FARABI
Jurnal Matematika dan Pendidikan Matematika
p-ISSN 2623-2332
e-ISSN **2798-5474**

Implementation of the Just In Time Method to Efficient Production Costs (Literature Review Study)

Gita Shyntia Lumbantobing[1], Putri K Nasution[2]
[1,2]Departement of Mathematics, Faculty of Mathematics and Natural Science, Universitas Sumatera Utara, Medan, 20155, Indonesia
Email: [1]gitatobing0107@gmail.com, [2] putrikhairiah09@gmail.com

ABSTRAK

Dalam kegiatan produksi, masalah persediaan merupakan satu hal yang harus diperhatikan guna menghindari pemborosan dalam proses produksi tersebut. Penelitian ini menunjukan pengendalian persediaan bahan baku dalam suatu produksi untuk mendapatkan tingkat persediaan yang optimal. Metode just in time (JIT) mengurangi tingkat persediaan sehingga dapat menekan biaya seefisien mungkin dengan didasari pada fakta bahwa Just In Time menurunkan lot pengiriman, sebagai sarana untuk menerapkan Just In Time dalam lingkup Lot economic order quantity (EOQ) besar. Berdasarkan penelitian ini diketahui bahwa dengan data yang sama, menggunakan just in time (JIT) biaya yang dikeluarkan lebih kecil dari biaya yang dikeluarkan sebelumnya. Biaya yang dikeluarkan sebelumnya sebesar Rp. 14.019.680,00 sementara dengan menggunakan metode economic order quantity (EOQ) biaya yang dikeluarkan sebesar Rp. 8.497.593,00 dan menggunakan metode just in time (JIT) biaya yang dikeluarkan sebesar Rp. 3.800.239,00 Dari hasil tersebut dapat dilihat bahwa dengan metode just in time (JIT) biaya produksi yang dikeluarkan lebih efisien. Penyelesaian dengan metode just in time (JIT) ini dilakukan dengan bantuan software MATLAB.

Kata kunci: *: Biaya, Just In Time (JIT), Persediaan*

ABSTRACT

In production activities, the problem of inventory is one thing that must be considered in order to avoid waste in the production process. This study shows the control of raw material inventory in a production to get the optimal level of inventory. The just in time (JIT) method reduces the amount of inventory so that it can reduce costs as efficiently as possible. Inventory control with the just in time (JIT) method is the development of the economic order quantity (EOQ) method by reducing shipping lots. Based on this research, it is known that with the same data, using just in time (JIT) the costs incurred are smaller than the costs incurred previously. Costs previously incurred were Rp. 14,019,680.00 using economic order quantity (EOQ) the costs incurred were Rp. 8,497,593,00 while using just in time (JIT) the costs incurred were Rp. 3,800,239, 00 From these results it can be seen that with the just in time (JIT) method the production costs incurred are more efficient. The solution using the just in time (JIT) method is done with the help of MATLAB software.

Keywords: Costs, Inventory, Just In Time (JIT).

A. Introduction

Just In Time (JIT) is a system designed to reduce costs, shorten delivery times, and get good quality as efficiently as possible so that companies are able to deliver their products according to consumer demand by eliminating all kinds of waste in the production process. (Simamora, 2012). One of the advantages of Just In Time (JIT) is that it can save on storage space and costs associated with rental and insurance costs by keeping inventory levels to a minimum.

Just In Time System also known as Toyota Production System developed by Mr. Taiichi Ohno, former vice president of Toyota. Taiichi Ohno argues that what is done in the production process looks at the timeline, from the time the customer orders to receive the money, by eliminating the timeline by eliminating waste that does not add value [2].

timeline

orders ⊢——————————————————————⊣ money

(eliminating waste that does not add value)

In an effort to eficient the cost of raw material inventory, companies can use the Just In Time method, deliveries are carried out regularly and purchases are made in small quantities, so as to reduce storage costs

Inventories are goods belonging to a company for the purpose of selling within a certain period of time, raw materials waiting to be used in the production process or goods that are still in the production process. [3]. Inventory control is a series of control policies to determine the level of inventory that must be maintained, when to make additional inventory orders and how much inventory to order. Inventory control determines and ensures the availability of the right inventory in the right quantity [4]

B. Mathematical Modelling

1. **Economic Order Quantity (EOQ)**

Economic Order Quantity (EOQ) is a calculation made to meet demand without excessive spending. The purpose of the Economic Order Quantity (EOQ) model is to minimize the total cost of inventory. To do this, it is necessary to balance the relevant costs. The two most important categories of inventory costs are ordering costs and holding costs.

