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FORECASTING OYSTER MUSHROOM SALES USING THE DOUBLE EXPONENTIAL SMOOTHING METHOD AT KUB RUMAH MUSHROOM BERSAMA

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Abstract

The amount of oyster mushroom production is often not by consumer orders due to a lack of attention to the mushroom stock in the Mushroom House KUB. The purpose of this study is to apply double exponential smoothing (DES) to predict future sales of oyster mushrooms so that consumer needs are met. This research method uses quantitative methods. The data source comes from data on sales of oyster mushrooms from June 2021-May to 2022. The data is analyzed using double exponential smoothing based on alpha and MAPE values. The results showed that an alpha of 0.6 with a MAPE value of 6.23% was the alpha with the smallest MAPE. This study concluded that the double exponential smoothing method could accurately predict future oyster mushroom sales.

Keywords: alpha, DES, oyster mushroom, MAPE, sale

Abstrak

Jumlah produksi jamur tiram yang dihasilkan sering tidak sesuai dengan pesanan dari konsumen karena kurangnya perhatian pada stok jamur yang ada di KUB Rumah Jamur. Tujuan penelitian ini adalah menerapkan double exponential smoothing (DES) untuk meramalkan penjualan jamur tiram di masa yang akan datang sehingga kebutuhan konsumen terpenuhi. Metode penelitian ini menggunakan metode kuantitatif. Sumber data berasal dari data penjualan jamur tiram pada bulan Juni 2021-Mei 2022. Data dianalisis menggunakan double exponential smoothing berdasarkan nilai alpha dan MAPE. Hasil penelitian menunjukkan alpha sebesar 0,6 dengan nilai MAPE 6,23% merupakan alpha dengan MAPE terkecil. Penelitian ini dapat disimpulkan bahwa metode double exponential smoothing dapat digunakan untuk meramalkan penjualan jamur tiram di masa yang akan datang dengan akurat.

Kata kunci: alpha, DES, jamur tiram, MAPE, penjualan

INTRODUCTION

Oyster mushroom (Pleurotus ostreatus) is one type of fungus that grows on wood media as a source of human food with various nutrients and can be used to substitute other nutritional sources that are relatively more expensive (Sutarman, 2012). Cultivation of oyster mushrooms is the same as various types of mushrooms that can be consumed, which requires lignin as a source of nutrition which is consumed by converting macro carbohydrate molecules into simpler sugar molecules with the help of the ligninase enzyme produced. Oyster mushroom lignin also requires hemicellulose, cellulose, essential macro elements, protein, and vitamin (Purwantoro & Sutjahjo, 2019)

Currently, various mushroom processing businesses are in high demand by new entrepreneurs who want to try to do business in the culinary or snack field because the raw materials are cheap, and many people like processed mushrooms, especially oyster mushrooms. However, sometimes the demand for the mushroom itself is not comparable to the ample supply of oyster mushrooms in the mushroom cultivation itself.

KUB Rumah Mushroom Bersama, located in the village of Hessa air Genting is a company engaged in the cultivation of oyster mushrooms. Mushroom sales vary widely. It makes it a problem for KUB Rumah Mushroom Bersama to know sales that occur in the future. Another problem is that the amount of mushroom production that is produced often does not match orders from consumers due to

a lack of attention to mushroom stocks. But in providing supplies, it is necessary to estimate the stages of mushroom cultivation and set the oyster mushroom cultivation itself, starting from the preparation of the barn, preparation of the backlog, to harvesting.

Based on research, KUB Rumah Mushroom Bersama has selling data whose sales levels have an erratic increase and decrease and contain a little trend element in it; thus, the forecasting method that is suitable for use in this type of data is Brown's double exponential smoothing (Wahyudi, 2020). Brown developed this method to overcome the differences between the actual data and the forecast value if there is a trend in the plot. The rationale for Brown's linear, exponential smoothing is similar to that of a linear moving average in that both single and multiple smoothing values lag behind the actual data. If there is an element of trend, the difference between single and numerous smoothing values is added to the smoothing value and adjusted for direction (Susianto & Guntoro, 2017). The Exponential Smoothing method is also called the smoothing or smoothing method. The Exponential Smoothing method has an exponentially weighted moving average on all past observed values. The Exponential Smoothing method is known as the weighting or smoothing constant. The actual value determines the extent to which current observations affect the forecast. If it is close to 1, the value of the latest forecast model will include a significant adjustment for any errors that occur in the value of the previous forecast model (Krisma *et al*., 2019).

