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ANALYSIS CONTROL SUPPLIES RAW MATERIALS WITH THE EOQ METHODS IN THE SMOOTHNESS OF THE PRODUCTION PROCESS

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Abstrak

This study aims to know how the raw material inventory control zinc aluminum UD. Pribumi and to know the difference between the cost of inventory by UD. Pribumi and inventory costs of raw materials, according to calculations control analysis of raw materials. The data collection technique used was the study of literature and field research, whereas data analysis tools used determination of the Safety Stock, Order Quantity Calculation using Economic Order Quantity (EOQ), TIC and Maximum Inventory. From the analysis and discussion, the total cost of inventory for raw material zinc aluminum company spent on is Rp 13,326,326.2, - greater than using EOQ calculation of only Rp 6,538,820.19, - thereby save on inventory costs if the company is using EOQ method.

Keywords:
Inventory, Economic Order Quantity, Safety Stock, Reorder Point, TIC, Maximum Inventory.

Introduction

Economy and the development of the business when had been growing with very rapidly, along with the rapid development advanced technology. So that competition between manufacturing companies in the Probolinggo city is tight. One of a company more competitive in the market in the Probolinggo city that is UD. Pribumi. Its own move in manufacturing producing tools the kitchen like the baked, pot, cormorant and other. With the thight competition between a company making company to establish supplies raw materials in precisely so it can be had continued and can reach a desired goal.

Raw materials is a a very important point for a company. The raw materials that held by a company to bolster the smooth production process, because with the good management of the raw materials, be able to save on the cost of the raw materials so that the selling price products it can be competitive in the market. In addition, to the annual report industry company, supplies very important for will be done a control supplies proper.

Basically all companies hold planning and control material with the primary objectives suppress (to minimize) the cost and to maximum profit in a given time. In the planning and control raw materials problem occurs major is held supplies material the most appropriate that production activities not interrupted and the funds that are grown in a stock material not excessive. The issue impact on the determination of like how many the quantity that will be acquired in of an accounting period certain, how much or quantity that to be purchased in every time done by the purchase, when reservations material to do, how the minimum amount the quantity of material that there must always be in a safety stock company to avoid dismissal production due to delay material, and how the maximum number the quantity of material in a stock that funds detained not excessive.

With the raw material policy implemented in UD. Pribumi, the inventory costs can be pressed as small as possible. For minimising the cost of these supplies can be used in analysis of Economic Order Quantity. Economic Order Quantity is the sum of the quantity of items that can be obtained with minimal cost or often said as the optimal amount to purchase (Riyanto, 2001:78). Method of EOQ inventory level trying to reach minimum as possible, low cost and good quality. EOQ method in the planning of an enterprise will be able to minimize the occurrence of out of stock so not to disturb the process within the company and was able to save the cost of supplies issued by companies due to the efficiency of raw

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material supplies in the company concerned. In addition to the method EOQ the application of the company would could reduce the storage, saving space, good for a room the warehouse and the study, solving the problems arising from many supplies that is in warehouse. Analysis EOQ can be used easily and practical to plan how many times an ingredient bought and in quantity how many times the purchase.

In addition to determining EOQ, the company is also need to determining the time of reserving back the raw material that will be used or reorder point to the purchase of material already applied in EOQ does not disturb the production of activities. In the calculation of EOQ and ROP can be determined point minimum and maximum material supplies. Supplies held most of the point of maximum, specifically at the time of the material of which bought come. The purpose of the determination of the point of maximum was for funds in which it is embedded in material supplies not excessive, so there is no extravagance. Because at the time when material bought, the size of the material in the warehouse in the company same with stores clean or safety stock .

Based on the discussion the problem in the background, hence writers formulate problem namely "what analysis supplies raw materials with the methods EOQ can ease production process UD. Pribumi Probolinggo?". In accordance with formulation problem, hence writers give restrictions of the problems raised writer. Limit problems in writing this is just in the analysis control raw materials uses the method economic order quantity in the smooth process of production in UD. Pribumi Probolinggo and as for research purposes to be achieved in research is, to know the application of analysis control raw materials method economic order quantity in production process is has been running as expected an UD. Pribumi Probolinggo.

