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Analysis of Raw Material Control Using the EOQ Method in the Suwar-Suwir Agro-Industrial Business UD Sari Rasa, Jember

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ABSTRACT
Suwar-suwir UD Sari Rasa is an agroindustry business located at Jalan Trunojoyo No. 91, Kauman, Kepatihan, Kaliwates District, Jember Regency, East Java. This business produces shredded sweets made from cassava tape as raw material. Suwar-suwir has a variety of flavor variants consisting of vanilla, pineapple, strawberry, chocolate, and pandan flavors. The purpose of this study was to determine the optimal amount of cassava tape raw material inventory, which should be carried out by the UD Sari Rasa suwar-suwir business, when is the right time to reorder cassava tape raw materials, and what is the optimal total ordering cost to make cassava tape raw materials. procurement of raw materials for cassava tape. The method used in this study is EOQ (Economic Order Quantity), to determine the optimal quantity of raw material orders, ROP (Reorder Point) analysis tool to find out when is the right time to reorder raw materials, Safety Stock analysis tool is used to determine safety stock and Total Cost of Inventory (Total Cost) to calculate the total cost of ordering raw materials. Based on the results of the analysis using the EOQ method, the optimal number of orders for raw materials is 790 Kg of cassava tape with a purchase frequency of 63 times in one year with reordering of raw materials if the inventory reaches 305 Kg of cassava tape with a total inventory cost of Rp. 399.992,000.

Keywords — Inventory, Cassava Tape Raw Materials, EOQ (Economic Order Quantity)

1. Introduction

Agro-industry is an important activity that utilizes agricultural harvests as raw materials for production activities, and its relatively high market share and high added value can contribute to economic growth. Raw materials are biological resources that support production activities. This raw material will later become an agro-industrial product. Agro-industrial products are the final result of production activities.

The company's raw material inventory is an important production process requirement. Raw material inventory, namely biological resources stored in the company, which will be used for the production process [1]. Inventory control or stock control is the company's effort to provide resources in the form of raw materials needed optimally for the production process and to reduce the risk that will arise if the company does not have raw material inventory for the production process. Purchases of raw materials should not be more or even less than the amount needed. If the raw material inventory is lacking, it will hinder the smooth process of production [2]. Whereas If material standards which purchased excessively or leave a remainder of supply so will add cost savings. Because it is necessary to do process control in storage material standards and strategy evaluation of its implementation. This is useful for avoiding problem material storage standards Which are excessive, which will result in the quality of material standard decreased and the quality of the products produced also decreased [3].

This research was conducted at UD Sari Rasa, an agro-industrial business that produces

snacks, ranging from wet snacks to dry snacks typical of Jember. UD Sari Rasa located in Jl. Trunojoyo No. 91, Kauman, The Principality, Subdistrict Kaliwates, Jember Regency, East Java. Problems that arise is the number of consumer demand is decreasing and this agro-industry business does not yet have a proper raw material inventory control method. In addition, the high raw material inventory will cause high storage costs, resulting in a decrease in the quality of raw materials and a decrease in the quality of the products produced [4]. To control the inventory of cassava tape raw materials, a method is needed for designing optimal raw material inventory control with efficient costs.

The method that can be used to solve this problem: EOQ (Economic Order Quantity) method. According to [5], it states the method EOQ is model mathematics to determine the number of goods to be ordered by the company to meet projected demand by minimizing inventory costs so that the company management can create balanced and stable conditions and situations in production.

2. Method

Design research that will be used, namely descriptive research with the method quantitative. The population in this study is all raw material inventory data for 2021. The sampling technique that will be used is a census. The sample used in this study is raw material inventory data for 2021. The variables studied in this study include cassava tape raw material inventory, cassava tape raw material requirements, determination of the economic order quantity (EOQ), reorder point, inventory cost, safety stock, and Total Cost [6]. The research instruments that will be used are observations and open interviews containing questions about controlling raw material inventory. standard cassava Which there is on business Agroindustry Shredded UD Sari Rasa, which will be asked to the owner of UD Sari Rasa, namely Mrs. Wahyuni. The location study chosen is UD Sari Flavor, UD Sari Flavor This is an agro-industrial business located at Jl. Trunojoyo No. 91, Kauman, Kepatihan, Kaliwates District, Jember Regency, East Java. the time allocation required in this study is 6 months.

Data needed in this study is use data primary and secondary data. Primary data was obtained through direct observation and interviews at UD Sari Rasa, whereas data secondary was obtained from a data company that supports research. Data collection carried out in this study was by using the following techniques:

a. Collection of Primary Data with Interviews
b. Stage Collection Data Secondary with Observation
c. Documentation

3. Discussion

3.1. Analysis needs Cassava Tape Raw Materials

a. Purchase material cassava tape raw material

UD Sari Rasa uses local cassava tape as the raw material and carries out the purchase of raw materials in the area Mayang. Purchase materials this standard done every day as much as 200 Kg so that in One month UD Sari Rasa can buy cassava tape raw materials 26 times with a capacity of 5200 Kg. The following is the data on the purchase of cassava tape raw materials in January - December 2021.

