

Analysis Of Raw Material Inventory Control For Beef Concentrate Production Using The Economic Order Quantity (EOQ) Method

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Abstract

This research aims to analyze raw material inventory control at the Berkah Sejahtera cattle concentrate factory, before using the EOQ method and after using the EOQ method, analyzing the EOQ method can increase the efficiency of raw material inventory at the beef concentrate factory. The data analysis method used in this research is descriptive qualitative using the Economic Order Quantity method. The results of the research by using EOQ, the company can make optimal raw material purchases every time an order is 61,405 kg with a frequency of 17 times a year and the company can save total raw material inventory costs of IDR 17,545,259 with an efficiency of 45%. By conducting this research, it is hoped that companies will minimize their annual expenses.

Keywords: EOQ, Operations Management, Inventory.

INTRODUCTION

Concentrate itself is feed that has a low crude fiber content. The main nutrients from concentrate feed are energy and protein. Concentrates for livestock are useful for improving the nutritional quality of feed thereby accelerating livestock growth and development. (DINAKESWAN PROV. NTB, 2020)

Feed has a very important role in the life of livestock. Beef concentrate, as one of the main components in animal feed regimens, has an important role in ensuring that cows get the nutrients needed for optimal growth. Feed is the main component in a

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livestock business, because feed is useful as an important raw material for producing quality livestock. Under conditions like these, feed is one of the keys to successful development of the livestock sector.

The demand for beef supplies has increased from year to year, resulting in an increase in the population of cattle in the community. the awareness of farmers to provide optimal nutritional feed, which has resulted in a large demand for beef concentrate production, has an impact on controlling raw material supplies. Based on observations made at the factory, problems were found with the inventory of production materials which had not been planned properly, due to the irregular supply of production materials. This results in hoarding of production materials. If this continues, it could result in wastage of production material inventory. So there will be a loss in inventory costs. This is because the level of orders for beef concentrate continues to increase on certain days.

One of the control activities is specifically for the supply of raw materials. Control is carried out in such a way as to be able to serve raw material needs appropriately and at low costs. So far, when controlling raw material inventory, it has not been based on appropriate methods, but only based on previous experiences. Controlling raw material inventory is very important in a production in order to develop a business because it will affect cost efficiency, smooth production and the profits of the business itself. It is hoped that having supplies can facilitate the production process of an industry

Based on the description above, the focus of this research is on three main questions, namely:

First, how much total raw material inventory costs must be incurred in one year ? Second, when is the time to reorder (*reorder point*) raw materials in one year ? Third, how large is the ideal safety stock of *raw materials* that must be provided in one year?

Research Purposes

The objectives of this research are: (1) to analyze the total cost of raw material inventory that must be incurred in one year ; (2) to analyze when raw materials will be reordered (*reorder point*) *within one year* ; (3) to analyze the amount of safety stock of raw materials that must be provided in one year.



LITERATURE REVIEW

Understanding Rational Operations Management

According to (anugrahdwi, 2023) operational management is a management approach or function that is responsible for planning, organizing, directing and controlling various operational activities in an organization in order to achieve its operational goals.

Inventory Control

According to Herjanto, 2008 in (Daud, 2017) , inventory control is a set of control policies for determine what inventory levels should be guarded, when is the order for add inventory must be made and how much orders to be held, quantity or rate Supplies required vary for each factory company, it depends from the volume of production, type of company and the process.

Supply

According to A lexandri, 2009 in (Lahu et al., 2017) inventory is an asset which includes goods owned by the company with the intention of being sold within a certain business period or inventory of goods that are still in progress or in the production process or inventory of raw materials awaiting use in the production process.

According to Hani Handoko, 2000 in (Renta et al., 2013) Inventory is a general term that shows everything or a company's resources that are stored in anticipation of meeting demand.

According to Sumayang 2003 in (Renta et al., 2013) Basically all companies plan and control materials with the main goal of reducing costs to maximize profits within a certain time. In planning and controlling raw materials, the main problem is organizing the most appropriate material inventory so that production activities are not disrupted and the funds invested in material inventory are not excessive. Controlling inventory or *inventory control* is the activity of maintaining the amount of inventory at the desired level.

Optimal Inventory

Optimal inventory according to Achmad Slamet, 2007 in (Taufiq & Slamet, 2014) will be achieved if it is able to balance several factors regarding product quantity, product durability, length of production period, storage facilities and inventory storage costs, capital adequacy, distribution time requirements, protection regarding shortages of direct materials and spare parts, protection regarding labor shortages, protection regarding increases in prices of materials and equipment as well as risks inherent in inventory.