1. Ordering Cost

Ordering costs are costs that are used in ordering a stack of supplies or goods needed. Inventory orders must be based on the company's requirements for raw materials, semi-finished products and finished products. Order costs may vary and do not depend on the quantity of goods ordered.

2. Holding Cost

Storage cost is a cost that is used in terms that are classified as inventory storage. In addition to storing inventory, the company also requires costs for inventory. The factors included in this section are:

1. Insurance	4. Warehouse rental fee
2. Tax	5. electricity costs
3. Interest	6. Damage fee

They are assumed to be constant per unit of inventory. The greater the level of inventory, the higher the cost of storing inventory and vice versa.

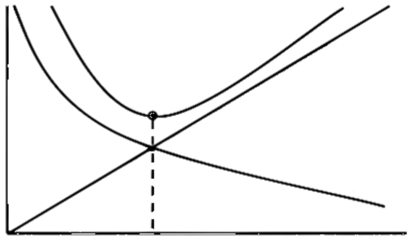

Figure 1. Total cost as a function of order quantity.

It can be seen in Figure (1) that holding costs and ordering costs are not directly proportional or opposite. If inventory is ordered in large quantities, the ordering costs are small but will be hampered by relatively large holding costs. Even so, if the inventory is ordered in small quantity, the frequency of ordering is often held so that it can result in high ordering costs even though it can lead to minimum holding costs. This requires stability between the two costs. In short, the most optimum order quantity is the quantity or order size that has the minimum holding costs and ordering costs

Formulation of the Economic Order Quantity (EOQ) method by balancing storage costs and ordering costs. So that,

$$TC = TC_1 + TC_2 \tag{1}$$

with, $TC_1 = \frac{D}{Q} C_1$, $TC_2 = \frac{Q}{2} C_2$, then the equation can be transformed into another form as:

$$TC = \frac{D}{Q} C_1 + \frac{Q}{2} C_2 \tag{2}$$

where :

D : Number of demand requirements

C_2: holding cost

Q: Economic order quantity (EOQ)

C_1: ordering cost

In obtaining the optimal value of Q with the aim of minimizing the total cost of inventory, equation (2) must be differentiated with respect to Q and then made equal to zero, so that the optimal Q value will be obtained. Where Q is the value of the Economic Order Quantity.

$$\frac{dTC(Q)}{dQ} = 0$$

$$\Leftrightarrow \frac{d(TC_1 + TC_2)}{dQ} = 0$$

$$\Leftrightarrow \frac{d\left(\frac{D}{Q} C_1 + \frac{Q}{2} C_2\right)}{dQ} = 0$$

$$\Leftrightarrow \frac{d\left(\frac{D}{Q}C_1\right)}{dQ} + \frac{d\left(\frac{Q}{2}C_2\right)}{dQ} = 0$$

$$\Leftrightarrow \left(-\frac{D}{(Q)^2}C_1\right) + \frac{C_2}{2} = 0$$

$$\Leftrightarrow \frac{C_2}{n} - \frac{D}{(Q)^2}C_1 = 0$$

$$\Leftrightarrow \frac{C_2}{2} = \frac{DC_1}{(Q)^2}$$

$$\Leftrightarrow (Q)^2 = \frac{2DC_1}{C_2}$$

$$\Leftrightarrow Q = \sqrt{\frac{2DC_1}{C_2}} = EOQ \qquad (3)$$

2. Just In Time Inventory Control (JIT/EOQ)

The Just in Time Inventory Control (JIT/EOQ) model is a combination of the Economic Order Quantity model and the Just In Time system. This JIT/EOQ formula is based on the fact that Just In Time reduces shipping lots, as a means to implement Just In Time in large EOQ Lot scopes [5].

The formulation of the Just In Time Inventory Control method is obtained from the reduction in total costs developed through the Economic Order Quantity (EOQ) method with equation (1) where by reducing the shipping lot it will affect the average inventory so that it is obtained $TC_1 = \frac{D}{Q_n}C_1$, $TC_2 = \frac{Q_n}{2n}C_2$, then the equation can be transformed into another form as:

$$T_{JIT} = \frac{D}{Q_n}C_1 + \frac{Q_n}{2n}C_2 \qquad (4)$$

where :
D : Number of demand requirements
C_2: holding cost
Q_n : Optimum order quantity
C_1: holding cost
n : Optimum number of shipments.

