



UDC 332

ANALYSIS OF RAW MATERIAL SUPPLIES FOR OEDANG SARI SOY SAUCE USING THE ECONOMIC ORDER QUANTITY METHOD AT CV. OEDANG SARI

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ABSTRACT

The increasing number of industries in the food and beverage sector at this time makes it difficult for businessmen to obtain and predict the demand for raw materials used in their industry, so it is necessary to estimate and manage inventory appropriately so that the production process runs smoothly. This research uses a quantitative approach with a descriptive research type. The types of data used are primary data and secondary data. The data analysis method used is EOQ (Economic Order Quantity) analysis, safety stock, reorder, point, and trend analysis of raw material requirements. The results of raw material inventory analysis for Oedang Sari Soy Sauce are not optimal because the difference between the optimal order of raw material which is 3,058.73 Kg/Order with the actual order of 889.58 Kg/Order, safety stock of 576.45 Kg and reorder point of 1,162.39 Kg is very far and the need for soy sauce raw materials at CV. Oedang Sari for the next twelve months experiences have decreased.

KEY WORDS

Demand trend, inventory, reorder point, safety stock.

The food and beverage industry sector is a mainstay sector that continues to experience rapid development and its relatively wide market share is a special attraction for entrepreneurs to work in businesses in a similar field. This has caused many new businesses to emerge that produce similar products, causing increased competition in the existing food and beverage industry. Facing this increasing competition, there will certainly be a lot of competition from various business activities, one of which is the business of providing raw materials for production activities. Therefore, it is necessary for companies to start thinking about how to manage good inventory so that supplies remain available for the smooth production process. The purpose of raw material inventory management is to reduce operational costs to a minimum including production, ordering and storage costs so that it will optimize company performance and maximize the profits received by the company (Ambarwati & Supardi, 2021). Therefore, inventory management is important for companies, considering that inventory is the main working capital for every company. Inventory reporting is also very important for companies to do, because this is related to company decision making (Utama et al., 2019)

Inventory itself arises when there is a synchronization between the existing demand and the supply and processing time of the raw materials used (Yamit, 2008). The uncertainty of the delivery period and the demand for raw materials to be used during one production period is a problem often faced by industries in Indonesia, so extra inventory is needed or can be referred to as safety stock and reorder point so that there is no excess or shortage of raw materials owned by the company (Paduloh et al., 2023).

CV. Oedang Sari is one of the companies that produce soy sauce with raw materials, namely black soybeans. Oedang Sari soy sauce is a soy sauce that has been on the market since 1928. In order to create the maximum quality of soy sauce, of course CV. Oedang Sari will use quality black soybeans. However, black soybeans used as raw materials are often not fulfilled. This is because soybean crops, especially black soybeans, are often used as side crops or interludes after planting rice so that black soybean production is very limited. This causes competition in obtaining black soybeans for soy sauce raw materials with similar business actors to be tighter.



As for when the harvest season arrives CV. Oedang Sari often buys black soybean raw materials in large quantities due to concerns about not meeting the needs of the raw materials used during the production process. However, this creates other problems such as the company spending too much money on storage of materials in the warehouse and it is not uncommon for the raw materials used to rot in the warehouse so that they cannot be reused to make soy sauce and can only be disposed of or sold at low prices for animal feed. Therefore, it is necessary for companies, especially CV. Oedang Sari which uses black soybeans to start thinking about how to manage good inventory so that black soybean supplies remain available and this will also affect the smooth production process carried out.

As for carrying out good inventory management, it is necessary to analyze whether the inventory owned by a company is optimal or not using the EOQ (Economic Order Quantity) method. By using the EOQ (Economic Order Quantity) method, the company can also achieve optimal inventory levels at a low cost so that the company will be able to minimize stockouts and be able to save on inventory costs incurred by the company due to the efficiency of raw material inventory in the company concerned (Heizer & Render, 2015).

