**Determination Lot Sizing Material Equal-angel Iron for Tower PT. X**

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**Abstract.** PT. X is a company that manufactures telecommunication towers, electricity towers, street lighting, guardrail, and others. PT. X strives to have stock material in order to be able to run production and meet customer needs. In the process of procuring raw materials at PT. X there is a problem, the delay in sending raw materials to the factory. Therefore in this practical work I will discuss the lot sizing at PT. X in determining the most effective technique to be applied, so that the production process is not hampered and can reduce production costs, especially on the cost of procuring raw materials. Then the ordering of raw materials is ordered using the Lot For Lot method, Economic Order Quantity and Period Order Quantity. The first step is to collect demand data of 40x40x4x6000 equal-angel iron for the tower. Then proceed with the calculation method using Microsoft Excel. The final step taken next is to analyze the calculations using these 3 methods. The results of this study the Period Order Quantity method has the smallest total cost.

1. **Introduction**

In this 4.0 Industry era, competition is increasingly fierce and competitive. Every company has a way to win the competition. For the example is to ensure the product planning. PT. X is a company that manufactures telecommunication towers, electricity towers, street lighting, guardrail, and others. PT. X strives to have stock material in order to be able to run production and meet customer needs. In the process of procuring raw materials at PT. X there is a problem, the delay in sending raw materials to the factory. Therefore in this study, will discuss about lot sizing at PT. X in determining the most effective technique to be applied. With the planning of ordering raw materials (equal-angel iron) using lot sizing techniques in addition to improving the production process so that it is not hampered because raw material aren’t available yet and can also reduce production costs, especially on the cost of procuring raw material.

2. **Method**

The method used in this research is Lot Sizing (Lot for Lot, Economic Order Quantity, Period Order Quantity). Lot For Lot technique aims to minimize storage costs to zero, because the lot size is the same as the need. Economic Order Quantity uses the concept of minimization of storage costs and order costs where the lot size remains based on the calculated minimization. [1] Period Order Quantity is the development of the Economic Order Quantity (EOQ) method for unequal requests over several periods. [2]
3. Results and Discussion

3.1. Collecting Data

Begins by collect product demand data of 40x40x4x6000 equal-angel iron for the tower. Which can be seen in Table 1 below

| Table 1. Product Demand |
|-------------------------|
| Period | Demand (ton) |
|-------------------------|
| 1         | 9,438        |
| 2         | 18,309       |
| 3         | 12,356       |
| 4         | 2,976        |
| 5         | 0,58         |
| 6         | 5,488        |
| 7         | 7,36         |
| 8         | 7,477        |
| 9         | 37,316       |
| 10        | 19,021       |
| 11        | 25,41        |
| 12        | 2,366        |
| **Total** | **147,997** |

In the process of applying the lot sizing method, several things are needed. These are as follows:

- **Lead Time**
  Lead time is the time waiting period for an order or the time period for ordering each item of raw material. The lead time needed is 1 week (period). [3]

- **Order Amount**
  The order amount is the order quantity must be ordered based on lot sizing.

- **Order Cost**
  Order cost is the cost required to place an order. For example, transportation costs (shipping) or other cost. The cost of ordering equal-angel iron material PT. X

| Table 2. Order Cost |
|---------------------|
| Transportation Cost |
| Rp 40/kg            |
| Rp 580/bar          |
| RP 40,000/ton       |

d. **Holding Cost**
  Holding Cost are cost related to storage, warehouse cost, warehouse electricity costs, or warehouse employee costs. The cost of warehouse electricity is Rp 7874/ton

3.2. Calculation the methods

Calculation of lotting with Lot For Lot Method

The use of Lot For Lot technique aims to minimize the cost of saving, so using this technique the cost of warehouse becomes zero. Therefore, it is often used for items that have a veryhigh cost unit save.
Table 3. Calculation of lotting with Lot For Lot Method

| LT = 1 period (week) | Past due | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------------------|----------|---|---|---|---|---|---|---|---|---|----|----|----|
| work                |          |   |   |   |   |   |   |   |   |   |    |    |    |
| Gross requirements  |          |   |   |   |   |   |   |   |   |   |    |    |    |
| Receipt             |          |   |   |   |   |   |   |   |   |   |    |    |    |
| On hand             |          |   |   |   |   |   |   |   |   |   |    |    |    |
| Net requirements    |          |   |   |   |   |   |   |   |   |   |    |    |    |
| Order receipt       |          |   |   |   |   |   |   |   |   |   |    |    |    |
| Order release       |          |   |   |   |   |   |   |   |   |   |    |    |    |

Holding Cost using Lot For Lot Method

Total Holding Cost = Amount on hand \times Price of holding cost

Total Holding Cost = 16,074 ton \times Rp 7874 = Rp 126,564

Order Cost using Lot For Lot Method

Total Order Cost = Order Release \times Price of order cost

Total Order Cost = 122,485 \times Rp 40,000 = Rp 4,899,414

Total Cost using Lot For Lot Method

Total Cost = Rp 126,564 + Rp 4,899,414 = Rp 5,025,978

Calculation of lotting with Economic Order Quantity Method

Calculations using the EOQ method use the following formula [4]

\[ EOQ = \sqrt{\frac{2 \times D \times S}{H}} \]

\[ EOQ = \sqrt{\frac{2 \times 147,997 \times Rp 40,000}{Rp 7874}} \]

\[ EOQ = 38,77 \text{ ton} \]

