Analysis of EOQ (Economic Order Quantity) as a Basis for Controlling Multi Item Raw Materials at Laatunsa Bakery Tasikmalaya

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ABSTRACT	ARTICLE INFO

The goals of this study were to analyze the most cost-effective requirements for the primary raw materials based on the requirements of Laatunsa Bakery for the 2020–2021 period, due to the excessive frequency of raw material acquisitions, the inventory procedure results in a high cost expenditure; to examine the total cost of the primary raw material inventory that must be paid by Laatunsa Bakery for the 2020–2021 period, to analyse the frequency of purchases that are necessary; to analyze the quantity of safety stock (safety stock); to analyze the timing of reordering (reorder point), and to analyze the Laatunsa Bakery's primary raw material inventory control utilizing the EOQ method. Data gathering was place between November 2021 and February 2022. All information pertaining to the acquisition of the primary raw material inventory required for production, as well as the associated expenses of raw material inventory was utilized. This study adopted Economic Order Quantity as the analytical technique approach.
The study's findings utilizing the EOQ approach revealed that the inventory of raw wheat cost Rp. 585,581.45, a savings of Rp. 2,613,934.94. Additionally, saving Rp 2,559,472.21 on sugar raw materials costing Rp 585,582.23 is possible. Additionally, the cost of the raw ingredient for butter is Rp. 585,582.23, saving Rp. 2,559,472.21. Additionally, the cost of the raw material for eggs is Rp 952,399.69, saving Rp 3,355,584.19. Additionally, the developer can save IDR 1,132,400.99 on the IDR 590,582.81 in raw materials.When compared to conventional method, the EOQ method can reduce inventory costs and optimize the need for raw materials. The EOQ approach is utilized using Microsoft Excel for the calculation.

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1. Introduction

The company's objective is to make profit. Numerous elements, including the efficient production, have an impact on this objective. The availability of raw materials to be processed in production has an impact on how smoothly production proceeds (Ruauw, 2011: 1). Therefore, in carrying out the production process, companies need raw materials to be processed into products with added value and the best quality. In order for production to run on time, the company must be able to provide the raw materials needed in the production process (Daud, M. N., 2017: 185).

In order to ensure that the supply of raw materials is always met with the lowest possible cost, consideration of the importance of the availability of raw materials in relation to production amount causes these raw materials to always be ready in as much quantity as each production period (Fithri, P., & Sindikia, A., 2014: 665-666). Inventory management in the company is crucial for efficient manufacturing (Santosa, S., Satriyono, G., & Bambang, R. N. 2018: 88). In order to prevent a mistake in production volume estimation that would result in an excess or deficit of production volume that would result in waste or an accumulation of inventory. So the need for an inventory control system that can support the smooth production, then use the planning method EOQ (Economic Order Quantity).

One model of a raw material inventory control model is EOQ. This methodology seeks to ascertain how many economic orders there are for a good or material. Utilizing the Economic Order Quantity in inventory control planning helps reduce inventory costs and improve the efficiency of production planning (Sirait, Gultom, & Nababan, 2013: 469).

One of the manufacturing companies in Tasikmalaya is Laatunsa Bakery, which operates a bakery where bread and pastries are made. a company that has been baking different kinds of bread and desserts since 2017. The primary basic materials used in the creation in Laatunsa Bakery Tasikmalaya are wheat flour, sugar, eggs, butter, and developer. Laatunsa Bakery purchases raw ingredients for 103 times of flour, sugar, and butter throughout the course of a year, and for 52 times of eggs and developers. Because of this, the company is forced to pay every time an order is placed. When there are more sales, there are fewer raw materials available since the company does not supply spares. To prevent a buildup and a lack of raw materials, it is therefore essential to manage the raw material inventory. In order to prevent issues with the supply of raw materials, the author applies the EOQ approach in this study.

2. Literatur Riview

2.1 Inventory

Inventory is defined as resources and the physical economy must be maintained to support the efficient production process, including raw materials and finished products, assembled components, auxiliary materials and goods in process, according to Haming and Nurnajamuddin (2007:4). According to Handoko (2011: 333)."The terminventoryis a general term that shows everything or organizational resources that are keept in anticipation of meeting demand". The statement "Inventory is a collection of goods stored for sale in the company's business activities and can be employed in the production process or can be used for a specific purpose (Swasono and Prastowo, 2021:134). The authors conclude that inventory is a company resource in the form of raw materials, raw materials, finished products, or items in process to be employed in production operations in order to meet consumer demand in anticipation of production delays, based on numerous interpretations.