In addition to predicting the optimal inventory used by the company, the company also needs definite forecasting to predict the uncertainty of demand or supply in the future. In this case, this forecasting will also be one of the considerations for the company in determining decisions in determining safety stock and reorder point so that there is no excess or shortage of raw materials needed by the company (Ardiansyah et al., 2023). With proper forecasting, the company will get many benefits such as efficient use of raw materials, maximizing sales and so on (Fahmi, 2016).

Based on this description, this study aims to: (1) analyze the optimal amount of soy sauce raw material inventory at CV. Oedang Sari; (2) analyze the amount of safety stock of soy sauce raw materials used at CV. Oedang Sari; (3) analyze the reorder point of soy sauce raw materials at CV. Oedang Sari; and (4) analyze the trend of soy sauce raw material requirements used in CV. Oedang Sari for the next twelve months.

METHODS OF RESEARCH

The approach used in this research uses Quantitative methods with the type of research used is descriptive method. This method is used to provide an overview of how CV. Oedang Sari implements a policy to carry out optimal raw material inventory in providing raw material purchasing considerations such as quantity, order time, order quantity and other related costs (ordering, storage and purchase) (Sugiyono, 2016). The method of determining the research location is done intentionally (purposive). Researchers make CV. Oedang Sari as a research location because CV. Oedang Sari is the oldest soy sauce factory, included in premium soy sauce with an expensive price but has many enthusiasts and has spread in several cities outside the city of Cirebon. The method of determining the respondents used in this study is purposive. There are three respondents selected including the owner of CV. Oedang Sari, Operations Manager and production employees of CV. Oedang Sari. As for data collection, researchers use interview, observation and documentation methods with data types including primary data and secondary data. The data analysis technique used in this research is to use the EOQ method, safety stock, reorder point and trend analysis. As for the *trend* analysis used in the form of linear trend, quadratic trend and exponential growth *trend* methods. Then there are three models that can be used in measuring forecasting errors, namely *Mean Absolute Percentage Error* (MAPE), *Mean Absolute Deviation* (MAD), *Mean Square Deviation* (MSD) (Kusdarwati et al., 2022).

RESULTS AND DISCUSSION

Ordering costs are costs directly related to black soybean ordering activities by CV. Oedang Sari. As for CV. Oedang Sari orders black soybeans once in a period of two weeks (every two weeks). The following is the amount of ordering costs that must be incurred by CV. Oedang Sari for each order:



Table 1 – Average Cost of Ordering Black Soybeans at CV. Oedang Sari starting from January 2022 - December 2023

Cost Type	Value (IDR/Order)
Telephone Costs	7.500
Transportation Costs	75.000
Labor Cost	80.000
Total Ordering Cost	162.500

Source: Primary Data Processed (2024).

Based on table 1, it can be seen that the average cost of ordering black soybeans made by CV. Oedang Sari on each order from January 2022 to December 2023 is IDR 162.500,00/Order. The details of the booking costs include the average telephone costs of IDR 7.500,00/Order, the average transportation costs of IDR 75.000,00/Order (additional gasoline money) and the average cost of labor costs as a transporter of IDR 80.000,00/Order.

The cost of purchasing raw materials is a price set based on the amount of money spent when buying Black Soybeans. The cost of purchasing black soybeans issued by CV. Oedang Sari as follows:

Table 2 – Average Cost of Purchasing Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Description	Value
Purchase Quantity of Black Soybeans (Kg)	889,58
Price (IDR/Kg)	14.571
Total Purchase Cost (IDR)	12.961.970

Source: Primary Data Processed (2024).

Based on Table 2, it can be seen that the average cost of purchasing black soybeans in each order from January 2022 to December 2023 is IDR12.961.970,00 with details of the average purchase amount of Black Soybeans of 889,58 Kg and the price of each Kg is IDR14.571,00/Kg.

