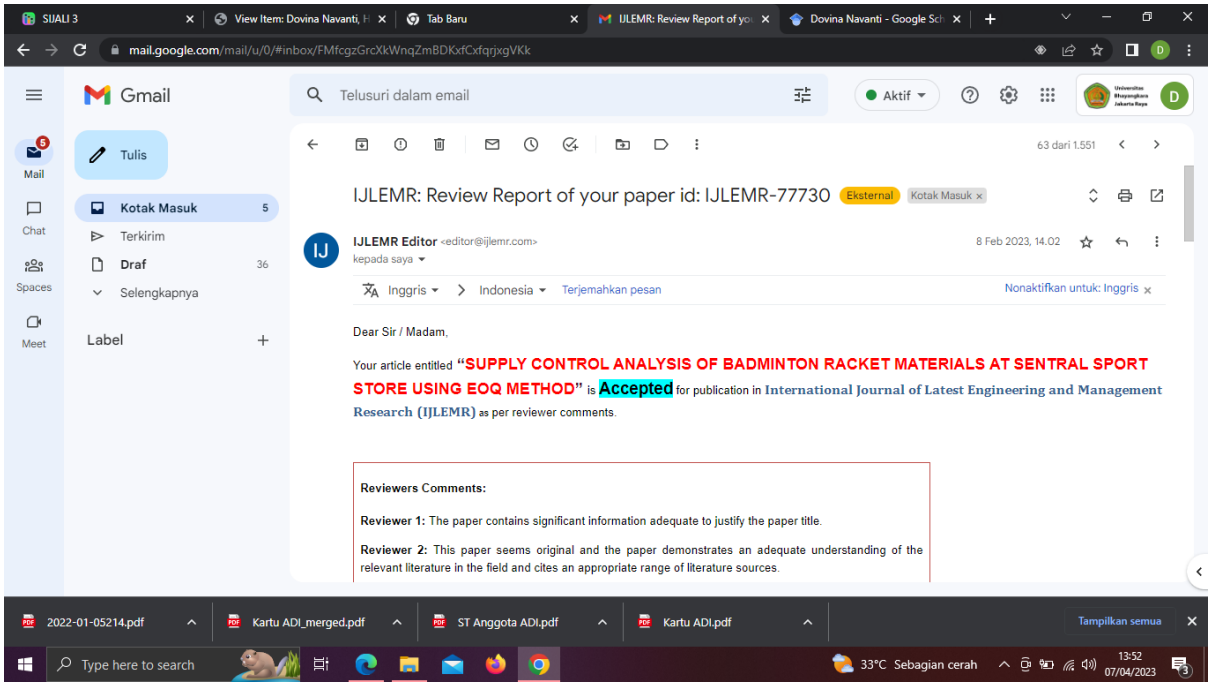
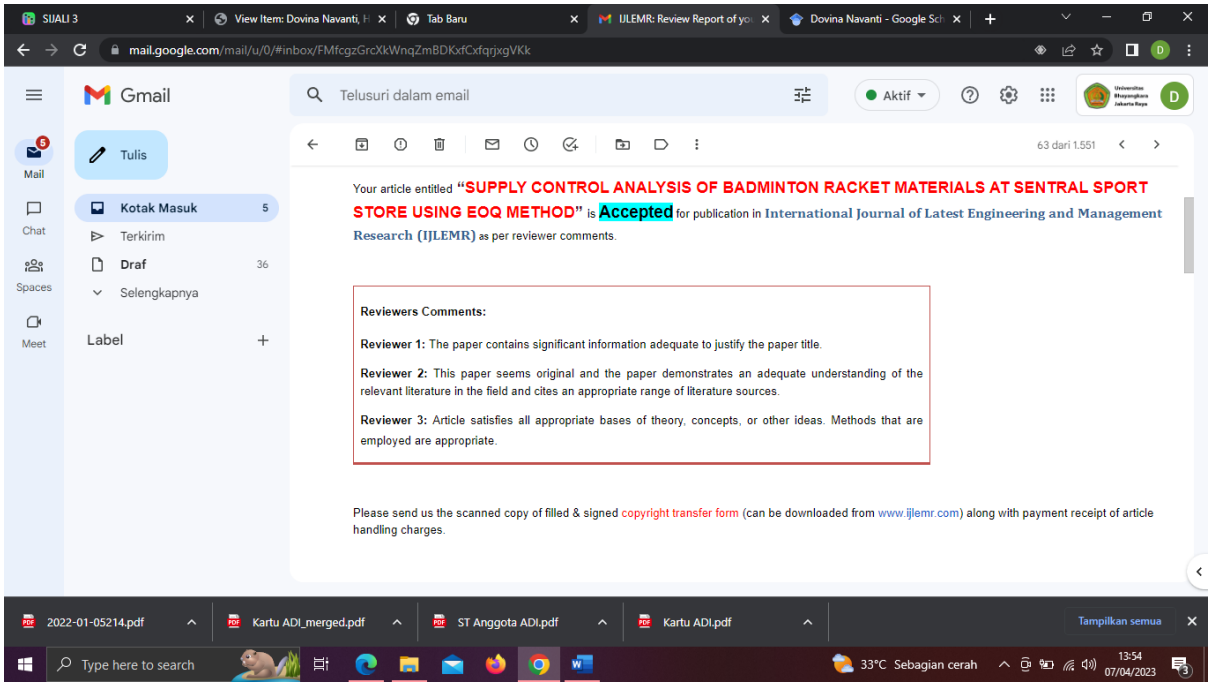
Supply Control Analysis of Badminton Racket Materials at Sentral Sport Store using EOQ Method