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Factors Affecting Inventory Control

According to Ahyari, 2005 in (Daud, 2017) factors that influence raw material inventory control include:

1. Estimated use of raw materials. Before a company purchases raw materials, it is appropriate for the company to prepare an estimate of raw materials for the purposes of the production process.
2. Price of raw materials The nominal amount spent by the company to purchase raw materials.
3. Inventory costs In maintaining raw material inventories, the company will of course not be free from the inventory costs that will be borne.
4. Purchasing Policy How much funds can be used to invest in supplies of raw materials is influenced by policy expenditures made within the company.
5. Use of raw materials The use of raw materials from companies in the previous period for production process purposes can be used as one of the basic considerations in organizing raw materials.
6. Waiting time (*lead time*) What is meant by waiting time is the time period required between the ordering of raw materials and the arrival of the raw materials being procured.
7. Raw Material Purchasing Model The selection of the purchasing model that will be used by the company is adjusted to the situation and conditions of the raw material inventory in question.
8. Safety stock. In general, to overcome shortages or running out of raw materials, companies will hold safety stock.
9. Repurchases in the management of raw material inventories are not enough to be carried out just once, but will be carried out repeatedly on a regular basis.

Understanding Raw Materials

According to (KBBI, nd) In the Big Indonesian Dictionary (KBBI) raw materials are materials that are processed through the production process into finished goods or basic necessities to make something.

According to Hanggana, 2006 in (Fahmi & Nanda, 2018) raw materials are materials that function to produce finished goods, these materials will be bound together or the production goods become one with the finished goods. Apart from that, Hanggana also said that in a company it cannot separated from raw materials and auxiliary materials because these two materials greatly influence the production process and production

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results. Based on the definition of raw materials above, it can be said that raw materials are the main materials in a company and are really needed in producing or creating a product.

Economic Order Quantity (EOQ)

Jay Heizer and Barry Render, 2010 in (Lahu et al., 2017) says that the economic order quantity model *Economic Order Quantity* (EOQ) is an inventory control technique that minimizes the total costs of ordering and storing.

EOQ calculation can be calculated using the formula:

$$EOQ = \sqrt{\frac{2 \cdot D \cdot S}{H}}$$

Information :

S = Cost per order

D = Total raw material requirements in one period

H = Carrying costs of average inventory

Total Inventory Cost (TIC)

The total cost of raw material inventory is the total of ordering costs plus total costs storage per year. This is done to save company inventory costs.

$$TIC = \left(\frac{D}{Q} S\right) + \left(\frac{Q}{2}\right) H$$

Information :

TIC : Total inventory cost

D : Number of uses in a year

Q : Economical Order Quantity

S : Cost of ordering raw materials per order

H : Raw Material Storage Costs Per Order

Safety Stock

According to Mahatmyo, 2014 in (Hidayat et al., 2020) *Safety stock* is held to anticipate the occurrence of unexpected stock outs in the company's inventory control. Running out of inventory in a company will result in lost sales. *The safety stock* calculation



can be determined by multiplying the safety factor by the standard deviation with the following formula:

$$\sigma = \sqrt{\frac{\sum (X - \bar{x})^2}{n}}$$

Where:

SS = *Safety Stock*.

σ = Standard deviation of demand during lead time.

Z = Safety factor.

n = Number of data.

x = Amount of material needed.

$\bar{x}$ = Average material requirements. According to Herjanto, 2015 in (Hidayat et al., 2020)

Reorder Point (Reorder Point)

Jay Heizer and Barry Render (2010: 99), put forward the reorder point, namely the inventory level where when inventory reaches that level, an order must be placed.

The formula for determining ROP is as follows:

$$\text{ROP} = \text{SS} + \text{DL}$$

Information :

SS = *Safety Stock*

d = Demand per day

L = Waiting time for new orders in days

This equation for ROP assumes demand during the lead time and the lead time itself are constant. Demand per day (D) is calculated by dividing the annual demand (D) by the number of working days in one year:

$$\text{Requests per day} = \frac{D}{\text{number of working days per year}}$$



RESEARCH METHODS

The research method used is method qualitative. The unit of analysis for this research is the Blessings Sejahtera cattle concentrate factory located in Buyut Ilir, Central Lampung Regency. The research location was chosen deliberately with the consideration that the research location is an industry that produces cattle feed which has many consumers. Respondents in this study are owners factory. The data used in this research is primary and secondary data. Primary data was obtained from interviews with the parties concerned using direct observation and recording. Secondary data was obtained from sales data, production data, feed formulas, raw material requirements, and data from related agencies that support this research.

Data Analysis Techniques

According to Moleong, 2010 in (Shelma Afriana Ulfa, 2018) Qualitative data analysis is an effort carried out by working with data, sorting it into manageable units, synthesizing it, looking for and finding patterns, finding what is important and what to learn, and decide what to tell others.

