COMPARING THE WMA AND SES METHODS FOR FORECASTING STOCK PRODUCT OF MS GLOW PUTRI

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Abstract: Ms Glow Putri Shop is a business that operates in the beauty sector, selling beauty products, namely skincare and bodycare, which are useful for maintaining healthy body and facial skin. However, Ms Glow Putri currently often experiences problems, namely tight competition and inventory management that is less effective in terms of sales numbers. Every month reaching ±1300 products, Ms Glow Putri also often experiences shortages and build-ups in skincare and bodycare stocks. This can reduce customer confidence so that Ms Giow Putri often experiences losses in the form of finance and other things, so this method is needed to predict some skincare and other stock supplies. bodycare provided in the following month. This method uses the Weighted Moving Average and Single Exponentiation Smoothing methods to predict supplies of skincare and bodycare stocks. The results of research on Ms GIow daughter using the Weight Moving Average Method with a weight of 5 with a MAPE of 1.08% and the SingIe Exponentiation Smooting Method with an Alpha of 0.1, namely 0.84%, then the comparison between the two methods can be stated that the SES method is the best method good, because it has the lowest error.

Keywords: forecasting; ms glow putri; ses and wma

Abstrak: Toko Ms Glow Putri adalah usaha yang bergerak di bidang kecantikan, menjual produk kecantikan yaitu skincare dan bodycare berguna untuk menjaga agar kesehatan kulit tubuh dan wajah tetap terjaga. Namun Ms Glow Putri saat ini sering kali mengalami permasalahan yaitu persaingan yang ketat dan manajemen persediaan yang kurang efektif dengan jumlah penjualanan. Setiap bulan mencapai ±1300 produk maka Ms Glow Putri juga sering mengalami kekurangan dan penumpukan pada stok skincare dan bodycare ini dapat mengurangi kepercayaan pelanggan sehingga Ms Glow Putri sering mengalami kerugian berupa finance dan lainnya maka perlu metode ini untuk memprediksi beberapa persediaan stok skincare dan bodycare yang disediakan pada priode di buIan berikutnya. Metode ini menggunakan metode Weighted Moving Averege dan Single Exponential Smoothing untuk memprediksi persediaan pada stok skincare maupun bodycare. HasiI penelitian pada Ms GIow Putri dengan mengggunakan Metode Weight Moving Averege dengan bobot 5 dengan MAPE 1,08% dan Metode Single Exponential Smooting dengan Alpha 0,1 yaitu 0,84% maka perbandingan antara dua metode tersebut dapat dinyatakan bahwa metode SES adaIah metode paling baik karena memiliki error terendah.

Kata kunci: ms gIow putri; peramalan; ses dan wma

INTRODUCTION

Currently, the development of information technology is very rapid. Many people use applications to help make decisions and find solutions to various problems, including in the business world. Every business person tries to achieve their goals and missions, such as in the beauty and skin health industry. Skin and facial health is very important and is considered by both women and men because both are the main elements of appearance that must be taken care of. A good appearance increases self-confidence, so skincare and bodycare products are in great demand [1].

Bodycare and skincare are a series of body treatments used to maintain the healthy condition of body and facial skin. Ms GIow Putri's shop is located on Jalan Lintas Sei Piring, District. Rahuning, Regency. Asahan, 21273. Where the products marketed are skincare and bodycare. Previously, the shop implemented a sales system that had been carried out by Mrs. GIow Putri, where customers had to come directly to the shop to buy skincare and bodycare products. However, intense competition and ineffective product management are the challenges faced.

Every month sales to customers can reach ±1300 products. and the quantity is large enough, MS GIow Putri often experiences problems, namely, shortages and accumulation of supplies of skincare and bodycare products can cause storage so that customer demand cannot be met. This probIem can affect customer trust in MS GIow Putri and can experience losses in the form of finance and other losses. Therefore, forecasting is needed to determine the stock amount of skincare and bodycare products in order to anticipate product buildup or shortages.

To predict the supply of these products in this research, it is up to date, namely using the method that has the best results from comparing the two methods, namely the Weighted Moving Average method and single Exponential Smoothing.

The Weighted Moving Average method and the Single Exponential Smoothing method to predict how much product stock must be provided in the next period to meet customer demand. So these two methods will be compared to see which method produces the best accuracy.