2.2 Inventory Manajement

According to Handoko (2011: 333) Inventory control is a crucial managerial task because many organizations invest the most rupiah in their physical inventories of current assets. Inventory control, according to Assauri (2005:176), is one of a series of tasks that are closely tied to one another in the company's complete production operation in accordance with what has been planned in advance in terms of time, quantity, quality, and cost. According to the above definition, inventory control refers to a management system used by the business to control raw materials or inventory in order to maintain safety with ideal quantities and shorten the time between reorders.

2.3 Materials

Raw materials are Various products that the company buys from suppliers and uses or processes into finished goods that are created by the company (Daud, 2017: 186). Raw materials are the capital of the production process until the production results (Sulaiman & Nanda, 2015: 2). Therefore, it may be inferred that raw materials are the primary elements required in production processes, whether generating semi-finished goods or finished goods with a marketable value.

2.4 Economic Order Quantity

One inventory control model that makes it simple for businesses to choose the quantity of orders for cheap raw materials in accordance with those businesses' needs during the production process is the Economic Order Quantity. According to Siswanto (2015: 125), Ford Harris and RH Wilson

independently created the Economic Order Quantity inventory model in 1915. Additionally, this model is deterministic and accounts for the two most fundamental kinds of inventory costs, namely:

1. The order expenses

2. Storage expenses

According to Handoko (2011: 339), "In theory, the EOQ concept, which is frequently referred to as the fix order quantity, is simple. The number of inventory orders and the inverse cost of inventory ordering costs are calculated using the EOQ model.

2.5 Economic Order Quantity Multi Item With Microsoft Excel

Siswanto (2015: 136) claimeds that Windows-based software has made it incredibly easy to manipulate data or carry out calculations. Excel is a very useful spreadsheet program that makes using the Economic Order Quantity simpler and more enjoyable.

A company can estimate the quantity of inventory orders with the lowest cost in less time by using Microsoft Excel in the EOQ method calculation.

3.   Method, Data, and Analysis

The researcher uses a quantitative descriptive approach to his research, which tries to depict things that occur objectively by employing numbers in the form of nominal figures derived from business data. For this reason, a quantitative approach is used as an approach in research proposals, processes, data analysis and conclusions with aspects of calculation and certainty of numerical data. Quantitative method is used to calculate the optimal inventory of raw materials at Laatunsa Bakery. The Laatunsa Bakery's inventory of raw materials used to make bread and cakes, as well as the price of that inventory, are all used in this study.

3.1 Data Collection Method

The authors of this study utilized the following methods for gathering data:

1. Documentation is a method for gathering data by using records that are already in existence, such as information on the history of the organization or the different kinds of raw materials used.

2. The chairman and staff of Laatunsa Bakery were contacted through an interview in order to acquire the data required for this study.

3. Direct observation of the object being examined is used as a data gathering method.

4. Literature study is a data gathering activity that involves reading, logging, and managing. In this study, the author employs books, journals, and ebooks that are relevant to the topic at hand.

3.2   Sources And Methods For Gathering Data

Sources in this study are primary data and secondary data. Primary data were obtained through conducting in-person interviews with the chairman and staff of Laatunsa Bakery, and secondary data included statistics on raw material requirements, inventory costs, and information specific to this study.

3.3   Method Of Data Analysis

This study's analysis techniques include:

Economic Order Quantity

Economic Order Quantity (EOQ) can be used to determine the ideal number of orders and purchases in each order while keeping costs to a minimum. The formula below can be used to calculate EOQ:

$$EOQ = \sqrt{\frac{2SD}{H}}$$

Known:

EOQ = Economical ideal purchase volume

S   = One-time Order expenses

D   = Total raw material requirement

H   = Storage expenses

Frequency of Purchase of Raw Materials

The Economic Order Quantity (EOQ) method's calculation findings are used to determine the frequency of orders that the company can place depending on the frequency of raw material purchases. The formula for determining how frequently to buy raw materials is as follows:

$$F = \frac{R}{EOQ}$$

Known:

F   = Frequency of purchasing raw materials

R   = Total raw material requirements

EOQ = Economical ideal purchase volume

Safety Stock

Safety stock is a measure taken by businesses with raw material reserves to prepare for shortages if the business has increased production orders or delays (lead time) in supplying raw materials. This way, businesses can avoid worrying about raw material shortages and halting production.