In obtaining the optimal value of Q_n with the aim of minimizing the total cost of inventory by reducing shipping lots, equation (4) must be differentiated against Q_n and then made equal to zero, so that the optimal value of Q_n will be obtained. Where Q_n is the value of Just in Time Inventory Control

$$\frac{dT_{JIT}(Q_n)}{dQ_n} = 0$$

$$\Leftrightarrow \frac{d(TC_1 + TC_2)}{dQ_n} = 0$$

$$\Leftrightarrow \frac{d\left(\frac{D}{Q_n}C_1 + \frac{Q_n}{2n}C_2\right)}{dQ_n} = 0$$

$$\Leftrightarrow \frac{d\left(\frac{D}{Q_n}C_1\right)}{dQ_n} + \frac{d\left(\frac{Q_n}{2n}C_2\right)}{dQ_n} = 0$$

$$\Leftrightarrow \left(-\frac{D}{(Q_n)^2}C_1\right) + \frac{C_2}{2n} = 0$$

$$\Leftrightarrow \frac{C_2}{2n} - \frac{D}{(Q_n)^2}C_1 = 0$$

$$\Leftrightarrow \frac{C_2}{2n} = \frac{DC_1}{(Q_n)^2}$$

$$\Leftrightarrow (Q_n)^2 = \frac{2nDC_1}{C_2}$$

$$\Leftrightarrow Q_n = \sqrt{\frac{2nDC_1}{C_2}} = JIT/EOQ$$

or

$$Q_n = \sqrt{n}\sqrt{\frac{2DC_1}{C_2}}$$

By substituting equation (2.4) we get,

$$\Leftrightarrow Q_n = \sqrt{n} \times EOQ \qquad (5)$$

where :
EOQ: Economic Order Quantity (EOQ)

3. Optimum ordering frequency.

Optimum order frequency is the size or number of orders made during one period. The order frequency is obtained by dividing the total demand by the optimum order quantity,

$$F = \frac{D}{Q_n} \qquad (6)$$

where :
F = optimum ordering frequency
Q_n = Optimum order quantity
D = number of demand needs in a period

4. Total inventory cost (T_{JIT})

Total inventory cost with Just In Time (T_{JIT}) is the total of total ordering cost (TC_1) and total holding cost ((TC_2) in one period

1. Total cost of the message (TC_1)

The total cost of ordering will vary based on the frequency level of goods ordered. Ordering costs are limited by the quantity of goods ordered. If the level of orders held during a period increases, the cost of ordering in that period will also increase. Meanwhile, if the level of orders placed during a period decreases, the cost of ordering in that period will also decrease.

$$TC_1 = \frac{D}{Q_n} C_1 \quad (7)$$

1. Total storage cost (TC_2)

The total holding cost is based on the size of orders placed in storage by subtracting shipping lots. The larger the order size, the more storage costs will be in one period and vice versa.

$$TC_2 = \frac{Q_n}{2n} C_2 \quad (8)$$

Then the calculation of the total cost of raw material inventory using the Just In Time method, namely,

$$T_{JIT} = TC_1 + TC_2$$

$$\Leftrightarrow T_{JIT} = \frac{D}{Q_n} C_1 + \frac{Q_n}{2n} C_2$$

$$\Leftrightarrow T_{JIT} = \frac{D}{Q_n\sqrt{n}} C_1 + \frac{Q_n\sqrt{n}}{2n} C_2$$

$$\Leftrightarrow T_{JIT} = \frac{D}{Q_n\sqrt{n}} C_1 + \frac{Q_n\sqrt{n}}{2n} C_2 \left(\frac{\sqrt{n}}{\sqrt{n}}\right)$$

$$\Leftrightarrow T_{JIT} = \frac{D}{Q_n\sqrt{n}} C_1 + \frac{Q_n n}{2n\sqrt{n}} C_2$$

$$\Leftrightarrow T_{JIT} = \left(\frac{1}{\sqrt{n}}\right)\left(\frac{D}{Q_n} C_1 + \frac{Q_n}{2} C_2\right)$$

Or

$$\Leftrightarrow T_{JIT} = \left(\frac{1}{\sqrt{n}}\right) TC \quad (9)$$

where :