Therefore, the aim of this research is to build an information system that can provide convenience in forecasting product stock inventory by using a comparison of the results of the Weighted Moving Average (WMA) and Single Exponential Smoothing (SES) methods for sales in the next period.

Research with the title "Comparison of the Weighted Moving Average Method and Single Exponential Smoothing School Enrollment Levels in the Papuan Traditional Area" states that the SES method is the best because it is a method based on forecasting which is the best method. reference for the government in the coming year[2].

Research entitled "Comparison of Weighted Moving Average and Single Exponential Smoothing in pharmaceutical product inventory forecasting[3].

Research with the title "Comparison of Single Moving Average and Single Exponential Smoothing in forecasting saIes of coupling sucker goods at PT. Pertamina Ep Asset-1 Field Jambi[4].

Research entitled "Comparison of the Single Exponentiation Smoothing and Moving Average Methods in forecasting sales of cooking oil products at PT Tunas Baru Lampung [5].

Research with the title "Comparison of the Accuracy of Sales Forcasting Using Single Exponentiation Smoothing (SES) and Double Exponential Smoothing (DES) Methods at PT. Bosowa berlian motor makassar[6].

Research with the title "Comparative analysis of Single Moving Average, Single Exponential Smoothing and Naive Model (Case: building sales forecasting)"[7].

Research with the title "Analysis of Chicken Price Forecasting Using the Moving Average and Exponential Smoothing Methods at CV. Tabassam Az Zufar Jombang" states that the smallest method error value is the SES method with $\alpha = 0.7$ where MAD is 23,384, MSE is 1,096,023,269, and MAPE is 16%[8].

Research with the title "Comparison of Time Series Methods for Predicting Sales of UD Folding Mats "Lamongan FoIding Mat Award" which states that the smallest Mape uses SES compared to the WMA and SMA methods, for the following month period uses the SES method with $\alpha = 0.7$[9].

Research entitled "Designing a Stock Inventory Forecasting Application Using the Weighted Moving Average (WMA) Method at XYZ goods Store" states that the application aims to help process the next month's goods data using the Weighted Moving Average method[10]. So, it can be concluded that the WMA and SES methods have good results based on accuracy values.

METHOD

Method Single Exponential Smoothing
The Single Exponential Smoothing method is a method that uses very little past data and assumes fluctuating or unstable data. Exponential smoothing is a moving average forecasting technique with weighting where the data is weighted byan Exponential function. Exponential smoothing a moving average forecasting method with sophisticated weighting, but is still easy to use.calculation using the Single Exponential Smoothing formula, then α = alpha which is used for inventory quantity data [11].

The Single Exponential Smoothing formula is as follows:

$$Ft \ = \ \alpha Xt - 1 + (1 - \alpha)Ft - 1 \qquad (1)$$

Description,
Ft+1 : Forecast for the period (t+1)
Xt   : Riii value of period t
α : Weight indicating the smoothing constant $(0 < \alpha < 1)$
Ft-1 : Forecast for period t-1

Method Weighted Moving Average
The Weighted Moving Average method used to find trends from a time series or time series using a moving average, where greater weight is given to newer data. Forecast calculations are based on the latest data which is considered the most relevant in the forecasting process [12].

$$WMA \ = \ (\textstyle\sum(Data*bobot))/(\textstyle\sum bobot) \qquad (2)$$

Description,
Xt : Actual data for a certain period (t).
W : Weight

Analysis of the Single Exponential Smoothing Calculation Process
The formula can be seen as follows :

$$F_{t+1} \ = \alpha Y1 + (1 - \alpha) \ F_{t-1} \qquad (3)$$

Description,
Ft+1 : forecast for period t+1
Y1   : real value of period t
α : weight indicating the smoothing constant $(0< \alpha<1)$

Ft-1 : forecast for period t-1

The error value is used to measure the error in forecasting using MAD, MSE & MAPE. The forecasting error value can be found using the following formula:

Mean Absolute Deviation (MAD)

MAD is the average absolute error during a certain period. Absolute values are useful for avoiding positive deviation values and negative deviation values. MAD is formulated as follows:

$$MAD = 1/n \sum_{t=1}^{n}|e_t| \qquad (4)$$

Description,
e_t : Error in the t-th period
n : Number of periods

Mean Square Error(MSE)