Storage costs are costs incurred due to the black soybeans stored by CV. Oedang Sari. Details of storage costs incurred by CV. Oedang Sari can be seen in the following table:

Table 3 – Average Cost of Purchasing Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Description	Value
Labor Cost (IDR/Year)	1.920.000
Electricity Cost (IDR/Year)	1.020.000
Tobacco Purchase (IDR/Year)	120.000
Total Capital Interest (IDR/Year)	16.398.850
Total Storage Cost (IDR/Year)	19.458.850
Raw Material Inventory (Kg)	19.909,38
Storage Cost per Unit (IDR/Kg/Year)	977

Source: Primary Data Processed (2024).

Based on Table 3, it can be seen that the average total cost of storing black soybeans is IDR 19.458.850,00/Year and for each Kg is IDR 977/Kg/Year. The details of this storage cost include labor costs of IDR1.920.000,00/Year, electricity costs of IDR 1.020.000,00/Year, purchase of tobacco to be used as a natural pesticide to repel rats of IDR 120.000,00/Year and total capital costs of IDR 16.398.850,00/Year.

EOQ (Economic Order Quantity) analysis is a method to determine the optimal quantity of black soybean inventory at CV. Oedang Sari, but can reduce operational costs to a minimum including ordering costs and storage costs (Rusdiana, 2014). The following is the value of Economic Order Quantity (EOQ) at CV. Oedang Sari starting from January 2022 - December 2023 can be seen in the following table:



Table 4 – Average Cost of Ordering Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Cost Type	Value
Black Soybean Demand (D) (Kg/Year)	28.125
Ordering Cost (S) (IDR/Order)	162.500
Storage Cost (H) (IDR/Kg/Year)	977
Optimal Ordering (EOQ) (Kg/Order)	3.058,73

Source: Primary Data Processed (2024).

From table 4 it is known that the optimal ordering of Black Soybeans (EOQ) obtained for 1 year is 3.058,73 Kg/Order. From these results it can be seen that the ordering of black soybeans made by CV. Oedang Sari is not optimal because the amount of raw material ordering is much greater than the optimal amount of ordering (EOQ). The comparison between the actual booking and the optimal booking of black soybeans made by CV. Oedang Sari can be seen in the following table:

Table 5 – Average Cost of Ordering Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Description	Actual Ordering	Optimal Ordering	Difference
Order Quantity (Kg/Order)	889,58	3.058,73	2.169,15
Frequency (Day)	24	9	15
Ordering Cost (S) (IDR/Year)	5.137.607	1.494.188	3.643.419
Storage Cost (H) (IDR/Year)	434.560	1.494.188	1.059.628
Total Inventory Cost (IDR/Year)	5.572.167	2.988.376	2.583.791

Source: Primary Data Processed (2024).

Based on table 5, above, it can be seen that optimal ordering (EOQ) for 1 year CV. Oedang Sari can place an order of 3.058,73 Kg/Order with an order frequency of 9 times and the cost of procuring raw materials of IDR 2.988.376,00/Order. For more details can be seen in the following figure:

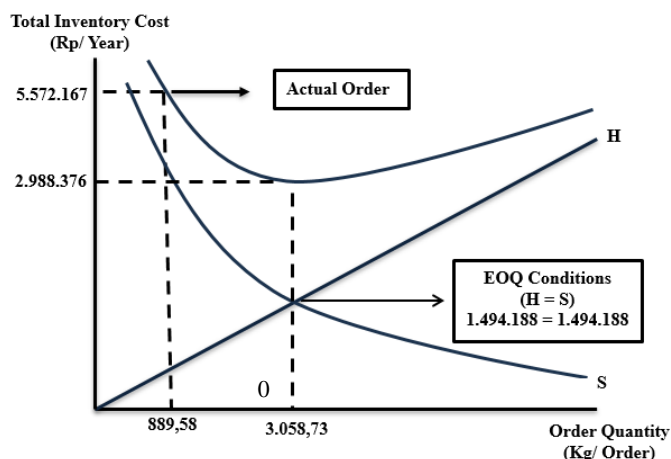


Figure 1 – Optimal Black Soybean Order Quantity Curve (Source: Primary Data Processed, 2024)

As one of the conditions for EOQ (optimal inventory) conditions is when the ordering cost (S) and storage cost (H) have the same size (Sihombing et al., 2020). Based on Figure 1, it can be seen if the EOQ condition is reached ($H = S$) if CV. Oedang Sari provides raw materials as much as 3.058,73 Kg/Order with an order frequency of 9 times per year. This is more profitable because CV. Oedang Sari only needs to spend a total inventory cost of IDR 2.988.376,00/Year, meaning that the company can save costs of IDR 2.583.791,00/Year.