Riska Iskandar (2020: 43), formula safety stock:

SS = the standard amount of foreign exchange from the level of need X 1,65

Known:

SS = Safety Stock

Re Order Point

The point at which inventory must be used to make up the shortfall in raw material inventories is known as the reorderpoint. ROP ordering makes the assumption that the lead time demand will remain constant and the same. If not, add more stock or keep some on hand for safety.

Formula Reorder Point in Handoko's estimation (2011: 343):

ROP=(Lead time x Penggunaan hari)

Known:

ROP = Reorder Point

Total Inventory Cost

Total Inventory Cost (TIC) is the sum of all expenses incurred to maintain inventory, from ordering materials to selling the products. The formula for computing Total Inventory Cost (TIC) is as follows:

$$\text{TIC} = \sqrt{2.\text{DSH}}$$

Known:

D = Total raw material requirement

S   = One-time Order expenses

H = Storage expenses (year)

4. Result And Discussion

According to the study's findings, the Laatunsa Bakery company was able to reduce ordering expenses and storage costs by employing the EOQ method. A company can estimate the quantity of inventory orders with the lowest cost in less time by using Microsoft Excel in the EOQ method calculation. The results of the Economic Order Quantity calculation using Microsoft Excel are as follows:

Figure 1. EOQ Multi Item Analisis Q Optimal

Item	Requirements (Kg)	Planning period (day)	Order expenses (Rp)	Storage expenses (Rp)	Lead Time	Q (unit)	N	Y (day)	Usage (day)	R (unit)	R (day)	TIC (Rp)
Flour	2575	335	30533,98	109,3	1	1199,459	2,146802	156,0461	7,686567	7,686567	155,0461	131100,8
Sugar	515	335	30533,98	545,16	1	240,1864	2,144168	156,2377	1,537313	1,537313	155,2377	130940
Butter	515	335	30533,98	545,16	1	240,1864	2,144168	156,2377	1,537313	1,537313	155,2377	130940
Eggs	780	335	80769,23	359,95	2	591,6491	1,318349	254,1057	2,328358	4,656716	252,1057	212964,1

Source: Calculation Result Microsoft Excel, 2021

Known:

Q = Economic Order Quantity

N = Re Order Cycle (Time)

Y = Re Order Cycle (Day)

R = Re Order Point

Figure 1 using A comprehensive EOQ study of five items is shown in one worksheet in Microsoft Excel, with the first six columns presenting the data to be examined and the subsequent column displaying the findings. By reducing expenses, the usage of Microsoft Excel's Economic Order Quantity attempts to make it simpler for businesses to maintain their raw material inventory. The level of inventory increase is determined in Kg units by utilizing the optimal Q analysis, and it is as follows: flour 1199,459 Kg, sugar 240,1864 Kg, butter 240,1864 Kg, eggs 591,6491 Kg, developer 12,11774 Kg. The reordering cycle for flour is 2.146802 (rounded down to 2), sugar is 2.144168 (rounded down to 2), butter is 2.144168 (rounded down to 2), eggs are 1.318349 (rounded up to 1), and developer is 2.145614 (rounded down to 2). Additionally, it was discovered that the duration of one reorder cycle in days was as follows: for flour 156.0461 days (rounded to 156 days), for sugar 156.2377 days (rounded to 156 days), for butter 156.2377 days (rounded to 156 days), for eggs 254.1057 days (rounded to 254 days), and for developer 156.1325 days (rounded up to 156 days). Additionally the daily usage in kilograms for the following items: wheat 7.686567 Kg, sugar 1.537313 Kg, butter 1.537313 Kg, eggs 2.328358 Kg, developer 0.077612 Kg. Additionally, it was discovered after placing a new order in kilograms, namely for flour 7.686567 Kg, sugar 1.537313 Kg, butter 1.537313 Kg, eggs 4.656716 Kg, and developer 0.078327 Kg. The period of reordering was also discovered, and it was as follows: for wheat, 155.0461 days (rounded to 155 days), for sugar, 155.2377 days (rounded to 155 days), for butter, 155.2377 days (rounded to 155 days), for eggs, 252.1057 days (rounded to 252 days), and for developer, 155,1324 days (rounded up to 155 days). The entire cost of inventory was also discovered to be Rp. 131,100.8

for wheat, Rp. 130,940 for sugar, Rp. 130,940 for butter, Rp. 212,964,1 for eggs, and Rp. 132,667 for developer.