Literature Review

Supplies Of Raw Materials

Control supplies is a function managerial very important, because supplies phisik many companies involves the rupiah largest investment in the post of assets smoothly. If corporate infuse too much their supplies, to cause the cost storage excessive, and may have "opportunity cost " (the funds could be implanted in investment more favorable). Similarly if corporate have no supplies enough, can result in costs of the occurrence less dressed up. Handoko (2011: 333).

Each company hold the activities production would require supply raw materials, funds the availability of supplies raw materials so expected a company industry can do production process in accordance with the need or consumer demand. In addition with the supplies the raw materials that enough available in a warehouse also expected to have facilitate the activities firm production and can prevent less dressed up raw. Delay schedule the fulfillment of products ordered consumers, this to be harmful company in terms of image a less well.

On principle all companies carry out a process will hold production supply will raw materials to the continuity of our production process in the company. In general the use of raw materials is based on the assumption that every month always the same, so that in a staged manner will be shut down at a particular time. So that it will not let it happen running out of the raw material took place before discharged. Theoretically the state of affairs is may be imputed, however not that easy. Sometimes raw materials still quite a lot has been done but the purchase, and led the build up of raw material in warehouse. This could possibly lowers the quality material and it will devour storage charges.

As a broad outline there are two of factors affect uncertainty the raw material that is from in company and of from outside the company. Uncertainty of in the company caused by a factor of the company own in discharging raw materials, by sharing raw materials by the company does not always exactly with what always planned. Maybe one day there is a technical problem that it would impede the production process that would cause usage of raw materials diminished. It might be that extravagants or because the raw material that is less good that discharging raw materials out of the original plan.

Besides uncertainty raw materials in the company there were also uncertainty of firm outer. Uncertainty from outside company during while carrying out the purchase calculated that the raw materials that bought the arrival of just in time for supplies that is up. But in fact the raw materials that often not in accordance with calculated, or material are coming before the time presented.

Function Supplies

The main function of supplies that is as a platform, links between the process of the production and distribution of to obtain efficiency. The functions of another supplies that is as a stabilizer the price of fluctuations demand. More specific, supplies can be categorised according to their function as follows (Yamit, 1996: 216):

A. Supplies inside (lot size), supplies arose because there are requirements economical in providing (replishment) again. Provision of in Lot a major or with little speed faster in demand will more economical. Factor requirements economical among others the cost of setups, the cost of preparation production or the buying and the cost of transport.
B. Supplies reserve, control supplies arising pertaining to with uncertainty. Forecasting consumer demand usually predicted forecasting. The time of a cycle the production of (lead time) likely deeper than which is predicted. The number of production been denied can only predicted in the process. Supplies reserve secure failure reached consumer demand or meet the needs of manufacturing just in time.
C. Supplies anticipation, supplies may arise anticipate a decline in supplies (supply and an increase in the demand or the increase in prices. To keep of continuity product delivery to consumen, a company can maintains an inventory of in order vacation labor or anticipate strike labor.
D. System supplies can be seen as a population place (stock point) to the flow of place the supplies. Inventory control consisting of control the flow of supplies and the number of inventory will accumulates in supplies. When the involves a change physical products, as evil heat or assembly several components, supplies in a stream of the supplies half be that work in process. If a product not subject to change physically but were removed from a depository place of another storage, supplies called supplies transportation. The sum of supplies half-finished and supplies transportation called supplies pipeline. Supplies pipeline is a total investment change and should be controlled.
E. Supply more namely supplies that cannot be used because of excess or physical damage that occurs.

Control the raw materials that held on its web site company, certain made to be able to activities support which is in the company who wrote it. Integration of all implementation activities in the company will support the creation of control the raw materials that well in a enterprise.

According to Assauri (2008: 177), a purposeful surveillance supplies can be interpreted as business to keep do not get company exhausted the limited supply so as to cause certain production process, keep the determination of supplies by companies did not so big that the fees related to the supplies can be reduced and to buy raw materials in petty can be avoided.

Determination of the quantity of supplies it is necessary to determine before did a snapshot assessment supplies. The amount of supplies. The number of supplies can be determined with two systems that most common known at the end of the period, namely: a period of system, which is that every the end of the period done calculation to the number of physical supplies the end of the number can known for sure. Next one is perpectual sytem, or book inventory which is that every time a record expenditure given administration goods supplies.

Economic Order Quantity

In determining wisdom provision of material the right basis in the sense so as not to disturb production process, there are several method of conducting management supplies, one effort is by means of dots order economic called a method of economic order quantity.