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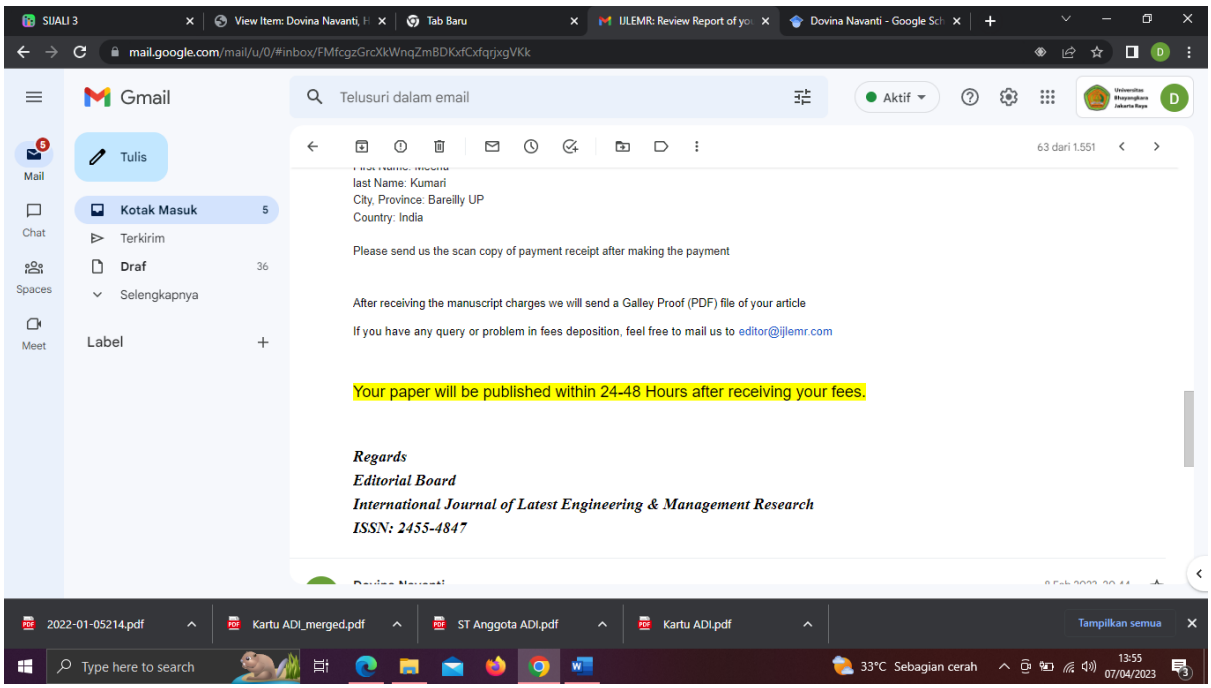