It may be inferred that by maximizing the level of raw material inventory, the EOQ approach with optimal Q analysis in Microsoft Excel can lower expenses.

Figure 2. EOQ Multi Item Analisis N Optimal

Item	Requirements (Kg)	Planning period (hari)	Order expenses (Rp)	Storage expenses (Rp)	Lead Time	Q (unit)	N	Y (day)	Usage (day)	R (unit)	R (day)	Total Order cost (Rp)	Total storage cost (Rp)	TIC (Rp)
Flour	2575	335	30533,98	109,3	1	1199,459	2,146802	156,0461	7,686567	7,686567	155,0461	65550,41	65550,41	131100,8
Sugar	515	335	30533,98	545,16	1	240,1864	2,144168	156,2377	1,537313	1,537313	155,2377	65469,98	65470	130940
Butter	515	335	30533,98	545,16	1	240,1864	2,144168	156,2377	1,537313	1,537313	155,2377	65469,98	65470	130940
Eggs	780	335	80769,23	359,95	2	591,6491	1,318349	254,1057	2,328358	4,656716	252,1057	106482	106482	212964,1
Developer	26	335	31057,69	10798,39	1	12,229445	2,145614	156,1325	0,078327	0,078327	155,1325	66637,81	66029,16	132667

Source: Calculation Result Microsoft Excel, 2021

In Figure 2, the multi-item EOQ analysis of the optimal N in Microsoft Excel, the reorder period in the multi-item case is carried out separately with optimal Q. Because the frequency of ordering raw materials is the result of the total raw material requirements divided by the EOQ or the level of additional inventory obtained from the optimal Q analysis. So, in the multi-item analysis, in addition to the addition of optimal Q inventory, it is necessary to carry out an optimal N reorder cycle. By using the optimal N analysis in Figure 2 with Microsoft Excel , it can be seen that the Total Inventory Cost (TIC) for the main raw materials is Rp. 738.611.8,-.

Discussion Result

Based on the examination of the Total Inventory Cost (TIC) reported by the company for the fiscal year 2020–2021, it indicates a higher amount of Rp. 15,268,767.5 as opposed to Rp. 738,611.8 when applying the EOQ technique. Consequently, it can save Rp 14,530,155.7. From the explanation above, it can be inferred that adopting the Economic Order Quantity is more effective at reducing costs when managing raw material inventory. This is demonstrated by the difference between the company's total inventory expenses and the total inventory costs using the EOQ approach. Less frequent order cycles and fluctuations in the volume of additional inventory are the causes of this. Finding the number of cost-effective orders for each production item purchased will undoubtedly have an impact on profits. The EOQ method can be applied in the company to measure the ideal order that enables the company to meet demand without spending excessively with the goal of minimizing storage costs and excess inventory.

5. Conclution and Suggestions

5.1 Conclution

1. Based on the examination of the Total Inventory Cost (TIC) reported by the company for the fiscal year 2020–2021, it shows a higher amount of Rp. 15,268,767.5 compared to Rp. 738,611.8 when applying the EOQ technique. Consequently, it can save Rp 14,530,155.7. According to the report, using the EOQ method can help businesses reduce their inventory expenses.

2. According to the findings of an examination of inventory control using the EOQ approach, less is purchased by making purchases of flour, sugar, butter, and developer raw materials twice a year and eggs just once. The company's approach is 103 times for wheat, sugar, and butter raw ingredients and 52 times for buying eggs and development.

3. Because orders are placed less often than is typical, inventory control of raw materials using the EOQ method results in much lower inventory expenses over the course of a year.

5.2 Suggestions

1. The cost of supplying raw materials can be reduced if the organization employs the EOQ method. However, because the EOQ approach requires a lengthy procurement period, the danger of damaged raw materials is higher. Therefore, if a company uses the EOQ approach, it must handle raw materials more precisely to cope with perishable raw materials or it can look for other, more suitable methods for obtaining raw material supplies.

2. In order to prevent a production halt due to a shortage of raw materials, the company can offer safety stock.

3. Businesses might use a reorder point to prevent delays in placing raw material orders.

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