TC = Total cost of ordering with EOQ

T_{JIT}= optimum total inventory cost

Q_n = quantity of goods per order

D = number of demand needs in a period

C_1= cost per order

C_2= holding cost per unit

5. Optimal Delivery Amount

Equation (5) is substituted into the optimal average inventory formula $a = \frac{Q_n}{2n}$ then,

$$a = \frac{Q_n}{2n}$$

$$\Leftrightarrow a = \frac{\sqrt{\frac{2nDC_1}{C_2}}}{2n}$$

$$\Leftrightarrow a = \frac{\sqrt{n}\sqrt{\frac{2DC_1}{C_2}}}{2n}$$

$$\Leftrightarrow a = \frac{\sqrt{n} \times EOQ}{2n}$$

$$\Leftrightarrow 2na = \sqrt{n} \times EOQ$$

$$\Leftrightarrow \frac{n}{\sqrt{n}} = \frac{EOQ}{2a}$$

$$\Leftrightarrow \left(\frac{n}{\sqrt{n}}\right)^2 = \left(\frac{EOQ}{2a}\right)^2$$

$$\Leftrightarrow \frac{n^2}{n} = \left(\frac{EOQ}{2a}\right)^2$$

$$\Leftrightarrow n = \left(\frac{EOQ}{2a}\right)^2 \quad (10)$$

where :

a : Specific target average

n: Optimum delivery quantity

EOQ : Economic Order Quantity

6. The "Lilliefors" test.

Normality test with lilliefors is needed in inventory control to determine distribution pattern. The distribution pattern is used to determine whether the data to be processed using the Just In Time method comes from a population that is normally distributed or not, so it can be assumed that the sample obtained truly represents the population. Data that is normally distributed has a normal/directed pattern of data distribution, generally depicted by a graph with a bell-shaped and symmetrical curve.

To determine the value and shape of the normal distribution graph, two measurement parameters are needed, namely the average value and the standard deviation. The vertex in the graph is determined by the mean value and the width of the center point (mean) is determined by the standard deviation. Lillifors test transforms the data in Z values so that the area of the normal curve can be calculated as normal cumulative probability ($F(Z_i)$). After that, the magnitude of the difference between the probability and the empirical cumulative probability $S(Z_i)$ is sought. Then the biggest difference or L_{count} compared to L_{table} (Noor, 2016). Suppose the sample size is n with data values 1,2,…,i, then the proof steps are:

1. Setting the hypothesis
   H_0 :Distribution of population data is normal;
   H_a : Distribution of population data is not normal
2. Calculating the significance level α

3. Calculate the standard number of each data (X)

$$Z_i = \frac{X_i - \bar{X}}{s}$$

Where,
Determine the average

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Determine the standard deviation

$$s = \sqrt{\frac{\sum_{i=1}^{n} (X_{i-}X)^2}{n-1}}$$

4. Calculating raw number probability cumulatively

$$F(Z_i) = P(Z) \leq Z_i$$

5. Count

$$S(Z_i) = \frac{banyaknya\ Z\ \leq Z_i}{n}$$

6. Calculate the difference $|F(Z_i) - S(Z_i)|$
7. Find the largest value among absolute values (L_0)
8. Make a comparison of L_0 with a table of critical values for the liliefors test

C. Implementation

1. The assumptions used

The assumptions used in the Just In Time Inventory Control method include:

1. The requirement per period is deterministic and remains at D.
2. The constant ordering cost for each order is C_1.
3. The holding cost per unit per time period is C_2.
4. Order delivery times are constant.
5. No discount
6. The inventory level of each order is known.
7. There are no reorders due to lack of stock

2. Data Collection

Assuming an example of the production of galvanized raw materials for a period of 12 months (1 year) [7], To implement the just-in-time method to streamline production costs, the following data are needed:

1. Data on the number of orders and the use of a galvanized raw material

Month	**Ordering galvanized raw materials (sheets)**	**Use of galvanized raw materials (sheet)**
January	775	811
February	630	625
March	910	912
April	1020	1000
May	840	853
June	995	825
July	800	952
August	500	521
September	652	670
October	1300	1250
November	910	942
December	900	838
Amount	**10232**	**10199**
Average	**852,67**	**849,92**

Table (1) shows that the number of orders in January is smaller than the number of uses, this is because the company still has 50 pieces of galvanized raw material in stock.

2. raw material inventory cost

table 2. raw material inventory cost

fee type	total cost
Ordering cost	Rp, 885.000,00/ order
Holding cost	Rp. 4000,00/ unit

In general, the elements of inventory costs are holding costs and ordering costs.