EOQ = Economic Order Quantity

D = Demand

S = Order Cost

H = Holding Cost

Frequency Order = \frac{D}{EOQ}

Frequency Order = \frac{147,997}{38,77} = 3,817 = 4 times

EOQ = Economic Order Quantity

D = Demand
**Table 4. Calculation of lotting with Economic Order Quantity Method**

| LT = 1 period (week) | Time |
|----------------------|------|
| work Past due | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Gross (requirements) | 9,438 | 18,309 | 12,356 | 2,976 | 0,58 | 5,488 | 7,26 | 7,478 | 37,316 | 19,021 | 25,41 | 2,366 |
| Receipt | 25,5116 | 16,074 | 36,535 | 24,179 | 21,203 | 20,623 | 15,135 | 7,875 | 0,398 | 1,8521 | 21,601 | 34,961 | 31,595 |
| Net requirements | 0 | 2,2350 | 0 | 0 | 0 | 0 | 0 | 36,918 | 17,169 | 3,809 | 0 |
| Order receipt | 0 | 38,770 | | | | | | 38,773 | 38,773 | 38,773 |
| Order release | 38,770 | | | | | | 38,773 | 38,773 | 38,773 |

Holding Cost using Economic Order Quantity Method

*Total Holding Cost = Amount on hand \times Price of holding cost*

*Total Holding Cost = 233,027 ton \times Rp, 7874 = Rp 1,834,852*

Order Cost using Economic Order Quantity Method

*Total Order Cost = Order Release \times Price of order cost*

*Total Order Cost = 155,08 \times Rp 40,000 = Rp 6,203,200*

Total Cost using Economic Order Quantity Method

*Total Cost = Rp 1,834,852 + Rp 6,203,200 = Rp 8,038,052*

Calculation of lotting with Period Order Quantity Method

According to Hansa, A. P. A., (2015) Period Order Quantity is an approach using this concept of economic order quantities to be used in discrete or diverse demand periods. [5] In this method, POQ does not have a certain lot size but it will follow the demand requirements every month. POQ value can be known from the following formula:

\[
EOI = \frac{D}{Q}
\]

\[
EOI = \frac{147.99}{38.77} = 3,817 \times 4 = 4 \text{ times}
\]

\[
POQ = \frac{12 \text{ week}}{4 \times \text{times}} = 3
\]

*POQ = Period Order Quantity*

*EOI = Economic Order Interval*

*D = Demand*

*Q = Quantity*

**Table 5. Calculation of lotting with Period Order Quantity Method**

| LT = 1 period (week) | Time |
|----------------------|------|
| work Past due | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Gross (requirements) | 9,438 | 18,309 | 12,356 | 2,976 | 0,58 | 5,488 | 7,26 | 7,478 | 37,316 | 19,021 | 25,41 | 2,366 |
| work | Past due | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
|------|----------|----|----|----|----|----|----|----|----|----|----|----|----|
| Gross (requirements) | 9.43% | 18.30% | 12.35% | 2.97% | 0.58% | 5.48% | 7.2% | 7.47% | 37.31% | 19.02% | 25.4% | 2.36% |
| Receipt | 25.51% | 16.0% | 15.33% | 2.97% | 0% | 12.7% | 7.2% | 0% | 56.33% | 19.02% | 0% | 2.36% |
| On hand | 25.51% | 16.0% | 15.33% | 2.97% | 0% | 12.7% | 7.2% | 0% | 56.33% | 19.02% | 0% | 2.36% |
| Net requirements | 0% | 2.235% | 0% | 0% | 0.58% | 0% | 7.47% | 0% | 0% | 25.4% | 0% |
| Order receipt | 17.56% | 7% | 13.3% | 28% | 63.8% | 14% | 27.7% | 76% |
| Order release | 17.56% | 7% | 13.3% | 28% | 63.8% | 14% | 27.7% | 76% |

Holding Cost using Period Order Quantity Method

\[ Total \text{ Holding Cost} = \text{Amount on hand} \times \text{Price of holding cost} \]
\[ Total \text{ Holding Cost} = 132,114 \text{ ton} \times Rp \ 7874 = Rp \ 1.040.263 \]

Order Cost using Period Order Quantity Method

\[ Total \text{ Order Cost} = \text{Order Release} \times \text{Price of order cost} \]
\[ Total \text{ Order Cost} = 122,485 \times Rp \ 40.000 = Rp \ 3.788.374 \]

Total Cost using Period Order Quantity Method

\[ Total \text{ Cost} = Rp \ 1.040.263 + Rp \ 3.788.374 = Rp \ 4.828.637 \]

4. Conclusion

Based on the data that has been described. Analysis on lot sizing material equal-angel iron using 3 methods (Lot for Lot, Economic Order Quantity dan Period Order Quantity, it can be seen that the one providing the smallest total cost is the Period Order Quantity (POQ) with a total cost Rp 4.828.637. The benefit of this analysis for PT. X is able to find out which lot sizing techniques can be chosen to be applied so that the company can make savings.

5. References

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