Table 1. Purchase material standard tape cassava in the year 2021

No	Month	Purchase (Kg)
1	January	5,200
2	February	4,800
3	March	5,400
4	April	5,200
5	May	5,200
6	June	5,200
7	July	5,400
8	August	5,200
9	September	5,200
10	October	5,200
11	November	5,200
12	December	5,200

Count	62,400
Avg.	5,200

b. Use raw materials for tape cassava

UD Sari Rasa carries out the production process twice a day, in the morning at 03.00 WIB and 07.00 WIB with a production capacity of as much as 4 recipes where every recipe needs 20 Kg cassava tape so that one production requires 80 Kg of cassava tape. So every two productions in a day the capacity of raw materials used is 160 Kg. The following is data on the use of cassava tape raw materials in January - December 2021.

Table 2. Use raw materials of tape cassava

No	Month	Working days	Use raw materials tape cassava (Kg)
1	January	26	4160
2	February	24	3840
3	March	27	4320
4	April	26	4160
5	May	26	4160
6	June	26	4160
7	July	27	4320
8	August	26	4160
9	September	26	4160
10	October	26	4160
11	November	26	4160
12	December	26	4160
Ammount		312	49,920
Avg.			4,160

3.2. Calculation Method EOQ (Economic Order Quantity)

a. Cost Booking

Purchase or booking material standard cassava tape will give rise to a cost, namely the ordering *cost*.

Table 3. Cost of raw materials for cassava tape every time order

No	Type Cost	Amount Cost (Rp)
1	Transport and unloading	5,000
Amount		5,000

Table 4. Costs for ordering raw materials for cassava tape at UD Sari Rasa in 2021

No	Type of Cost	Cost per Order (Rp) (a)	Order Frequency (Times) (b)	Total Annual Order Fee 2021 (Rp) (a x b)
1	Transport and unloading	5,000	312	1,560,000
Amount		5,000		1,560,000

b. Cost Storage

Cost material standard counted in form presentation, that is presentation from the price supply (price from material standard tape cassava) [7]. The size of the presentation set by UD Sari Rasa that's it as big as 10%.

Table 5. Storage Cost Raw Materials Cassava Tape

Average inventory price per (Kg) (a)	% Inventory Cost (b)	Cost Storage (Rp) (a x b)
8,000	10	800

c. Economic Order Quantity (EOQ) Method

The Economic Order Quantity method aims to know what is the optimal amount of cassava tape raw material purchases that can minimize inventory costs incurred by UD Sari Rasa.

Table 6. Raw material usage, Raw material prices, and Raw material inventory Costs in 2021

Uses of cassava tape raw materials			Order cost per order (Rp)	Storage Cost (Rp)
Amount (Kg) (a)	Avg. Price per Kg (b)	Total Cost (Rp) (a x b)		
49,920	8,000	399,360,000	5,000	800

From Table 6, we can count the amount optimal purchase using the Economic Order Quantity formula as follows:

$$Q_{opt} = \sqrt{\frac{2DS}{H}}$$

Information:
Q $_{opt}$ / EOQ: optimal quantity purchase (Kg)
D: annual demand in units for inventory items (Kg)
S: *ordering cost/ordering* cost (Rp)
H: *holding cost/storage* cost (Rp)

Calculation of the optimal number of purchases of cassava tape raw materials at the UD Sari Rasa suwar-suwir business in 2021:

$$Q_{opt} = \sqrt{\frac{2\ x\ 49920\ x\ 5000}{800}}$$

= 790 Kg (*Rounding*)

The optimal purchase of cassava tape raw materials at the UD Sari Rasa suwar-suwir business in 2021 is 790 Kg with the frequency of purchases made by the UD Sari Rasa suwar-suwir business as much as:

$$= \frac{\textbf{use of raw materials for one year}}{\textbf{optimal amount of raw material purchases}}$$

$$= \frac{\mathbf{49920}}{\mathbf{790}}$$

= 63 times in one year ordering

With the ordering cycle:

$$= \frac{\textbf{active working days for one year}}{\textbf{frequency of purchases during one year}}$$

$$= \frac{\mathbf{312}}{\mathbf{63}}$$

= Every 5 days purchasing raw materials

In 2021, the optimal one-time purchase of cassava tape raw materials that must be purchased by the UD Sari Rasa suwar-suwir business is 790 Kg. The optimal purchase of cassava tape raw materials for one year is 63 times, with a period of once every 5 days.

3.3. Calculation of Safety Stock (S*afety Inventory)*

Safety stock = α σ. The purpose of *safety stock analysis* is to predict shortages or delays in ordering raw materials and damage to raw materials due to storage [8]. *The service level* that has been used by the factory is 90% with a value of 1.28 which allows the factory to fulfill supply.