Research about Predicting the Number of New Students Enrolling Using One-Parameter Double Exponential from Brown stated that Brown's one parameter as a precise method with a value of α = 0,2 produced F_{t+m} (*the size of the forecast*) 38,89 in the result (Aden & Jauzi, 2019). Research stated that forecasting the outcome of passport application by the Double Exponential Smoothing method with parameter α = 0.4 (determining alpha based on *trial* dan *error*) resulted in a MAPE value of 14.28 % (Seno & Kamila, 2022). The double exponential smoothing method is expected to predict the number of sales of oyster mushrooms based on the data obtained at KUB Rumah Mushroom Bersama. It belongs to the excellent category in forecasting the passport application in the future, so this method can be used at the Imigrasi Kelas II Non-TPI office in Depok to prediction amount of passport applicants in 2021 as a guide to determine the strategy of service to reach good performance.

RESEARCH METHODS

Type of Research

The research used the quantitative method. The method uses both systematic and mathematical models.

Time and Place of Research

The research was conducted at KUB Rumah Mushroom Bersama, located in Hessa Air Genting village. The study was conducted from March 2022 to July 2022.

Procedure

1. Problem Identification

Problem identification is the first step in implementing Double Exponential Smoothing. Problem identification aims to determine the appropriate data to be analyzed using the double exponential smoothing method.

2. Method, Source, and Data Collecting

This research method is quantitative. The data used in this study is in the form of sales of Oyster Mushrooms at KUB Rumah Mushroom Bersama from June 2021-May 2022. The techniques used for data collection include the following:

a) *Field Research*

In field research, researchers directly visit the research site and take the data needed for research. Field research was carried out by direct interviews with the owners of the Joint Mushroom KUB to obtain information and observe the source of data on the sale of Oyster Mushrooms directly.

b) Literature Research

Literature research is carried out by collecting references from journals or academic books related to the problems discussed and used as support for comparisons in thesis completion.

3. Data Processing

At this stage, the obtained data proceeds into new information that is easier to understand.

4. Data Analysis

The processed data is analyzed using double exponential smoothing based on the alpha (α) and MAPE values.

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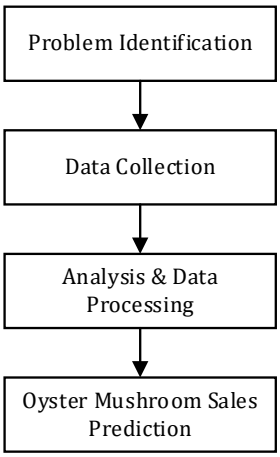

Figure 1. Research Flowchart

RESULT AND DISCUSSION

In this study, the problems identified were the sale of mushrooms that did not use the oyster mushroom sales system in the next month, so the stock made was often deficient, even in excess, and the amount of mushroom production produced was often not by orders from consumers due to lack of attention to mushroom stock in KUB Rumah Mushroom Bersama. After these problems are identified, input needs analysis and output needs analysis is carried out. Input needs analysis is an analysis of data in the form of input materials that will be processed by calculating the double exponential smoothing method. The rationale for the double exponential smoothing method is that the smoothing value will occur before the actual data if there is a trend component (Fajri & Johan, 2017). The data were analyzed as input in the form of data on sales of oyster mushrooms for the last year at KUB Rumah Mushroom Bersama, which can be seen in Table 1.

Table 1. Oyster Mushroom Sales Data

No.	Period	Number of Oyster Mushrooms Sold (Unit/Pcs)
1.	June 2021	200
2.	July 2021	350
3.	August 2021	390
4.	September 2021	434
5.	October 2021	478
6.	November 2021	513
7.	December 2021	523
8.	January 2022	554
9.	February 2022	578
10.	March 2022	598
11.	April 2022	611
12.	May 2022	615

Analysis of output requirements in the form of a forecasting application program display with the double exponential smoothing method will be designed in the interface design. The interface design of this application program uses Microsoft Visio supporting software. This application program will later run on Windows 10 Enterprise, which is adjusted to the operating system.

The double exponential smoothing algorithm is applied to forecasting oyster mushroom sales at KUB Rumah Mushroom Bersama based on Table 1. The double exponential smoothing calculation is obtained from the exponential smoothing calculation. The approach to determining the optimal parameter values is by trial and error and is selected based on the smallest MAPE value. The specified alpha values are 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9. The closer the alpha value is to 1, the closer the forecast value is to the actual value (Purwanto & Hanief, 2017). The results of MAPE calculations using Brown's double exponential smoothing method on oyster mushroom sales data can be seen in Table 2.