According to Rangkuti (2007: 11) economic order quantity is a number of the purchase of raw materials in every time a message with the money that the lowest. And according to Ahyari (1995:163) to be able to achieve that goal is eating the company must meet several factors about the supplies of raw materials. As for those factors are :

1) An estimate of discharging. Activities before buy raw materials carried out, then management must be able to make estimates of what the raw material that will be used in the process of production in a period.
2) Price of the material. The price of the raw materials will be purchased to be one of the determining factors in policy preparation materials. The price of this raw material is the basis for

preparing the calculation of how much the company's funds are to be provided for investments in the supply of raw materials.

3) Costs supplies. Costs to implement supplies raw materials this must be reckoned also in the determination of the amount supplies raw materials.
4) Discharging in accordance its use. Discharging raw materials in accordance its use of periods ago (actual demand) is one of the factors that need attention because for the purpose of production process will be used as one of basis of consideration in obtaining raw materials in the next period.
5) Lead time is respite who required (the happening) between when reservations raw materials with the coming raw materials itself. Waiting time this must be paid attention because are closely linked to the best.
6) Material supplies security (safety stock). Supplies security is additional supplies that are held to protect or keeping the possibility of less dressed up (stock out). Besides being used for the occurrence repeat of delays in the arrival of raw materials and when reserving back (reorder point).
7) The model of purchase material. Management companies should be able to model of corresponds most on situation and conditions the raw materials that bought. Model of optimal or economic order quantity.
8) Reservations return (reorder point). Reorder point is one or time specified companies should hold reservations raw materials back, so that the reservations the precise with endless the raw materials that bought, especially with the EOQ methods.

Hypothesis

The study is done to knows the difference calculation control company raw materials by using the EOQ method and to calculation been held by the company. On research of Halim and Tarigan (2014) showed that the company who applies the methods of EOQ can control supplies a company so get the quantity and the cost of an optimal. And the research of Hidayah (2016) in his research also denoting a company who applies the methods of EOQ can control supplies a company so mendpatkan the quantity and the cost of an optimal. Thus dpat formulated hypothesis as follows.

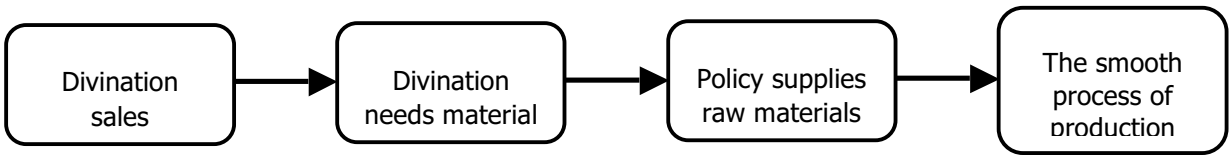
Hypothesis: expected control supplies raw materials by using the method EOQ more effective in the smooth process of production.

The Skeleton Thought

Company supply will need to have the raw material to ensure that the process of roduksinya not will be stunted due to lack of suplay. Hence the company must be more careful about consider concerning the supply the raw material in a company so they do not hinder process of producing or make the failure of the production process.

Assuming that the policies supplies the raw materials that right it is capable of ensuring the smooth process of production namely by analyzing whether a significant relation exists between forecasting needs raw materials and analyzes is there a difference between peralamalan needs the average raw materials with kebijakasaan the raw materials that been held by the company. Based on the discussion made a like frame follows:

Figure 1 the framework of thought



Source: UD Pribumi, 2017

Research Methods

Type and data sources

The type of research used researchers is research quantitative with the approach descriptive, which is a research methodology arranged in order to give a picture in systematic about scientific information derived from the subject or object research. Data sources used the primary and secondary data and teknik data collection used that is by using a method of interview, observation, documentation (Sugiyono. 2013:194).

Technique data analysis

In this research, using data processing calculation EOQ namely (Render and Heizer, 2001:320):

1. Determine the cost of reservations and storage charges.
2. Then the data processed and calculated by using the method EOQ to acknowledge the number of reservations optimal.
3. After it was done, it can be specified number of frequency reservations and the time between reservations.
4. The last stage is counting of the total cost.