Table 7. Service level value

Service Level	Service Factor	Service Level	Service Factor
50%	0	86%	1.08
70%	0.52	87%	1.13
75%	0.67	88%	1.18
80%	0.84	89%	1.23
85%	1.04	90%	1.28

Note: Service level 90% has a value of 1.28

Meanwhile, standard deviation has the following formula :

$$\sigma = \sqrt{\in \frac{(d - d_i)^2}{n}}$$

d = requirement per year/ working days per year (Kg)
$\boldsymbol{d_i}$= daily use (Kg)

For more details on standard deviation calculations, see Table 8 :

Table 8. Calculation of Standard Deviation for 2021 at UD Sari Rasa

Month	Use	Estimation	Deviation	Square
	$\boldsymbol{d_i}$	d	($\boldsymbol{d_i}$-d)	($\boldsymbol{d_i}$-d)²
January	4160	4160	0	0
February	3840	4160	- 320	102400

March	4320	4160	160	25600
April	4160	4160	0	0
May	4160	4160	0	0
June	4160	4160	0	0
July	4320	4160	160	25600
August	4160	4160	0	0
September	4160	4160	0	0
October	4160	4160	0	0
November	4160	4160	0	0
December	4160	4160	0	0
Amount	49920			153600
Avg.	4160			
Standard Deviation	113			

Source : processed primary data, year 2021

Can be calculated by the formula:

$$\sigma = \sqrt{\in \frac{(d - d_i)^2}{n}}$$

$$= \sqrt{\frac{153.600}{12}}$$

= 113

The standard deviation in 2021 for UD Sari Rasa is 113 and the service level used is 90% with a value of 1.28. So, to find out the size of the safety stock, it can be calculated using the formula:

$$safety\ stock = \propto \sigma$$

= 1.28 x 113

= 145

The safety stock that must be available/ existing in UD Sari Rasa in 2021 is 145 Kg.

3.4. Calculation of Reorder Point (ROP)

The reorder point is a decision that a company must reorder raw materials so that they can immediately get the raw materials when the raw materials run out [9]. In a day the raw material used for cassava tape is 160 kg.

$$ROP = safety\ stock + \bar{d}\,L$$

Information:
ROP: Reorder Point (Kg)
$\bar{d}$: daily use (Kg)
L: *lead time* (day)

Calculation:
ROP = 145 + (160 Kg x 1)
= 145 + 160 Kg
= 305 Kg

UD Sari Rasa must reorder raw materials for cassava tape with a raw material inventory of 305 kg in 2021.

3.5. Calculation of Raw Material Inventory Costs (Total Cost/ TC)

The purpose of calculating the total cost of raw material inventory is to find out the total inventory costs incurred by the UD Sari Rasa suwar-suwir business in 2021 . The following is the calculation of the total cost of raw material inventory :

$$\boldsymbol{TIC = \sqrt{2DS\ x\ S\ x\ H}}$$

Information:
TIC: inventory variable costs (Rp)
D: raw material requirements per year (Kg)
S: cost per order (Rp)
H: storage costs per unit (Rp)

Calculation:

$$\boldsymbol{TIC = \sqrt{2DS\ x\ S\ x\ H}}$$

$$= \sqrt{\boldsymbol{2\ x\ 49,920\ x\ 5,000\ x\ 800}}$$

= Rp 632,000

DC = D x average price of raw materials
= 49,920 x 8,000
= Rp 399,360,000

TC = TIC + DC
= Rp 632,000 + Rp 399,360,000
= Rp 399,992,000

The total cost of raw material inventory in the UD Sari Rasa suwar-suwir business in 2021 based on the EOQ (Economic Order Quantity) method is Rp 399,992,000.

Table 9. Comparison of the inventory of raw materials for cassava tape at UD Sari Rasa and using the EOQ method in 2021.

Information	UD Sari Rasa	EOQ Method
Purchase Quantity (Kg/Day)	200	790
Purchase Frequency (Times/Year)	312	63
Safety stock (Kg/Day)	-	145
Reorder point (Kg/Day)	-	305
TC (Rp/Year)	404,248,000	399,992,000

Based on Table 9, it can be seen that UD Sari Rasa does not have a Safety Stock and also does not apply a Reorder Point. The result is that UD Sari Rasa has a problem of excess cassava tape raw materials which can result in high storage costs. Meanwhile, if a factory does not implement a Reorder Point, it will result in the factory purchasing raw materials too frequently with increasing costs [7]. In the total inventory cost column, the costs incurred by UD Sari Rasa are higher than the costs incurred based on the EOQ method. The difference in total inventory costs (TC) from a comparison of company calculations using the EOQ method can save costs of IDR. 4,256,000.

4. Conclusion

The results of this research can be concluded:

a. Controlling the supply of cassava tape raw materials at UD Sari Rasa using the EOQ method calculation, namely the optimal order quantity in 2021 is 790 Kg in one order, and raw material orders can be made every 5 days.
b. The optimal amount of cassava tape needed for the shredded business at UD Sari Rasa is 790 kg of cassava tape.
c. The right time to order cassava tape raw materials is at the point of re-ordering cassava tape raw materials which must be carried out by the UD Sari Rasa suwar-suwir business, namely when 305 kg of cassava tape raw materials are in the warehouse.
d. The total inventory costs that must be incurred by the UD Sari Rasa suwar-suwir business in 2021 using the EOQ method is IDR 399,992,000.

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