$TIC_{per} = Biaya\ Pemesanan + Biaya\ Penyimpanan$

$$TIC_{per} = (\bar{D} \times C_1) + (n \times C_2)$$

where:
TIC_{per} : Total company cost
$\bar{D}$: Average use of raw materials for one year (one period)
C_1 : Ordering Costs
n :Number of months in one period (12 months)
C_2 : holding costs

Then the total cost of the company's storage is as follows:

$TIC_{per} = (\bar{D} \times C_2) + (n \times C_1)$

$TIC_{per} = (849{,}92 \times Rp. 4.000{,}00) + (12 \times \text{Rp.} 885.000{,}00)$

$TIC_{per} = (Rp.\ 3.399.680) + (\text{Rp.} 10.620.000)$

$TIC_{per} = Rp.\ 14.019.680$

The company's total inventory of raw materials for the period of one year adalah $Rp.$ 14.019.680

3. Data Processing

3.1. Data Normality Test with Lilliefors Test

Test the normality of the data on the use of galvanized raw materials from table (1) by using the Lilliefors Normality Test (Section (2.6)).

Hypothesis:
H_0 : The use of galvanized raw materials in one year comes from a normally distributed population.

H_1: The use of galvanized raw materials in one year comes from a population that is not normally distributed.
Criteria:
If $L_0 = L_{hitung} < L_{table}$ accept H_0 and
If $L_0 = L_{hitung} > L_{table}$ reject H_0

No	X_i	Z_i	$F(Z_i)$	$S(Z_i)$	$\|F(Z_i) - S(Z_i)\|$
1	811	-0,2044	0,4207	0,33333	0,08737
2	625	-11,813	0,119	0,16667	0,04767
3	912	0,32607	0,6293	0,66667	0,03737
4	1000	0,78825	0,7852	0,91667	0,13147
5	853	0,01619	0,508	0,58333	0,07533
6	825	-0,1309	0,4483	0,41667	0,03163
7	952	0,53615	0,7054	0,83333	0,12793
8	521	-17,275	0,0418	0,08333	0,04153
9	670	-0,9449	0,1736	0.25	0,0764
10	1250	210,127	0,9821	1,00	0,0179
11	942	0,48363	0,6844	0,75	0,0656
12	838	-0,0626	0,4761	0,50	0,0239

Based on table 3. Normality Test of Raw Material Usage Data it can be concluded that

$$L_0 = Max\,[|F(Z_i) - S(Z_i)|] = 0,13147$$

$L_0 = L_{\alpha(n)}$, seen from the Liliefors normality test table with a significant level of α = 0.005 and n = 12

$$L_0 = L_{\alpha(n)} = L_{0.05(12)} = 0,242$$

So that $L_{hitung} < L_{table}$ is accepted, which means the raw material usage data comes from a normally distributed population so that calculations using the Just In Time model in inventory control can be performed.

3.2. Economic Order Quantity Determination (EOQ)

Economic Order Quantity (EOQ) is determined to obtain the optimal number of shipments. The required data are:
1. Amount of raw material requirement in one period (D = 10199)
2. The cost of ordering raw materials (C_1 = Rp.885,000.00)
3. Cost of raw material storage (C_2 =Rp.4000,00)

Economic Order Amount (EOQ) in equation (3), as follows:

$$EOQ = \sqrt{\frac{2DC_1}{C_2}}$$

$$= \sqrt{\frac{2(885000)(10199)}{4000}}$$

$$= \sqrt{\frac{18052230000}{4000}}$$

$$= \sqrt{4513057{,}5}$$

$$= 2124{,}395$$

$$\approx 2124$$

3.3. Determining Total Cost with EOQ

From equation (2) it is obtained,

$$TC = \left(\frac{D}{Q}C_1 + \frac{Q}{2}C_2\right)$$

$$TC = \left(\frac{10199}{2124}(\text{Rp}.885.000{,}00) + \frac{2124}{2}(Rp.4000{,}00)\right)$$

$$TC = (4{,}8018\,(\text{Rp}.885.000{,}00) + 1062\,(Rp.4000{,}00))$$

$$TC = (4{,}249{,}593 + 4{,}248{,}000)$$

$$TC = (4{,}249{,}593 + 4{,}248{,}000)$$

$$TC = Rp.8.497.593{,}00$$

3.4. Determination of optimal delivery quantity, The required data are
a.Economic Orders Quantity ($EOQ = 2124$)
b. Average optimal inventory
To get the optimal average inventory, it is calculated as follows :