MSE is the mean squared error or mean squared forecasting error. The lower the MSE value, the smaller the error in the prediction results. MSE is formulated as follows:

$$MSE = 1/n \sum_{t=1}^{n}|e_t|^2 \qquad (5)$$

Description,
e_t : Error in the t-th period
n : Number of periods

Mean Absolute Perentage Error (MAPE)

Mean Absolute Percentage Error (MAPE) is a relative measure used to assess the percentage deviation of forecasting results. The higher the MAPE value, the greater the error in predicting the results, while the lower the MAPE value, the smaller the prediction error. MAPE is formulated as folows:

$$MAPE = 1/n\sum_{t=1}^{n}|e_t/x_t|x\ 100\% \qquad (6)$$

Description,
e_t : Error in the t-th period
n : Number of periods

RESULTS AND DISCUSSION

The results of Ms GIow Putri's research show that the Weighted Moving Average method with a weight of 5 produces a MAPE of 1.08%, while the Simple Exponential Smoothing method with an alpha of 0.1 produces a MAPE of 0.84%. Based on this comparison, the SES method is proven to be superior because it has a lower error rate. Skincare calculation results using the Weighted Moving Average Method

Table 1. WMA Method Skincare Calculation Table

Period	Supply	Ft	Error	Abs Error	Error^2	MAPE (%)
May 2023	1.076	-				
June 2023	1.074	-				
JuIy 2023	1.095	-				
August 2023	1.105	-				
September 2023	1.073	-				
October 2023	1.080	1086,27	6,27	6,27	39,27	1%
November 2023	1.075	1084,73	9,73	9,73	94,74	1%
December 2023	1.088	1081,27	-6,73	6,73	45,34	1%
January 2024	1.070	1082,07	12,07	12,07	145,60	1%
February 2024	1.075	1077,33	2,33	2,33	5,44	0%
March 2024	1.078	1076,60	-1,40	1,40	1,96	0%
ApriI 2024	1.095	1076,73	-18,27	18,27	333,67	2%
May 2024	**Prediction**	**1082,67**				

Table 2. WMA Method Bodycare Calculation Table

Period	Supply	Ft	Error	Abs Error	Error^2	MAPE (%)
May 2023	307	-				
June 2023	305	-				
JuIy 2023	325	-				
August 2023	335	-				
September 2023	300	-				
October 2023	316	315,47	-0,53	0,53	0,28	0%
November 2023	305	316,00	11,00	11,00	121,00	4%
December 2023	320	312,27	-7,73	7,73	59,80	2%
January 2024	300	313,53	13,53	13,53	183,15	5%
February 2024	305	308,47	3,47	3,47	12,02	1%
March 2024	310	307,40	-2,60	2,60	6,76	1%
ApriI 2024	325	307,67	-17,33	17,33	300,44	5%
May 2024	**Prediction**	**313,33**				

Then the calculation results from the SES method are presented in the form of a table of results where there are 2 tables, namely the calculation results for skincare and bodycare.

Table 3. SES Method Skincare Calculation Table

Month	Actual Data (Yt)	Ft	Abs Error $|Yt-Ft|$	Error^2 $|Yt-Ft|^2$	Abs Eror/Yt
May 2023	1.076				
June 2023	1.074	1076	2	4	0,00
July 2023	1.095	1075,80	19,20	368,64	0,02
August 2023	1.105	1077,72	27,28	744,20	0,02
September 2023	1.073	1080,45	7,45	55,47	0,01
October 2023	1.080	1079,70	0,30	0,09	0,00
November 2023	1.075	1079,73	4,73	22,40	0,00
December 2023	1.088	1079,26	8,74	76,39	0,01
January 2024	1.070	1080,13	10,13	102,69	0,01
February 2024	1.075	1079,12	4,12	16,98	0,00
March 2024	1.078	1078,71	0,71	0,50	0,00
April 2024	1.095	1078,64	16,36	267,73	0,01
May 2024	-	1080,27			
Total	**-**	**-**	**101,02**	**1659,1**	**0,09**

Calculation of forecasting skincare product stock inventory in the period May 2024:

$F_{may\ 2024} = \alpha\ Y_{apriI\ 2024} + (1-\alpha)\ F_{april\ 2024}$

$= (0,1 \times 1095)+(1-0,1)\ 1078,64$

$= 109,5+970,77$

$= 1080,27$

Mean Absolute Deviation (MAD) is the first measure of overall forecasting error for a model

$$MAD = \frac{|Yt-Ft|}{n} = \frac{101,02}{11} = 9,18$$

This forecasting capability is actually used because it has a MAPE value of

less than 20%. At the sample test stage, it was found that the forecast amount of skincare product inventory for May 2024 was 1080.27 with an error rate of 0.08%.

