Design analysis of raw materials inventory on TC1118 cloth products with JIT approach

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Abstract. Control of inventory of raw materials becomes an important part of the manufacturing process. By controlling good raw materials will reduce storage costs in warehouses, increase productivity and profits of the company. In this paper use quantitative methods that will result in the calculation of the most efficient order quantity to increase the productivity. Based on the just-time approach, control of raw material inventory is done by planning the purchase of raw materials by using the right delivery system so as to produce short delivery time. By ordering one day and added with proper inventory calculation will result in a reorder point in accordance with the company's production capacity and able to reduce the storage of raw materials in the warehouse. The impact of the implementation of just in time, storage of raw materials in the warehouse becomes less and reduce inventory cost by 9.4%, so as to generate greater profit the company and can make savings of Rp7,581,515,237.

1. Introduction
PT. XYZ is a textile company around the world competing in the field of textiles. The resulting products include woven and colour cloths. Where the resulting product has so many requests from local or international customers. With variations of products produced in roll form willing to compete as a supplier of high quality cloths. Inventory control at PT. XYZ there is a problem with the amount of raw material inventory stored in the warehouse, because demand is not well designed, the amount of product demand is not commensurate with the amount of raw material purchased. This problem is based on inventory data that has unstable stocks in the period from January 2017 to December 2017.

From the data shows that the quantity of demand and quantity of TC1118 raw materials is unstable, causing the amount of stocks to rise and fall and increase inventory costs. And there is also the problem of the number of requests that are not in accordance with the amount of inventory because the inventory design system used cannot adjust the number of customer requests with the amount of inventory contained in the warehouse [1]. Therefore, this study aims to apply good raw material control and can reduce inventory costs at PT. XYZ.
2. Literature Review

2.1. Inventory

Inventory is also an idle source waiting for further processing [2]. The next process is in the form of shopping activities on manufacturing systems, marketing activities of the circulatory system or activities of use in household systems [3]. The need for inventory control systems basically arises because of problems that may be faced by companies in the form of excess or shortage of inventory [4].

2.2. Just in Time

Just in Time is a sustainable and compelling problem-solving philosophy that supports lean production. Lean production (Lean Production) supplies customers exactly as customers want when customers want it, without wastage, through continuous improvement according to [5] quoted in [6].

The basic concept of JIT is to produce the required product, at the right time or required by the customer, in an appropriate quantity with the customer, on every process in the production system, in the most economical or most efficient way through waste elimination and continuous improvement, according to [7].

3. Methodology

The type of this research is Quantitative Research, because this research is a research on a company in the field of textile is precisely about the control of raw materials inventory by the method of Just In Time (JIT) in the form of raw material inventory data in one year more shaped numbers than the narrative [7]. The problems discussed only on the process of controlling the raw materials TC1118 so that will get the solution of the inventory problems in the form of good planning and minimum cost.

3.1. Input data

In this study, there are some data to be entered for processing based on the working procedure of the method used. User demand data for TC1118 Cloth in the period from January 2017 to December 2017 will be description at Table 1.

| Month  | Demand  | Unit |
|--------|---------|------|
| Jan-17 | 306,363 | YARD |
| Feb-17 | 199,906 | YARD |
| Mar-17 | 262,070 | YARD |
| Apr-17 | 100,056 | YARD |
| May-17 | 200,469 | YARD |
| Jun-17 | 156,000 | YARD |
| Jul-17 | 150,509 | YARD |
| Aug-17 | 236,395 | YARD |
| Sep-17 | 205,942 | YARD |
| Oct-17 | 289,308 | YARD |
| Nov-17 | 248,926 | YARD |
| Dec-17 | 100,123 | YARD |

After the request data, there is a raw material requirement for each product produced, Table 2 is the material requirements data for the TC1118 Cloth product.

| Level | Component        | Summary  | Unit | Source |
|-------|------------------|----------|------|--------|
| 0     | Fabric TC1118    | 1        | Yard | Made   |
| 1     | Fabric Gray TC1118 | 1     | Yard | Buy    |
| 1     | Textile Dyes Colour | 0.025 | Kg   | Buy    |
| 1     | Alkali Profix RE  | 0.2     | Kg   | Buy    |
3.2. Just In time method

Based on the system of Just In Time that inventory will follow the amount of usage to be produced as needed [8] quoted in [6], therefore an inventory plan is made based on the assumption of safety stock of 15% of the daily requirement of each raw material.

| Month  | Fabric Grey | Textile Dyes | Alkali Profix |
|--------|-------------|--------------|---------------|
| Jan-18 | 231052      | 5776         | 46210         |
| Feb-18 | 227013      | 5675         | 45403         |
| Mar-18 | 222974      | 5574         | 44595         |
| Apr-18 | 218936      | 5473         | 43787         |
| May-18 | 214897      | 5372         | 42979         |
| Jun-18 | 210858      | 5271         | 42172         |
| Jul-18 | 206820      | 5170         | 41364         |
| Aug-18 | 202781      | 5070         | 40556         |
| Sep-18 | 198742      | 4969         | 39748         |
| Oct-18 | 194703      | 4868         | 38941         |
| Nov-18 | 190665      | 4767         | 38133         |
| Dec-18 | 186626      | 4666         | 37325         |

Based on the above table it can be calculated inventory planning by using the ROP (Re Order Point) method against one of every requirement of raw material to fulfil the production of TC1118 product. Here is an example of Re Order Point calculation for the material of Gray Cloth TC1118:

