obtained in 2019 with as many as 52 bars and in 2020 with as many as 58 bars.

Observing the reorder point implies that when the inventory level reaches the stock safety level, the firm must make another order to avoid running out of stock.

The calculation of demand forecasting, Economic Order Quantity (EOQ), order frequency, safety stock, and reorder point of two types of raw materials are summarized in Table 7 and Table 8.

**Table 7**
**Demand forecasting of raw material, Economic Order Quantity (EOQ), order frequency, safety stock, and reorder point for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters 2018-2020**

| Year | Demand forecasting (bars) | EOQ (bars) | Order frequency (times) | Safety Stock (bars) | Reorder Point (bars) |
|---|---|---|---|---|---|
| 2018 | 3057.6 | 263 | 12 | 20 | 40 |
| 2019 | 4404 | 315 | 14 | 29 | 58 |
| 2020 | 4852.8 | 331 | 15 | 32 | 64 |

Source: recap of calculation, 2018

**Table 8**
**Demand forecasting of raw material, Economic Order Quantity (EOQ), order frequency, safety stock, and reorder point for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters 2018-2020**

| Year | Demand forecasting (bars) | EOQ (bars) | Order frequency (times) | Safety Stock (bars) | Reorder Point (bars) |
|---|---|---|---|---|---|
| 2018 | 3588 | 277 | 13 | 23 | 46 |
| 2019 | 4048.2 | 293 | 14 | 26 | 52 |
| 2020 | 4852.8 | 309 | 15 | 29 | 58 |

Source: recap of calculation, 2018

## CONCLUSION AND RECOMMENDATIONS

The forecast of raw materials for the 2018-2020 period was generated by regressing data on raw material usage in the past five years. According to the preceding five years of data, it can be observed that two categories of raw materials have undergone a rising trend. It will be easier to decide on the number of raw materials that will be purchased if the predicted consumption of raw materials is calculated. The corporation estimated the increase in demand for the next periods based on raw material utilization from the previous year. It is assumed that by utilizing forecasting techniques, the estimated future demands would not deviate much from the actual demands (Kourentzes et al., 2020). Nevertheless, the use of forecasting in this form of regression assumes that the demands are normal and that there is no economic or social turbulence.

The computation of Economic Order Quantity (EOQ) is required to determine the most economical quantity of raw materials ordered as well as the number of order frequencies. EOQ optimizes ordering cost and holding costs (Gonzales & Gonzales, 2014). If the amount of raw material orders exceeds the requirements in the production cycle, it reduces the risk of running out of raw materials, and saves on ordering costs due to reduced frequency of orders, but increases holding costs since raw materials are retained longer in inventory. Meanwhile, if the quantity of raw materials ordered is less than the demand in the production cycle, it will reduce holding costs because raw materials are quickly depleted, but it will raise the risk of running out of raw materials and ordering costs since the frequency of ordering is higher. According to the EOQ calculation for the raw material of the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters, in 2018, the firm needed to purchase 263 bars on a constant order basis and make 12 purchases per year or on a monthly basis to fulfill the raw material's annual demand of 3057.6 bars. The frequency of these purchases is the same as the previous company's estimate, which is once a month, but their volume of purchases was not constant, therefore there is the possibility of overstocking or running out of stock. The frequency of raw material purchases in 2019 and 2020 is higher than 12 times per year, implying that the company must have made another purchase in less than 1 month. Otherwise, it will raise the holding cost. To reduce holding costs, they must purchase a smaller amount of orders but with a higher frequency of orders for the Square Hollow 40 mm x 40 mm x 2 mm x 6 meters in the years 2019–2020 and for the Rectangular Hollow 40 mm x 60 mm x 2 mm x 6 meters in the years 2018–2020. The demand, lead time, and raw material cost are assumed to be known and constant in this EOQ calculation.

Safety stock is required to prepare for the possibility of raw material shortages due to increased demand (Baroto, 2002). A certain amount of raw material stocks exceeding actual demand must be kept; therefore, stockouts must be avoided. Thus far, the corporation has not kept safety stock, resulting in raw material shortages occasionally. The computation of safety stock is intended to determine how much efficient safety stock is required. Safety stock incurs additional expenses, requiring a more careful assessment to avoid excess inventory and higher raw material purchase costs.

A reorder point is the level of the remaining inventory at which raw materials must be purchased (Haobenu et al., 2021). Reorder points include the lead time of the order as well as the amount of safety stock retained. When the inventory position exceeds the reorder point level, the firm must order again. This is done to replenish the stock of raw materials before they run out. By determining the amount of reorder points, the raw materials purchased are expected to arrive at the warehouse when supplies run out, allowing the manufacturing process to function smoothly.

The computation of demand forecasts, EOQ, safety stock, and reorder points was intended to ease the continuity of the production process in CV Modern Arsiteknis, reduce the risk of raw material shortages, and minimize the ordering cost and holding cost.

This study is limited to CV. Modern Arsiteknis with normal demand assumptions and did not calculate forecasting errors. It is suggested that future studies apply to other organizations and calculate using different forecasting methods, such as exponential smoothing or a seasonality model, and compute the error forecasting to determine the accuracy of the forecasting approach.

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