Bodycare calculations using the SES method can be seen in table 4:

Table 4. Bodycare Calculation Table for SES Method

Month	Actual Data (Yt)	Ft	Abs Error $|Yt-Ft|$	Error^2 $|Yt-Ft|^2$	Abs Error/Yt
May 2023	307	-	-	-	-
June 2023	305	307	2	4	0,01
July 2023	325	306,80	18,20	331,24	0,06
August 2023	335	308,62	26,38	695,90	0,08
September 2023	300	311,26	11,26	126,74	0,04
October 2023	316	310,13	5,87	34,43	0,02
November 2023	305	310,72	5,72	32,71	0,02
December 2023	320	310,15	9,85	97,08	0,03
January 2024	300	311,13	11,13	123,93	0,04
February 2024	305	310,02	5,02	25,19	0,02
March 2024	310	309,52	0,48	0,23	0,00
April 2024	325	309,57	15,43	238,22	0,05
May 2024	-	311,11	-	-	-
Total	-	-	111,35	1709,68	0,35

Calculation of forecasting inventory of bodycare products in the period May 2024:

$$F_{may\ 2024} = \alpha\ Y_{april\ 2024} + (1-\alpha)\ F_{april\ 2024}$$
$$= (0,1 \times 325) + (1-0,1)\ 309,57$$
$$= 32,5 + 278,61$$
$$= 311,11$$

Mean Absolute Deviation (MAD) is the first measure of overall forecasting error for a model:

$$MAD = \frac{|Yt-Ft|}{n} = \frac{111,35}{11} = 10,12$$

This forecasting capability is actualy used because it has a MAPE value of less than 20%. At the sample test stage, it was found that the forecast amount of bodycare product inventory for May 2024 was 311.11 with an error rate of 3.18%.

MAPE is using the Single Exponential Smoothing Method with good forecasting. The following a graphical table comparing the Weighted Moving Average and Single Exponential Smoothing Methods in Bodycare
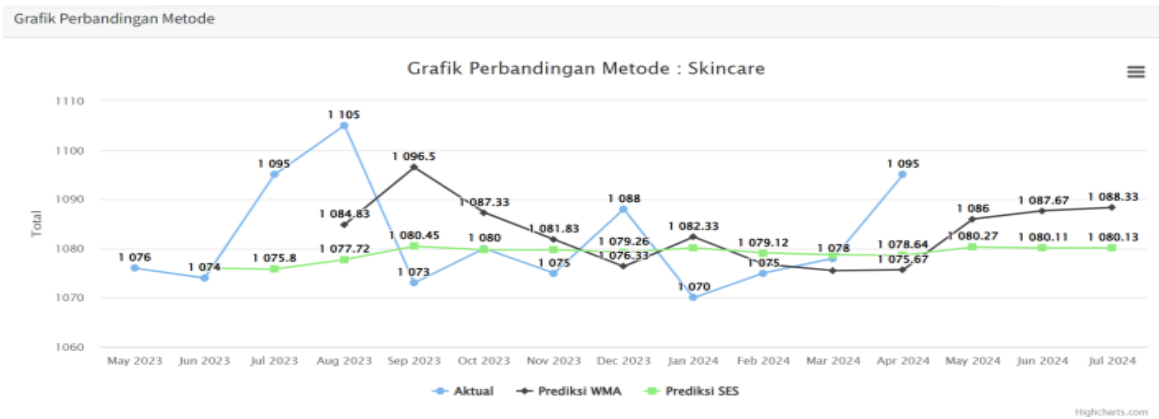
Image 1. Skincare Comparison Chart Page

Image 2. Bodycare Comparison Chart page

From the graph, you can only see predictions, WMA and SES predictions along with inventory data from Ms Glow. Meanwhile, it can be stated that the SES method is a better method than the WMA method because it has the smallest MAPE error which can be seen from the comparative calculation of the Weighted Moving Average method and the Single Exponential Smoothing method.