Safety Inventory is inventory provided to protect or maintain the possibility of a shortage of raw materials. Therefore, the procurement of safety inventory is very important to hold, because with the inventory of raw materials the company can continue to run its



production while waiting for the delivery of new raw materials to the company and can be used in the production process (Kushartini & Almahdy, 2016). The following safety stock that must be owned by CV. Oedang Sari can be seen in the following table:

Table 6 – Average Cost of Purchasing Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Description	Value
Standard Deviation (Kg)	341,09
Z value	1,69
Safety Stock (Kg)	576,45

Source: Primary Data Processed (2024).

Based on table 6 the safety stock value of black soybeans at CV. Oedang Sari is 576,45, meaning CV. Oedang Sari must provide at least 576,45 Kg of black soybeans in the warehouse as a safety stock. However, the situation in the field, CV. Oedang Sari has not implemented this safety stock system, due to the very abundant stock of black soybeans in the warehouse due to always buying supplies offered by farmers (suppliers) to the company due to fear of shortages and running out of the availability of raw materials on the market given the limited availability of black soybeans on the market. In addition, ignorance of the optimal order quantity in ordering raw materials results in CV. Oedang Sari cannot estimate the exact amount of safety stock that must be prepared and is considered too risky if it buys raw materials at once due to considerations of the availability and price of raw materials on the market.

The reorder point (ROP) is the amount or level of certain inventory to reorder black soybeans. As for the calculation of reorder points according to company policy, the value is lower than the calculation by the EOQ method due to the calculation of safety stock and the use of raw materials during the lead time (Sarjono & Kuncoro, 2014).

Table 7 – Average Cost of Ordering Black Soybeans at CV. Oedang Sari starting from January 2022-December 2023

Cost Type	Value
Total Usage (D) (Kg/Production)	292,97
Leadtime (L) (Days)	2
Safety Stock (SS) (Kg)	576,45
Reorder Point (Kg)	1.162,39

Source: Primary Data Processed (2024).

Based on table 7 the reorder point value of black soybeans at CV. Oedang Sari is 1.162,39, meaning that the company must reorder the minimum black soybeans when the black soybean inventory in the warehouse reaches 1.162,39 Kg. For more details can be seen in the following curve:

Based on Figure 2, it can be seen that if the black soybean reorder titi is 1.162,39 with a safety stock of 576,45, it means that CV. Oedang Sari must reorder the minimum black soybeans when the black soybean inventory in the warehouse reaches 1.162,39 Kg, so that the inventory in the warehouse is not less than the safety stock that has been provided or runs out completely. Then the ROP obtained of 1.162,39 Kg is much less than the minimum inventory that must exist, which is 15.000 Kg. The amount of inventory has advantages such as enabling the company to continue producing for a long period of time without worrying about running out of raw materials, but on the other hand the company also suffers considerable losses due to swelling storage and maintenance costs, loss of raw materials due to damage in warehouses caused by age, pests and so on with the amount of raw materials wasted on average 200 kg of black soybeans wasted each month.

In forecasting, companies can use various methods, one of which is using trend analysis. As for the implementation of the use of trend analysis in CV. Oedang Sari is useful for predicting the need for black soybeans in the future (Putri et al., 2019). Previously, CV.



Oedang Sari only places orders if there are suppliers who offer and carry out production activities only following the existing weather conditions, because the weather is considered as one of the important factors in making oedang sari soy sauce. This is because the weather will affect the initial fermentation process and the existing black soybean chopping process, so it is not uncommon for companies to not want to take too much risk and decide to produce less or not at all.