EOQ formula which can be used is :

$$\text{EOQ} = Q* = \frac{\sqrt{2}DS}{\text{H}}$$

Description :

D = demand
S = ordering cost
H = carrying cost

Total Cost

$$\text{TC} = \frac{Q}{2}H + \frac{Q}{S}D$$

Description :

Q = The number of reservations
H = storage costs
S = The cost of set up

Research Result

A description of the raw material

UD. Pribumi do buy raw materials zinc aluminium of supplier in the probolinggo which has long been partner.

Table 1. Buy raw materials zinc aluminium (in a sheet)

No.	Months the purchase	Years		
		2014	2015	2016
1	January	342	402	380
2	Pebruary	362	382	380
3	March	445	371	399
4	April	330	397	353
5	May	453	365	396
6	June	453	499	544
7	July	634	549	354
8	August	362	590	330
9	September	342	409	296
10	October	368	416	330
11	November	386	450	480
12	December	397	381	329
Total		**4.874**	**5.211**	**4.571**
Average		*406,17*	*434,25*	*380,97*

Sumber : Secondary data, 2017

Raw materials that is digudang largely used to production process and some kept for reserve production next. Data on the use of raw materials in UD. Pribumi can be seen in table below.

Table 2 .The use of the raw materials required (in a sheet)

No.	Months the purchase	Years		
		2014	2015	2016
1	January	333,59	418,97	371
2	Pebruary	353,58	374	371,69
3	March	435,42	361,72	390,02
4	April	321,78	388,56	345,45
5	May	444,64	458,09	389,34
6	June	444,64	492,38	541,42
7	July	622,37	541,13	345,45
8	August	353,58	582,25	321,95
9	September	243,35	401,9	288,11
10	October	352,74	408,56	321,93
11	November	376,93	443,42	472,75
12	December	388,56	373,5	319,92
Total		**4.271,18**	**5.244,48**	**4.479,03**

Sumber : Secondary data, 2017

The cost of reservations consisting of, the cost of loading and raw materials, cost of to the warehouse, and the cost of telephone and a letters. More details data reservations can be seen in the table below.

Table 3. Reserving the details of the cost of raw materials

No.	The cost	Years		
		2014	2015	2016
1.	Loading and raw material costs	Rp. 1.680.000	Rp. 1.800.000	Rp. 1.800.000
2.	Cost of to the warehouse	Rp. 2.400.000	Rp. 2.400.000	Rp. 2.400.000
3.	The cost of telephone correspondence	Rp. 240.000	Rp. 240.000	Rp. 240.000
Total		**Rp. 4.320.000**	**Rp. 4.440.000**	**Rp. 4.440.000**
Average per month		*Rp. 360.000*	*Rp. 370.000*	*Rp. 370.000*

Sumber : Secondary data, 2017

Storage charges needed to further analysis, reckoned in the form of the percentage namely the percentage of the value of supplies. The storage consisting from above expenses varied directly with quantity supplies. Based on the calculation of EOQ, the cost of storage each company has been set at 10 % of the supplies per items. Data on storage charges can be look at the table below.

Table 4. The percentage save costs, cents a price, and storage charges.

Years	% The cost of save	Price per share (Rp)	storage costs (Rp)
2014	10%	15.000	1.500
2015	10%	15.000	1.500
2016	10%	15.000	1.500

Sumber : Secondary data, 2017

Table 5. details storage charges

Cost	Years

	2014	2015	2016
The cost of storage facility	Rp. 120.000	Rp.120.000	Rp. 120.000
Total	**Rp. 120.000**	**Rp.120.000**	**Rp. 120.000**

Sumber : Secondary data, 2017

Data Analysis

Analysis needs raw materials

To find out the needs of raw materials in the first month of the year 2017 with either trend projection method. Forecasting raw material needs months to 37 (January 2017) as follows:

a = 388,74
b = -0.33
$Y = a + bX$
= 388,74 + (-0.33) x 37
= 388,74 – 12,21
= 376,53
So forecasting raw materials to the moon to 37 (january 2017) is of 376,53 sheets.

EOQ calculation

The number of discharging raw materials, the price of raw perunit and besarya the cost of reservations in UD. Pribumi over a period of years 2014-2016 can be seen in table 6 the following.