CONCLUSION

The product stock inventory forecasting system at Ms Glow Putri using the WMA and SES methods can help product inventory for May 2024 based on mape values using the WMA method, the forecast for skincare products is 1082.67. Meanwhile for bodycare products it is 313.33. Using the SES forecast method for skincare products it is 1080.27 with α (alpha) of 0.1 while for bodycare products it is 311.11

BIBLIOGRAPHY

[1]   N. Samia, M. Fatihah, and W. Arafah, "Anteseden dari Green Purchase Intention pada Merek Bodycare di Indonesia," *J. Pendidik. Tambusai*, vol. 8, no. 1, pp. 1010–1018, 2024.

[2]   F. Reba, A. Sroyer, S. Yokhu, and A. Langowuyo, "Perbandingan Metode Weighted Moving Average dan Single Exponential Smoothing Angka Partisipasi Sekolah Wilayah Adat, Papua," *Sainmatika J. Ilm. Mat. dan Ilmu Pengetah. Alam*, vol. 18, no. 2, p. 161,2021,doi: 10.31851/sainma

tika.v18i2.6617.

[3] N. Sari, H. Hasdiana, and E. Rahayu, "Perbandingan Weight Moving Average dan Single Exponential Smoothing pada Peramalan Persediaan Produk Farmasi," *JiTEKH*, vol. 10, no. 2, pp. 75–83, 2022, doi: 10.35447/jitekh.v10i2.580.

[4] S. H. Pratama and N. Rarasati, "Perbandingan Single Moving Average dan Single Smoothing Eksponensial Dalam Peramalan Penjualan Barang Coupling Sucker di PT.Pertamina Ep Asset-1 Field Jambi," *Technologia*, vol. 3, no. 1, pp. 20–31, 2024.

[5] N. Chaerunnisa and A. Momon, "Perbandingan Metode Single Exponential Smoothing Dan Moving Average Pada Peramalan Penjualan Produk Minyak Goreng Di Pt Tunas Baru Lampung," *J. Rekayasa Sist. Ind.*, vol. 6, no. 2, pp. 101–106, 2021, doi: 10.33884/jrsi.v6i2.3694.

[6] Z. Idris, J. Kamase, and J. S. Tjan, "Perbandingan Akurasi Sales Forcasting Menggunakan Metode Single Exponential Smoothing (SES) dan Doubel Exponential Smoothing (DES) Pada PT. Bosowa Berlian Motor Makassar," *J. Account. Financ.*, vol. 3, no. 1, pp. 50–57, 2022.

[7] B. Dewantoro, A. Kadir Jailani, and J. K. Teknik Informatika Universitas Dipa Makassar Jln Perintis Kemerdekaan, "Analisis Perbandingan Single Moving Average, Single Exponential Smoothing dan Naive Model (Kasus : Peramalan Penjualan Bangunan),"

Tek. Inform., vol. 502, no. 2, p. first_page-end_page, 2023.

[8] David Ari fianto, Fatma Ayu N.F.A, and Tri Rijanto, "Analisis Peramalan Penjualan Ayam Dengan Menggunakan Metode Moving Average Dan Exponential Smoothing Di Cv. Tabassam Az Zufar Jombang," *J. Penelit. Bid. Inov.PengelolaanInd.*,vol.3,no.1,pp.44–52,2023,doi: 10.33752/invantri.v3i1.5006.

[9] W. C. Wardana and P. Aisyiyah Rakhma Devi, "Perbandingan Metode Time Series Untuk Prediksi Penjualan Tikar Lipat," *JATI (Jurnal Mhs. Tek. Inform.*, vol. 8, no. 3, pp. 3726–3732, 2024.

[10] I. Setiawan, "Rancang Bangun Aplikasi Peramalan Persediaan Stok Barang Menggunakan Metode Weighted Moving Average (Wma) Pada Toko Barang Xyz," *J. Tek. Inform. Vol. 13, No. 3, Agustus 2021*, vol. 13, no. 3, pp. 1–9, 2021.

[11] M. Thamrin, "Analisis Prediksi Persediaan Beras Menggunakan Metode Single Exponential Smoothing Berbasis Web," *J. Ilm. Multidisiplin Ilmu Komput.*, vol. 1, no. 1, pp. 31–40, 2023, doi: 10.61674/jimik.v1i1.110.

[12] F. Ustadatin, A. Muqtadir, and A. Arifia, "Implementasi Metode Weighted Moving Average (WMA) Pada Prediksi Harga Bahan Pokok," *Komputika J. Sist.Komput.*,vol.12,no.2,pp.83–90, 2023,doi:10.34010/komputika.v12i2.10304.