Data obtained from the field was analyzed through the following stages:

1. *Data collection* (data collection) Grouped data is arranged in the form of narratives, so that it forms a series of meaningful information in accordance with the research problem.
2. *Data Reduction* (Data Reduction) Categorization and reducing data, namely collecting important information related to the research problem, then the data is grouped according to the problem topic.
3. *Data Display* (Data Presentation) In order to see the overall picture or a particular part of the research, efforts must be made to create various kinds of *matrices*, *graphs*, *networks* and *charts*. In this way, researchers can master the data and not drown in piles of details.
4. *Conclusion Drawing/verification* (drawing conclusions) The initial conclusions reached are still temporary, and will change if strong supporting evidence is not found at the next stage of data collection. However, if the conclusions reached at the initial stage are supported by valid and consistent evidence when the researcher returns to the field to collect data, then the conclusions put forward are credible conclusions.



Data collection technique

The data collection techniques used in this research are:

1. Interview

Interviews are a method of collecting data by conducting direct questions and answers with the owner of the Blessing Sejahtera cattle concentrate industry factory, by asking several questions related to the research topic. By conducting interviews, researchers can formulate control of production raw materials and process the data.

2. Observation

Observation is direct observation and recording in the field carefully and systematically. The aim of collecting this data is to simplify and strengthen the research results.

3. Documentation

Documentation is a data collection method that is carried out by recording or copying data in the field.

Data Analysis Process

1. Collect data on demand (sales) or costs of using raw materials during 2023.
2. Identify ordering costs and holding costs.
3. Data is processed and calculated using the EOQ (*Economic Order Quantity*) method to determine the optimal order quantity.
4. The next stage is to calculate the total inventory costs
5. Then calculate the amount of safety stock to protect or guard against the possibility of a shortage of materials (*Safety Stock*).
6. Then determine at what point the company must place a reorder.
7. The final stage calculates maximum inventory.
8. The results obtained from data processing techniques using the EOQ method are that inventory costs incurred by the company can be minimized and the company can determine the difference in efficiency of ordering raw materials made before and after using the EOQ method.

RESULTS AND DISCUSSION

The raw materials used in the production process of Blessing Sejahtera beef concentrate are palm oil meal, copra meal, soybean meal, sodium, dried cassava, coffee husks, bran. Raw materials for cow feed are used in accordance with the quantities made



according to consumer demand and production capacity. The availability of raw materials stored in the warehouse is recorded to secure the availability of raw material stock.

Table 1 Purchase Data

Month	Raw material						
	Soybean Meal	Bran	Coffee Bark	Sodium	Ogok	Palm Oil Meal	Copra Meal
January	850	600	650	15	700	750	700
February	850	600	650	15	700	750	700
March	850	600	650	15	700	750	700
April	900	700	700	15	750	800	750
May	1,000	700	700	16	750	800	750
June	1,000	700	800	20	800	850	700
July	650	500	500	11	750	600	600
August	850	600	650	15	500	750	750
September	1,500	750	800	20	700	1,000	900
October	1,350	950	1,000	25	900	1,200	1,200
November	1,350	900	1,000	21	1,100	1,250	1,200
December	1,200	850	950	20	1,000	1,100	1,000
Total (kg)	12,350	8,450	9,050	208	1,000	10,600	9,950
Average (kg)	1,029	704	754	17	779	883	829

Table 2 Usage Data

Month	Raw material						
	Soybean Meal	Bran	Coffee Bark	Sodium	Ogok	Palm Oil Meal	Copra Meal
January	970	610	630	15	660	715	775
February	930	615	630	16	675	720	780
March	930	600	630	15	655	715	770
April	885	615	675	17	705	765	720
May	905	625	690	17	720	785	740
June	940	655	720	17	750	820	770
July	890	635	635	15	670	690	850



August	885	625	630	16	655	715	730
September	1,030	714	790	16	820	895	840
October	1,305	900	1010	21	1,050	1,130	1,080
November	1,255	870	960	20	1050	1,090	1,070
December	1,180	820	900	20	1080	1,020	1090
Total (Kg)	12,105	8,284	8,900	205	9,490	10,060	10,215
Average (Kg)	1,009	690	742	17	791	838	851

Table 3 Costs for Ordering Raw Materials in 2023

No.	Cost	Total Fees
1	Transportation Costs	1,500,000
2	Labor Wages	8,400,000
Total cost		IDR 9,900,000

The ordering costs incurred by the company each time an order is made is IDR 412,500, which is obtained from the total ordering costs incurred by the company in 2023 divided by the frequency of orders made in 2023.