- Usage for one year = \( \sum Y = 2506067 \) yard
- Usage for one month = \( \frac{\sum Y}{\sum n} = 208839 \) yard
- Usage for one day = \( \frac{\sum Y}{\text{the number of working days a month}} = \frac{208839}{25} = 8354 \) yard
- Use during Lead Time = \( \frac{\text{Usage for one day}}{\text{lead time}} = \frac{8354}{1} = 8354 \) yard
- The number of shipments for one year = \( \frac{\sum Y}{\text{Usage for one day}} = \frac{2506067}{8354} = 300 \) time shipment
- Safety Stock = 15% of raw materials per day = 1253
- ROP = Use during Lead Time + Safety Stock = 8354 + 1253 = 9607 yard

Table 4. Reorder Point Fabric Grey 1118.

| Fabric Gray TC1118 |             |
|--------------------|-------------|
| Usage for one year | 2506067     |
| Usage for one month| 208839      |
| Usage for one day  | 8354        |
| Use during Lead Time| 8354       |
| The number of shipments for one year| 300        |
| Safety Stock       | 1253        |
| Re Order Point     | 9607        |
4. Result and Discussion
Based on the result of forecasting and the result of verification by using Moving Range map then obtained Master Production Schedule for TC1118 Cloth production in 2018 can be represented at Table 5.

Table 5. Master Production Schedule.

| Period | Fabric TC1118 | Textile Dyes Colour | Alkali Profix RE |
|--------|---------------|---------------------|-------------------|
| Jan-18 | 231052        | 5776                | 46210             |
| Feb-18 | 227013        | 5675                | 45403             |
| Mar-18 | 222974        | 5574                | 44595             |
| Apr-18 | 218936        | 5473                | 43787             |
| May-18 | 214897        | 5372                | 42979             |
| Jun-18 | 210858        | 5271                | 42172             |
| Jul-18 | 206820        | 5170                | 41364             |
| Aug-18 | 202781        | 5070                | 40556             |
| Sep-18 | 198742        | 4969                | 39748             |
| Oct-18 | 194703        | 4868                | 38941             |
| Nov-18 | 190665        | 4767                | 38133             |
| Dec-18 | 186626        | 4666                | 37325             |
| Quantities | 1 | 0.025 | 0.2 |
Table 8. Holding Cost.

| Material                  | Holding Summary | Hold Cost | Holding Cost   |
|---------------------------|-----------------|-----------|----------------|
| Cloth TC1118              | 375910          | Rp 1,150  | Rp 432,296,500 |
| Textile Dyes Colour       | 9398            | Rp 5,135  | Rp 48,258,730  |
| Alkali Profix RE          | 75182           | Rp 825    | Rp 62,025,150  |
| **Holding Cost Summary**  |                 |           | **Rp 542,580,380** |

Based on table 6. to 8. the results obtained from the calculation of the amount of purchase costs, ordering costs, and storage costs by using inventory control methods just in time, to compare with the amount of costs by the method used by the company.

PT. XYZ is an industrial company engaged in the manufacture of textile products. PT. XYZ in the form of Cloths and yarns for use as a Cloth-making material and others. In this study focused on producer of gray cloth TC1118 made from gray Cloth, alkali profix RE, and textile dyes colour. Year 2018, PT. XYZ plans and produces TC1118 Cloth production of 2506607 bale. The JIT inventory system seeks to purchase raw material inventory in accordance with the quantity required by the production so that there is no waste of raw material purchases. In the early stages, the planning of raw material purchase must be adjusted to the production target so that it will not exceed the purchase of raw material inventory.

Table 9. Raw Material Purchase Plan Using Just In Time Approach At PT. XYZ.

| Material                  | Usage for one day | Safety Stock | ROP  |
|---------------------------|-------------------|--------------|------|
| Fabric Grey TC1118        | 8354              | 1253         | 9607 |
| Textile Dyes Colour       | 209               | 31           | 240  |
| Alkali Profix RE          | 1671              | 251          | 1921 |

Based on the just-time approach above the table on the control of raw material inventory at PT. XYZ is done by planning the purchase of raw materials by using the right delivery system so as to produce short delivery time. By ordering one day and added with proper inventory calculation will result in a reorder point in accordance with the company’s production capacity and able to reduce the storage of raw materials in the warehouse.

The total inventory cost calculation is done by summing up the purchase cost, ordering cost, and storage cost. The total inventory cost for the condition applied by the company and the conditions of the just-in-time implementation are presented in Table 10. The difference between the total inventory cost between the conditions applied by the company and the condition of the application of just in time is the total amount of savings that can be made by the company.

Table 10. Cost Comparison Of The Applied Companies With A Just In Time System Approach.

| Inventory Cost | Current (Rupiah) | Just In Time (Rupiah) | Saving (Rupiah) |
|----------------|------------------|-----------------------|-----------------|
| Purchase Cost  | Rp 79,026,227,300| Rp 72,343,915,900     | Rp 6,682,311,400|
| Order Cost     | Rp 341,280       | Rp 4,266,000          | -Rp 3,924,720   |
| Hold Cost      | Rp 1,445,708,937 | Rp 542,580,380        | Rp 903,128,557  |
| Total          | Rp 80,472,277,517| Rp 72,890,762,280     | Rp 7,581,515,237|
5. Conclusion
Based on research that has been done on the planning and control of raw materials by using the method just in time it can be generated conclusion as follows, Storage of raw materials in the warehouse becomes less because by using the system just in time raw materials ordered directly manufactured so as to minimize the amount of inventory storage and reduce inventory cost by 9.4%. Company productivity increases with the short lead time of the company and the minimum amount of inventory stored in the warehouse, so as to generate greater profit and the company can make savings of Rp 7,581,515,237.

6. References
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