Table 2. MAPE Value

Alpha	MAPE
0.1	28.02 %
0.2	14.85 %
0.3	10.97 %
0.4	8.77 %
0.5	7.09 %
0.6	**6.23 %**
0.7	6.37 %
0.8	6.94 %
0.9	7.37 %

Based on Table 2, forecasting using Brown's double exponential smoothing method on oyster mushroom sales with an alpha of 0.6 is the alpha with the smallest MAPE value, so we use the calculation with alpha = 0.6. The calculation process uses the double exponential smoothing formula from Brown, calculates the forecast error rate from the actual data, and the forecast results from the double exponential smoothing method from Brown using the MAPE (*Mean Absolute Percent Error*) (Setiawan & Arief, 2021). MAPE is a measure of relative error. MAPE is usually more meaningful when compared to MAD because MAPE expresses the percentage of error prediction results against actual demand during a specific period which will provide information on the rate of error that is too high or too low (Hafizd Elison & Asrianto, 2020). The smaller the MAPE value, the closer the estimated value is to the actual value or the best method

chosen (Ariyanto et al., 2020; Lieberty & Imbar, 2015). It is research conducted by Dyah *et al*. (2020), which states that the double exponential smoothing method is chosen based on the smallest MAPE value. MAPE value < 10% indicates excellent predictive ability, which means very accurate prediction (Seno dan Kamila, 2022). This information shows that the calculation results using an alpha value of 0.6 will produce the most precise calculation because the MAPE value is 6.23%. Furthermore, S't, S''t, At, dan Bt was calculated by equations (1), (2), (3), and (4).

1. Determining S't

$S't = (\alpha \times X_t) + (1-\alpha)S'_{t-1}$ ..... (1)

For t = 1
X1 = 200
Because S't-1 is not available, then S'1 equals X1
S'1 = 200

For t = 2
X2 = 350
S'2 = (0,6 x 350) + (1-0,6) x 200
S'2 = 290

For t = 3
X3 = 390
S'3 = (0,6 x 390) + (1-0,6) x 290
S'3 = 350

The calculation was carried out calculated until the S'12 value.

2. Determining S" t

$S't = (\alpha \times S_t) + (1-\alpha)S''_{t-1}$ ..... (2)

For t = 1
X1 = 200
Because S" t-1 is not available, then S" t equals X1
S"1 = 200
For t = 2
X2 = 290
S"2 = (0,6 x 290) + (1-0,6) x 200
S"2 = 254

The calculation was carried out calculated until S'" 12 value.

3. Determining Constant At

At = 2S'1 – S''1
For t =1
At = 2 x 200 -200
At = 200
For t = 2
At = 2S'2 – S''2
At = 2 x 350 -254
At = 362

The calculation was carried out calculated until the A12 value.

4. Determining Constant Bt

$Bt = \frac{\alpha}{(1-\alpha)}(S't - S''t)$

For t = 1

$Bt = \frac{0,6}{(1-0,6)}(200 - 200) = 54$

For t = 2

$Bt = \frac{0,6}{(1-0,6)}(290 - 254) = 54$

The calculation was carried out calculated until the B12 value.

The results of forecasting the number of oyster mushroom sales with parameter alpha = 0,6 can be seen in Table 3.

Table 3. Forecasting the Number of Oyster mushroom Sales with Parameter Alpha 0.6

Period	Actual	S't	S''t	At	Bt
June 2021	200	200	200	200	0
July 2021	350	290	254	326	54
August 2021	390	350	311,6	388.4	57.6
September 2021	434	400.4	364.88	435.92	53.28
October 2021	478	446.96	414.13	479.79	49.25
November 2021	513	486.58	457.6	515.56	43.47
December 2021	523	508.43	488.1	528.76	30.50
January 2022	554	535.77	516.7	554.84	28.60
February 2022	578	561.11	543.35	578.87	26.64
March 2022	598	583.24	567.29	599.20	23.94
April 2022	611	599.9	586.85	612.94	19.57
May 2022	615	608.96	600.12	617.80	13.27

In table 3, S't is the first prediction amount in selling the oyster mushroom, S''t is the second prediction amount in selling the oyster mushroom, At is constant, and Bt is variable in the math equation to determine the amount of oyster mushroom, that will be sold in the next month. It is the first exponential smoothing value, S''t is a parameter of exponential smoothing that equals the previous exponential smoothing value, At is constant on period t, and dan Bt is the slope (Hariri & Mashuri, 2022). Based on the result in Table 2, forecasting of selling amount of oyster mushrooms in June 2022 can use equation (1). According to At

dan Bt in Mei 2022 in Table 2, the forecasted oyster mushroom will be sold at 631.

F_{t+m} = At + Bt ..... (3)
F_{t+m} = 617,8016 + 13,26385 ..... (4)
F13 = 631.0654 ~ 631 oyster mushroom

CONCLUSIONS AND SUGGESTIONS

Conclusion

The results of forecasting the sale of oyster mushrooms at KUB Rumah Mushroom Bersama in June 2022 using the double exponential smoothing method, as many as 631 oyster mushrooms with parameter alpha = 0.6. The results of forecasting the sale of oyster mushrooms are classified into the outstanding category (MAPE value = 6.23%) so that the forecasting results are accurate.

Suggestion

In forecasting values, it is better to use other methods so that there will be a comparison of which way is better in future research.

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