Table 6. Discharging raw materials, the cost of reservations and storage charges (2014-2016)

Years	Usage			cost of reservations	storage
	Total	Price/Sheet	Total cost		
2014	4.874	Rp. 15.000	Rp. 73.110.000	Rp. 4.320.000	Rp. 120.000
2015	5.211	Rp. 15.000	Rp. 78.165.000	Rp. 4.440.000	Rp. 120.000
2016	4.571	Rp. 15.000	Rp. 68.565.000	Rp. 4.440.000	Rp. 120.000

Sumber : Secondary data, 2017

1. Year 2014

$$EOQ = \sqrt{\frac{2 \times 4.320.000 \times 4.271,18}{1.500}}$$
$$= \sqrt{24.601.996,8}$$
$$= 4.960,04$$

The number of buy raw materials optimal every time message to 2014 which 4.1960,04 sheets, with the frequency of the buy raw materials required by UD. Pribumi, namely:

$$\frac{4.271,18}{4.960,04} = 0,86 \approx 1$$

With cycle reservations repeated that is

$$\frac{360}{0,86} = 419\ day$$

2. Year 2015

$$EOQ = \sqrt{\frac{2 \times 4.440.000 \times 5.244,48}{1.500}}$$

$$= \sqrt{31.047.321,6}$$
$$= 5.572,01$$

The number of buy raw materials optimal every time a message in 2015 of 5.572,01 sheets, with the frequency of the buy raw materials required by UD. Pribumi, namely:

$$\frac{5.244,48}{5.572,01} = 0,94 \approx 1$$

With cycle reservations repeated that is

$$\frac{360}{0,94} = 383\ day$$

3. Year 2016

$$EOQ = \sqrt{\frac{2 \times 4.440.000 \times 4.479,03}{1.500}}$$
$$= \sqrt{26.515.857,6}$$
$$= 5.149.35$$

The number of buy raw materials optimal every time a message on 2016 of 5.149,35 sheets, with the frequency of the buy raw materials required by UD. Pribumi, namely:

$$\frac{4.479,03}{5.149.35} = 0,87 \approx 1$$

With cycle reservations repeated that is

$$\frac{360}{0,87} = 414\ day$$

The determination of safety stock

Safety inventory (safety stock) is useful to protect the company from risks running out of raw materials (stock out) and the delay in the receipt of raw materials are ordered. By looking at and considering deviations between the estimated user of raw materials with real users can be known the magnitude of the irregularities. Once known the magnitude of the standard deviation of each year then it will be assigned a magnitude of safety stock. In the safety stock of management company determines how far raw materials are still accepted. In general the limit of tolerance is 5% above estimates and 5% below the estimate. In UD. Pribumi using two standard deviation of 5% with a value of 1.65.

- Year 2014; *Safety stock* = 1,65 x 255,38 = 421,38 Sheet
- Year 2015; *Safety stock* = 1,65 x 246,33 = 406,45 Sheet
- Year 2016; Safety stock = 1,65 x 136,29 = 224,88 Sheet

Reorder Point

Make a booking again when supplies of raw materials can be calculated with the formula:
ROP = *Safety stock* + (*Lead time* x *Per day needs*)

ROP 2014 = 421,38 + (1 x $\frac{4271,18}{360}$)

= 421,38 + 11,86 = 433,24 Sheet

ROP 2015 = 406,45 + (1 x $\frac{5244,48}{360}$)

= 406,45 + 14.568 = 421,02 Sheet

ROP 2016 = 224,88 + (1 x $\frac{4479,03}{360}$)

= 224,88 + 12,44 = 237,32 Sheet

The determination of supplies maximum (maximum inventory)

Supplies the maximum required by the company so that the amount of supplies that there in warehouse not excessive so that is not the case a waste of working capital. As for to know the magnitude of the maximum inventory bdapat used the following formula:

Maximum Inventory = safety stock + EOQ

- Year 2014 = 421,38 + 4960,04 = 5381,42
- Year 2015 = 406,45 + 5572,01 = 5978,46
- Year 2016 = 224,88 + 5149,35 = 5374,23

To know any more clear about calculation supplies raw materials in UD. Pribumi by using the method EOQ for eriode years 2014-2016 can be seen in table follows:

Table 7. EOQ, safety stock, reorder point, and maximum inventory raw materials (2014-2016)

Years	EOQ	*Safety stock*	ROP	Max Inventory
2014	4960,04	421,38	433,24	5381,42
2015	5572,01	406,45	421,02	5978,46
2016	5149,35	224,88	237,32	5374,23