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Supply Control Analysis of Badminton Racket Materials at Sentral Sport Store using EOQ Method

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Abstract: Sentral Sport Store is a store engaged of sports equipment, and produced a badminton racket. In managing the supply of basic materials to produce badminton racket, always excess of materials. This problem occurs due to a lack of knowledge in inventory as properly. Therefore, in this study is help the store in carrying out of inventory of basic materials optimally and save the store's expenses. In order to achieve this goal, the research used the Economic Order Quantity. As a result of research, the total cost of inventory based on store policy is IDR 1,229,166.653 with a purchase amount of 89 sets of basic materials per order, while the total inventory cost on the basis of using EOQ is IDR . Rp. 625,704.458, - with the purchase of 339 sets of basic materials per order. Thus, the cost can be saved as much as Rp. 625,704,458, -. in one year.
Keywords: Economic Order Quantity, basic materials, supplies

Introduction

Sentral Sport Store is a store whose business started in 1992 located in Bekasi city. Until now, it has been running about 30 years, sold badminton rackets which produced by themselves by supported materials from distributors. Beside, the store also purchased finished goods from other distributors. This research is only focused on badminton rackets. The sales system is carried out using an offline and online store system through e-commerce and social media.

Because there are so many enthusiasts of the badminton racket, the store always stocks basic materials and complementary materials to produce these badminton rackets. From these orders, there is excess stock of products, so there is hoarding of goods in the warehouse. This is due to the pandemic and difficulties in finding consumers who need these products. As for other impacts, such as the relatively take time to find consumers. With this impact, it can damage the products in the warehouse, because too many products are stored. If left alone, the store will suffer huge losses and even threaten left of business.

Based on the stockpiling of goods in Sentral Sport's warehouse store, they feel that they have not been optimal in controlling the supply of basic materials. So they need an EOQ method in order to control well ordering of goods by reducing inventory costs. Therefore researcher conducted research on the analysis of the EOQ method to control the inventory of basic materials at the Sentral Sport Store.

Literature Review

Economic Order Quantity

EOQ is a method of purchasing a number of inventory items that can be carried out as little as possible so that the total cost of all inventory items is low (Ayu A, Komariah, & Mulia Z, 2022) (Yuliana, Topowijono, & Sudjana, 2016) (Yopan Maulana, 2018) (Saragi & Setyorini, 2014) (Fahmi Sulaiman, 2015).

The EOQ technique is a technique used in the process of calculating the minimum amount and price of stock to increase the diagram of holding costs and ordering costs (Rully Mujiastuti, 2020) (Rorim Panday; Novita Wahyu; Dewi Sri; Cahyadi Husadha, 2020)**.** (Hudzaifah Dohar Pardomuan Marbun, 2015)**,** said that basically the Economy Order Quantity technique is a technique in the process of determining the lowest number of orders for goods in one order process (Septiawan & Panday, 2021). The Economy Order Quantity technique can be used as a technique that can align problems with managing raw material inventory and can be said to be the oldest control technique, thus obtaining a low total cost of supplying raw goods. The EOQ technique is needed in the process of purchasing several kinds of basic materials maximally and can cut the cost of stocks that need to be issued by the company or shop (Rorim Panday, 2021). In calculating the Economic Order Quantity, there are 2 costs that must be considered, namely ordering costs and holding costs(R. Panday, Rachmat, & Navanti, 2020)(Pradana & Jakaria, 2020).