Month	Initial Inventory	Ordering	Total Inventory	Usage
January	50	775	825	811
February	14	630	644	625
March	19	910	929	912
April	17	1020	1037	1000
May	37	840	877	853
June	24	995	1019	825
July	194	800	994	952
August	42	500	542	521
September	21	652	673	670
October	3	1300	1303	1250
November	53	910	963	942
December	21	900	921	838
Amount	**495**	**10232**	**10727**	**10199**
Average	**41,25**	**852,67**	**893,92**	**849,92**

From the table 4, we get the optimal average inventory (a = 468,96). So that the optimal number of deliveries in equation (10) is obtained,

$$n = \left(\frac{EOQ}{2a}\right)^2 = \left(\frac{2124}{2\,(469)}\right)^2 = \left(\frac{2124}{938}\right)^2$$

$$= (2{,}2644)^2 = 5{,}127 = 5$$

So the optimal number of shipments is 5

3.5. Determination of the optimal order quantity

To get a solution to the problem in this paper using the Just In Time Inventory Control (JIT/EOQ) model, the data needed are:

1 Economic Order Quantity ($EOQ = 2124$)

2. Optimal delivery quantity ($n = 5$)

By using equation (5), it is obtained,

$$Q_n = \sqrt{n} \times EOQ$$
$$Q_n = \sqrt{5} \times 2124$$
$$Q_n = \sqrt{5} \times 2124$$
$$Q_n = 4749{,}4083 \approx 4749$$

3.6. Determination of Order Frequency

Based on the order cycle using the Just In Time Inventory Control method equation (6), it is obtained:

$$F = \frac{10199}{4749} = 2.1476 \approx 2\ kali$$

3.7. Total Cost with Just In Time

Based on the Just In Time Inventory Control method, the total cost of raw material inventory in equation (9) is as follows:

$$T_{JIT} = \left(\frac{1}{\sqrt{n}}\right)\left(\frac{D}{Q_n}C_1 + \frac{Q_n}{2}C_2\right)$$

0r

$$\Leftrightarrow T_{JIT} = \left(\frac{1}{\sqrt{n}}\right) TC$$
$$\Leftrightarrow T_{JIT} = \left(\frac{1}{\sqrt{5}}\ (Rp.8.497.593{,}00)\right)$$
$$\Leftrightarrow T_{JIT} = \left(\frac{1}{\sqrt{5}}\ (Rp.8.497.593{,}00)\right)$$
$$\Leftrightarrow T_{JIT} = ((0{,}447214)\ (Rp.8.497.593{,}00))$$
$$\Leftrightarrow T_{JIT} = Rp.3.800.239{,}11 \approx Rp.3.800.239{,}00$$

D. Conclution

By using the Just In Time (JIT) method, it is known that from the data analyzed the ordering is not optimal so it has not brought minimum inventory costs. The minimum cost is affected based on the specified inventory level. With Just In Time the order quantity is 4749 pieces with an order frequency of 2 times while the order quantity made by the company is 852.67 pieces with an order frequency of 12 times and by using the ecomonic order method the order quantity is 2124 pieces with an order frequency of 5 time. Through the order quantity and frequency obtained, it was found that with just in time the company spent Rp. 3,800,239.00 while previously the company spent Rp. 14,019,680.00 and when using the economic order quantity method the inventory cost was Rp. 8,497. .593.00. So it can be concluded that Just In Time can reduce production costs.

E. Bibliography

Alexandri, M., & Benny. (2009). *Manajemen Keuangan Bisnis : Teori dan Soal* . Bandung: Alfabeta.

Herjanto, E. (2008). *Manajemen Operasi Edisi Ketiga* . Jakarta: Grasindo.

Noor, J. (2016). *Metodologi penelitian : Skripsi, Tesis, Disertasi dan Karya Ilmiah.* Jakarta: Kencana Prenada media Group.

Simamora, H. (2012). *Akutansi Manajemen.* Riau: Star Gate Publisher.

Sulistyowati, U. (2006). *Analisis Perencanaan dan Pengendalian Persediaan Bahan Baku dengan Pendekatan Model JIT/EOQ pada Percetakan Bintang Pelajar di Surakata[Skripsi].* Surakarta: Universitas Sebelas Maret.

Umair, M. A. (2018). *Analisis Penerapan Metode Just In Time dalam Upaya Meningkatkan Efiiensi Biaya Produksi Pada PT. Frigoglass Indonesia [Skripsi].* Makassar: Universitas Muhammadiyah Makassar.