Sumber : Secondary data, 2017

Calculation the total cost of supplies the raw materials required (TIC)

In the determination of value tic according to the EOQ method can use formula:

TIC $=\sqrt{2.D.S.H}$

TIC 2014 $=\sqrt{2 \text{ x } 388,56 \text{ x } 4.320.000 \text{ x } 1500}$
$= 2.244.044,92$

TIC 2015 $=\sqrt{2 \text{ x } 373,5 \text{ x } 4.440.000 \text{x } 1500}$
$= 2.230.475,29$

TIC 2016 $=\sqrt{2 \text{ x } 319,92 \text{ x } 4.440.000 \text{ x } 1500}$
$= 2.064.299,98$

In the determination of EOQ according to it can be using formulas:

TIC = (safety stock . The cost of storage) + (a charge reservations . The frequency of a purchase)

TIC company 2014 = 4.370.566,6

TIC company 2015 = 4.488.774

TIC company 2016 = 4.466.985,6

Comparison the total cost of raw materials supplies according to EOQ by using total supply the raw material that run the company and austerity which is produced during a period of the year 2014-2016 can be seen in table the following.

Table 8 .Comparison tic based EOQ and based on company

Years	TIC (company)	TIC (EOQ)	Saving
2014	Rp. 4.370.566,6	Rp. 2.244.044,92	Rp. 2.126.521,68
2015	Rp. 4.488.774	Rp. 2.230.475,29	Rp. 2.258.298,71
2016	Rp. 4.466.985,6	Rp. 2.064.299,98	Rp. 2.402.685,62

Sumber : Secondary data, 2017

Discussion

Data from of showing firm that relationship between EOQ, safety stock, ROP and maximum inventory raw materials during the period 2014-2016 is as follows:

A. in 2014 showed that the company do buy raw materials on a stock of 433,24 sheets, thus when reservations raw materials received with lead time one day, supply left still 421,38 sheets, while to avoid the occurrence of surplus raw materials, the number of to do of 4960,04 sheets, that does not exceed maximum inventory of 5381,42 sheets.
B. 2015 showed that the company do buy raw materials on a stock of 421,02 sheets, thus when reservations raw materials received with lead time one day, supply left still 406,45 sheets, while to avoid the occurrence of surplus raw materials, the number of to do of 5572,01 sheets, that does not exceed maximum inventory of 5978,46 sheets.
C. 2016 showed that the company do buy raw materials on a stock of 237,32 sheets, thus when reservations raw materials received with lead time one day, supply left still 224,88 sheets, while to avoid the occurrence of surplus raw materials, the number of to do of 5149,35 sheets, that does not exceed maximum inventory of 5374,23 sheets.

Meanwhile on the total cost of supplies raw materials can be compared according to EOQ and run company and the cost savings on the can be obtained during the period 2014-2016 is as follows:

A. in 2014 the total cost of according to the company Rp. 4.370.566,6 according to EOQ Rp. 2.244.044,92 so there was save by Rp. 2.126.521,68.
B. 2015 the total cost of according to the company Rp. 4.488.774 according to EOQ Rp. 2.230.475,29 so there was save by Rp. 2.258.298,71.
C. 2016 the total cost of according to the company Rp. 4.466.985,66 according to EOQ Rp. 2.064.299,98 so there was save by Rp. 2.402.685,62.

On the research of Halim and Tarigan (2014) shows that companies that apply the EOQ method to control the inventory of companies so get quantity and optimal inventory costs. And the Research of Hidayah (2016) also shows the companies that apply the methods to control the EOQ inventory company to get quantity and optimal inventory costs. Relation between the previous research with research now is the consistency of research with the same topic that inventory control raw materials by using the EOQ method is more efficient than on controlling inventory at UD. Pribumi of Probolinggo City.

Conclusion

From the data obtained from the company and data analysis above that calculations of the raw material inventory control by using the EOQ is more effective than the calculation of UD. Pribumi. It can be seen from the comparison table TIC and companies using EOQ. By using the EOQ company more cost saving to control the supply of raw materials.

Suggestion

Based on conclusion above, then the researcher give advice to a company that can be used be considered: company should review policy supplies raw materials that had been undertaken companies and companies have should determining the safety stock, ROP, and maximum inventory to avoid risk out of raw materials (stock out) and also excess raw materials so that it can be minimize cost of raw materials for the company.

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