The calculation techniques used are: EOQ calculation, total inventory cost, safety stock, and reorder point. The following is a systematic equation of each calculation using EOQ (Heizer, J., & Render, 2014) (Hillier & Lieberman, 2010) (Blumenfeld, 2009) (Onawumi, Oluleye, 2011) (Birbil, Bulbnul, J.B.G.Frenk, n.d.) (Tibrewala & Kleinstein, 2000):

1. **The formula is:**

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

2. **The formula of the total cost of inventory is**: $\left(\frac{D}{Q}\boldsymbol{S}\right) + \left(\frac{Q}{2}\boldsymbol{H}\right)$

Annotation:
EOQ: The optimal amount of orders
D: Total demand for basic materials/year
S: Order cost in one order
H: Cost of holding one product per year

3. **The formula of safety stock and standard deviation are:**

$$Standar\ deviasi\ (Sd) = \frac{\sqrt{\sum(x - \bar{x})^2}}{n-1}\ dan\ Safety\ stok = Sd\ x\ Z$$

Annotation:
Sd: Standard deviation
x: Total demand basic materials
$\bar{x}$: Avegare demand of basic materials
Z: normal Value

4. **The formula of Reorder point is:** $\boldsymbol{d = \left(\frac{D}{t}\right)\ dan\ ROP = d\ x\ L}$

Annotation:
d: Total demand basic materials/month/ day
D: Total demand basic materials /year
t: Total work-time/year
L: Lead time

Previous Research

Research on EOQ has been carried out by (Mathew, 2013) (Rorim Panday; Hernawati, 2015) (Emmanuel Adjin Okwabi, 2014) (Al-salamah, 2011) (Ameli, Mirzazadeh, & Shirazi, 2008) (Rezaei & Salimi, 2012), which in all research when used the EOQ method in inventory management on each research object, has been proven to reduce total inventory costs and minimize reordering and optimize ordering frequency.

Research Method

The data obtained from this study were obtained by interviews with store owners. This research is directly carried out at the Sentral Sport Store location, Bekasi, from September 2022 to October 2022. The calculation method used the Economic Order Quantity and other data such as: the ordering cost, the holding cost, and some data ordering goods. After all the necessary data has been obtained, calculations are carried out using the EOQ formulas.

Analysis and Discussion

In Sentral Sport Store, to produce badminton rackets, the main basic material is wood which is made of carbon fiber. The wood is obtained from regular distributors located in Cirebon. Sentral Sport Store orders the wood once a month with a lead time of approximately 10 days. As for complementary basic materials for badminton rackets, it requires strings and rubber to protect the racket handles. These materials are ordered from a regular store that sells strings and protective rubber located in Tangerang. Details, of material at the following table:

Table 1 Basic Material Data of Sentral Sport Store

Material for production	Amount	Price (IDR)
Badminton Racket Wood	1.068 pcs	85,000
Strings	1.068 pcs	15,000
rubber for racket handles	1.068 pcs	10,100

Source: Sentral Sport Store

Data on the need of basic materials for racket in 2021 can be presented:

Table 2 Data of Basic Material for 2021

No	Month	Total wood (pcs)
1	January	53
2	February	57
3	March	67
4	April	68
5	May	106
6	June	132
7	July	150
8	August	124
9	September	97
10	October	42
11	November	93
12	December	79
Total requirement basic material/year(D)		**1.068**
Average requirement/month ($\bar{x}$)		**89**

Source: Sentral Sport Store

It can be seen that the number of purchases of the basic material in 2021 is 1,068 sets. Average purchase of wood base materials in a month is 89 $sets$. Frequency of ordering once every 1 month, so a year are ordered to distributors 12 times. Purchasing of basic materials each month increase and decrease depending on the level of consumer demand. The ordering costs and holding cost are presented at Table 3 and table 4.