Table 4 Raw Material Storage Costs in 2023

No	Cost	Total Fees
1	Electricity	4,800,000
Total cost		4,800,000

The storage costs incurred by the company each time you place an order are IDR. 81 This cost is obtained from dividing the total storage costs per year by the total average use of raw materials in 2023

Table 5 Total Raw Material Inventory Costs in 2023

Raw material	Total inventory costs (Rp)
	(Average usage x H)+ (SxF)
Soybean meal	9,981,729
Bran	9,955,890



Coffee skin	9,060,102
Sodium	9,001,377
pile	9,964,071
Palm oil cake	9,967,878
Copra cake	9,968,931

Information :

H: Raw Material Storage Costs per Order

S: Cost of ordering raw materials per order

F: Order Frequency

Raw Material Inventory Control According to the EOQ Method

1. *Economic Order Quantity* and Order Frequency

Based on data on raw material requirements and data on storage costs and ordering costs, the quantity of raw materials using the EOQ method can be calculated as in the table as follows

Following:

Table 6 *Economic Order Quantity* and Order Frequency

Raw material	Economic Order Quantity (kg)	Economic order frequency (times)
	$EOQ = \sqrt{\frac{2.D.S}{H}}$	$I = \frac{D}{EOQ}$
Soybean meal	11,103	1,090
Bran	9,185	0.901
Coffee skin	9,520	0.934
Sodium	1,444	0.141
pile	9,831	0.937
Palm oil cake	10.122	0.993
Copra cake	10,200	1,001

Total Inventory Cost (TIC)



The total cost of raw material inventory is the total of ordering costs plus total storage costs per year. This is done to save company inventory costs. The total inventory cost can be determined by using the following formula:

Raw material	Total Inventory Cost (Rp)
	$TIC = \frac{D}{Q}S + \frac{Q}{2}H$
Soybean meal	888,397
Bran	744,027
Coffee skin	771,195
Sodium	117,043
Onggok	586,551
Palm oil cake	819914
Copra cake	826.206

Rescue Supplies (*Safety Stock*)

Determining the amount of rescue inventory can be done by comparing the use of raw materials and then looking for the standard deviation. After knowing what the standard deviation is, the amount of deviation analysis will be determined. In the deviation analysis, company management determines how much raw material is still acceptable. In general, the tolerance limit used is 5%.

Raw material	Standard Deviation	<i>Safety Stock</i> $Sd \times Z$
	$\sqrt{\frac{\sum (X - \bar{X})^2}{n-1}}$	
Soybean meal	434,783	713,044
Bran	667,645	1,094,938
Coffee skin	140,102	229,767
Sodium	1,739,994	2,853,590
pile	364,601	597,946
Palm oil cake	654,279	1,073,018
Copra cake	143,243	234,919



Reorder Point (*Reorder point*). It is known that the time difference between ordering and receiving raw materials (*lead time*) is 1 day, and the size of the safety stock is 6,797.222 kg, so the reorder time is: $Lead\ Time = 1\ day$ Safety Stock = 6,797.222 kg Number of working days in one year = 320 working days Total use of raw materials = 56474.5 kg Average use of raw materials is = 672.315Kg $ROP = 6,797.222 + (1 \times 176,482)$ $ROP = 6,797,222 + 176,482 = 6,973,704$

Number	Information	Company policy	EOQ method
1	Average Purchase	2,469.125	61,405
2	Total Cost of Raw Material Inventory	3,927,127	1,776,794
3	Order Frequency	24	17
4	Safety Stock		6,797,222
5	Re Order Point		7,784,872

CONCLUSION

The total purchase of raw materials using the company method per order is an average of 2,469.125 kg with a frequency of ordering 24 times a year, the total cost of inventory in one year is **IDR 39,229,617**, whereas with the EOQ method the company orders on average an average of 61,405 kg per order with a frequency of ordering 17 times a year, the total inventory cost in one year is IDR 1,776,794,000.

Controlling raw material inventory using the EOQ method is more efficient than the company method, the total efficiency of raw material inventory costs is **IDR 17,545,259** with a percentage of 45%

Suggestions

The things that can be suggested and become input for industry based on the discussion in the results of this research are:

1. This industry needs to review the control methods applied so far, because based on the results of processing using the methods used by researchers, total inventory costs can still be minimized. By using the EOQ method in industrial raw material procurement policies, you will get optimal raw material purchase quantities with minimum costs compared to previous policies.



2. Industry should determine the size of *safety stock* and *re-order points* in controlling raw material inventories to protect or guard against the possibility of shortages of raw materials that are greater than expected and to guard against possible delays in ordered raw materials.
3. When procuring raw materials at a cattle concentrate factory, it is best to purchase raw materials in large quantities and at a low frequency per production period, this is done to minimize inventory costs.

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