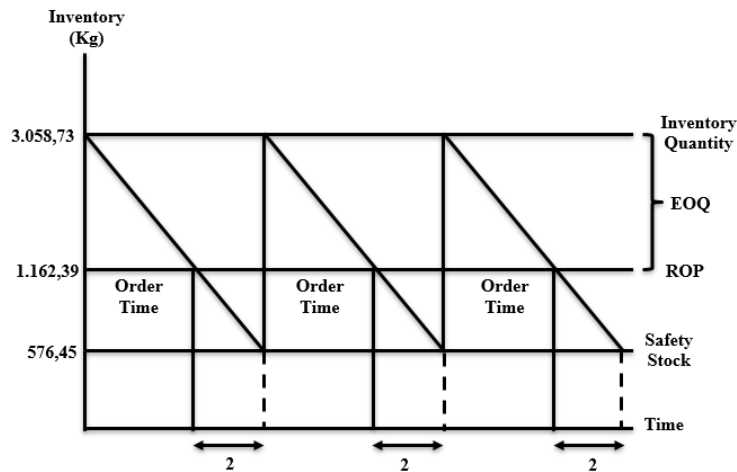


Figure 2 Black Soybean Inventory Utilization Curve (Source: Primary Data Processed, 2024)

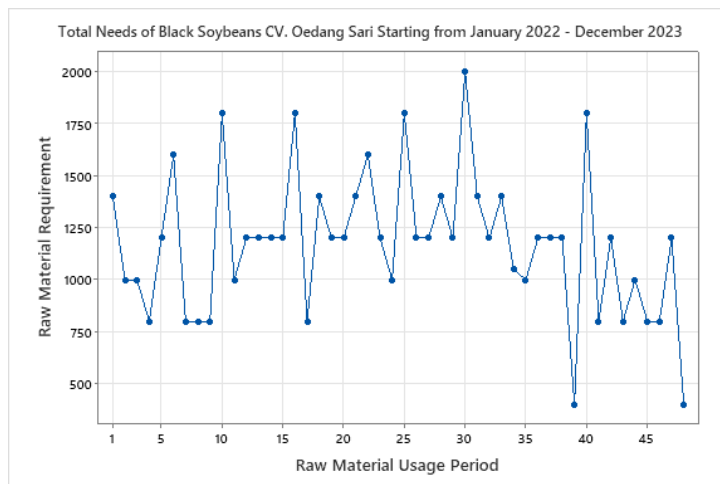


Figure 3 – The need for black soybeans at CV. Oedang Sari starting from January 2022 - December 2023 (Source: Secondary Data Analysis, January 2022 - December 2023)

In addition to existing demand and weather conditions, the amount of soy sauce stock in the warehouse is a consideration for companies in determining the need for raw materials used. This is because CV. Oedang Sari in certain months such as approaching Ramadan, the end of the year and other festive months, the company prefers to sell warehouse inventory first so that there is no accumulation and even damage due to too long storage. In addition, the money from selling soy sauce is also used for other operational activities such as purchasing raw materials, employee salaries and so on, so that not every time the need for raw materials is always high but adjusts to the company's circumstances and of course the budget owned by the company.

Figure 3 shows the demand for black soybeans at CV. Oedang Sari from January 2022 to December 2023 continues to fluctuate.

The right trend method is the trend method that provides the smallest forecasting error value. The smaller the MAP, MAD and MSD values, the smaller the error rate in the



forecasting method (Ompusunggu & Wage, 2021). Based on table 8, it can be seen that the smallest error value is in the quadratic trend forecasting method.

Table 8 – Average Cost of Ordering Black Soybeans at CV. Oedang Sari starting from January 2022- December 2023

Forecasting Model	MAPE	MAD	MSD
Linear <i>Trend</i>	27	253	113.211
Quadratic <i>Trend</i>	23,2	233	92.480,2
Exponential <i>Trend</i>	26	263	117.093

Source: Primary Data Processed (2024).