Table 3 Ordering cost for basic materials

No	Type of cost	Total. cost (IDR)
1	Communication cost	200.000
2	Shipping costs	600.000
3	Delivery administration cost	350.000
Total ordering cost		1.150.000
frequency		12
Ordering cost/order		95.833,333

Source: Data compiled

Table 4 Data on the holding cost of basic material

No	Type of cost	Total Cost (IDR)
1.	Cost of electricity for storage in the warehouse	400.000
2.	The cost of storing reserves for defective goods in the warehouse	1.500.000
Total holding cost		1.900.000
Demand basic material		1.068
The holding cost/set		1.779,026

Total cost based on provision of Store is: 1.150.000+1.900.000 = 3.050.000. And then, the Economic Order Quantity calculation process can be carried out, which the number of basic material requirements (D) is 1,068 sets, the cost of ordering each order (S) is IDR.95,833.333, and the cost of holding (H) is IDR 1,779,026/set. The Economic Order Quantity, frequency and total cost are as following table:

EOQ	Frequency	Total Cost
339,209	3,14 or 3 $times$	603.462,195

To calculate safety stock, it must be preceded by calculating the standard deviation. The following is the standard deviation, safety stock and ROP calculation:

Table 5 Standard Deviation, safety stock and ROP calculation

No	**Month (n)**	**Total basic material (x)**	**Average ($\bar{x}$)**	$(x - \bar{x})$	$(x - \bar{x})2$
1	January	53	89	-36	1.296
2	February	57	89	-32	1.024
3	March	67	89	-22	484
4	April	68	89	-21	441
5	May	106	89	17	289
6	June	132	89	43	1.849
7	July	150	89	61	3.721
8	August	124	89	35	1.225
9	September	97	89	8	64
10	October	42	89	-47	2.209
11	November	93	89	4	16
12	December	79	89	-10	100
TOTAL					12.718
$Standar\ deviation\ (Sd) = \frac{\sqrt{\sum(x - \bar{x})^2}}{n-1}$					34,003
$Safety\ stock = 34{,}003\ x\ 1{,}64\ =$					$55{,}765\ or\ 56\ sets$
Lead time					10 days
Working time in 1 year					300 days
calculated$d = \left(\frac{D}{t}\right) = \frac{1.068}{300}$=					3,58
ROP=3,58x 10+ Safety stock= 36+56					92 sets

Source: Data compiled

From the calculation results which are relatively more affordable using the Economic Order Quantity basis, the following table can be presented;

Table 6 Comparison of Provision Store Results with Economic Order Quantity Basis

Subject	Store provision	Economic Order Quantity
Average purchase of basic materials/ order	89 sets	339,209 sets
Total inventory cost	IDR. 3.050.000	IDR. 603.462,195
Purchase Frequancy	12 times	3 times
Safety stock	-	56sets
Reorder point	-	92sets

It can be concluded that the Q determined by the shop is a number of 89 sets and the Q resulting from the calculation of the Economic Order Quantity is a number of 339 sets, so that it can be said that using this calculation method can change the amount of purchase of basic materials with an increase of approximately 4 times more. It can also be seen that the total cost of inventory issued by the store is IDR. 3.050.000, and the total cost of inventory on the basis of EOQ is IDR. 603,462.19511552.

So that the cost that is saved and can be used as an advantage by the store every time you place an order for basic material is IDR. 3.050.000-IDR. 603,462.195 = IDR. 2.446.537,805. With the calculation of the Economic Order Quantity, the cost of inventory is lower than the cost of the provisions of the store, so that the Economic Order Quantity method can be applied to this Sentral Sport Store. And, with the results of this research, Sentral Sport Store when purchasing basic materials using the Economic Order Quantity method looks more affordable so that it can save on inventory costs incurred and make the store get relatively more adequate profits.

Conclusion

Based on the results obtained from the analysis and discussion, it can be concluded that using the Economic Order Quantity basis can help the Sentral Sport Store in managing all of its store's inventory activities. And Sentral Sport Store can generate more adequate profits again. By using the basic calculation of the Economic Order Quantity used at the Sentral Sport Store, the store can advance quickly and precisely, which saves IDR. 2.446.537,805 per year.

Suggestion

Researcher recommended to carry out the next analysis at Sentral Sport Store on the basis of calculating the Economic Order Quantity which can provide support in the production process.

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