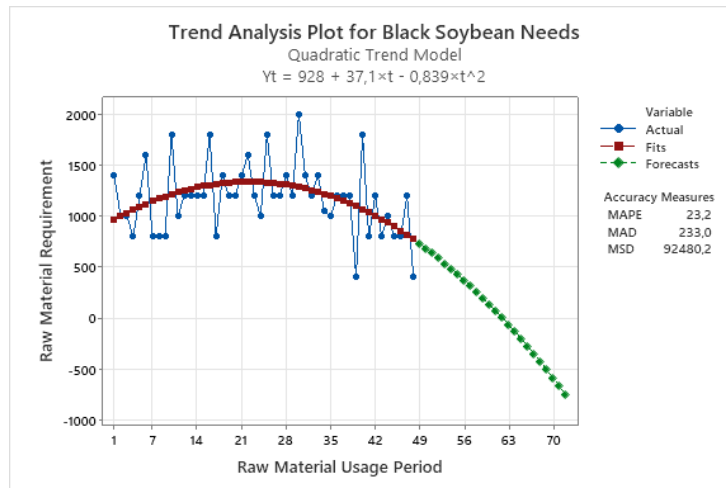


Figure 4 – Quadratic Trend of Black Soybean Needs at CV. Oedang Sari (Source: Primary Data Analysis, January 2022 - December 2023)

Figure 4 shows that the blue line is the actual demand for raw materials used by CV. Oedang Sari. The red line shows the *trend* of raw material requirements which has a tendency to curve downward and the green line is the result of forecasting analysis for the next twelve months with the results tending to curve downward as well. The following is a linear equation for the need for black soybeans at CV. Oedang Sari:

$$Y_t = 928 + 37,1T - 0,839 T^2$$

The quadratic trend equation above can be used as a forecast for CV Black Soybean needs. Oedang Sari in the next January - December 2024. Based on Figure 2. it can be seen that the forecasting of raw material requirements tends to continue to decline due to a decrease in the need for black soybeans needed by CV. Oedang Sari for the production process. The extreme weather factor (long drought) that occurred in 2023 was the main reason why the company did not want to take the risk of producing in large quantities as usual. This is because the long dry conditions that occur affect the process of initial fermentation and chopping of black soybeans so that the results of fermentation and chopping are deemed less than optimal and the yield of soy sauce produced will decrease.

In addition, with the long dry conditions, the supply of black soybeans on the market is getting smaller due to crop failure, this has caused the price of raw materials to soar, so instead of purchasing raw materials CV. Oedang Sari prefers to produce with the existing stock in the warehouse by continuing to purchase black soybeans in small quantities according to the existing budget. These problems have caused the decline in black soybean inventories in the warehouse and reduced the need to use black soybeans for production activities because it is feared that there is too much risk of failure in the fermentation and chopping process of raw materials so that this causes failure in the existing production process.



CONCLUSION

Inventory of soy sauce raw materials at CV. Oedang Sari is not optimal. This is because the optimal ordering of black soybeans is 3.058,73 Kg/Order with a frequency of ordering 9 times, while the actual ordering of black soybeans is 889,58 Kg/Order with a frequency of 24 times. Safety stock of black soybeans at CV. Oedang Sari is 576,45 Kg. Reorder point of black soybeans at CV. Oedang Sari amounted to 1.162,39 Kg and the need for black soybeans at CV. Oedang Sari for the next twelve months has decreased.

Based on the results of the research the authors can suggest for the company to carry out inventory calculations using the EOQ method because based on the results of the study it can save IDR 2.583.791,00 Then CV. Oedang Sari must also do forecasting of black soybean needs, this is done to determine future strategies in overcoming existing raw material inventory problems such as rising raw material prices, scarcity of raw materials and so on. Then CV. Oedang Sari can apply the EOQ method as a consideration before ordering raw materials such as consideration of the costs associated with ordering, so that the company can carry out a more profitable, precise purchase plan and of course save on ordering costs incurred by CV. Oedang Sari.

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