IMPLEMENTATION OF SIMPLE MOVING AVERAGE (SMA) IN PKS SOAP DEMAND PREDICTION

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Article Information

Abstract

PT. Jampalan Baru is the difficulty in predicting the number of requests for the following months. So it takes the method used for this research is the Simple Moving Average method with the PHP programming language and MySQL database. In this study, it is necessary to first arrange the steps and stages, in the application of the Simple Moving Average method with PHP programming to predict the demand for PKS soap in the future. The method used at PT. Jampalan Baru is to use qualitative and quantitative methods. From the results of the application of the Simple Moving Average method to predict the PKS detergent cream that has been done, then getting the prediction results in December 2021 resulted in the demand for citrus PKS soap totaling 24244.33 per cardboard with an error accuracy of 3.33%, lemons amounted to 25698 boxes with an error accuracy of 3.35% and lemongrass amounted to 23832.67 boxes with an error accuracy of 4.34%. The results of this study, the demand prediction process at PT. New Appendix, namely the creation of an application to predict future PKS soap demand using the PHP programming language, can facilitate the forecasting process quickly and accurately in accordance with the application of the Simple Moving Average method so that it can be used as a forecasting reference in the following month.

Keywords: Prediction, Demand, PKS Soap, Simple Moving Average

1. Introduction

The rapid development of technology and communication today provides many benefits that can facilitate human work, one of which is in predicting increasingly modern technology fields so as to produce predictions of process activities that can be carried out more practically, quickly and efficiently. Prediction means the process of predicting or predicting future events using past data and available related information[1].

PT. Jampalan Baru was founded in 1978 and has its address at Km 10 Jampalan Village, Simpang Empat District, Asahan Regency, Sumatra Province. North. PT. Jampalan Baru is engaged in soap production, oil packaging and rice milling. PT. Jampalan Baru had difficulty predicting the number of requests for the following months. Consumer needs are always changing in terms of consumption per day even per month is always not appropriate which will be influenced by the large number of market demands. Therefore it is relatively difficult to determine the exact market demand with the appropriate amount.

Definition of Forecasting

Forecasting is the art and science of predicting future conditions through testing using past data in the form of a mathematical model[2].

Forecasting is an attempt to predict future conditions by examining past conditions[3].

Forecasting means an activity of estimating or predicting future events, of course using the help of planning in advance, where this plan is designed according to the capacity and ability of demand/production that has been carried out in the company[4].

Forecasting is a process of systematically estimating what might happen in the future according to past and present information so that errors can be minimized[5].

The purpose of forecasting is to get a forecast that can minimize forecast errors that can be measured by Mean Absolute Deviation (MAD), Mean Square Error (MSE) and Mean Absolute Percentage Error (MAPE)[6].

Simple Moving Average

The Simple Moving Average method or abbreviated as SMA means the simplest moving average and does not use weights in calculating closing price movements[7]. This method is quite effective in determining the trend that occurs in PT. Jampalan Baru is one of the predictions for PKS soap demand.

The formula for the simple moving average method can be written as follows:[8]:

$$S_{t+1} = \frac{Xt + X_{t-1} + \cdots + X_{t-n} + 1}{n}$$

Information:
Xt   : Data in period t
St+1   : Forecast for period t
Xt–1   : Demand in period t – 1
Xt– n+1   : Demand in period t – n+ 1
N   : Timeframe of moving average.

Types of Forecasting Patterns

The following are the types of forecasting patterns that can be seen in the following picture[4]:

1. *Horizontal*(H) / Stationary, occurs if the data value fluctuates around the average value that is fixed, stable or is said to be stationary with respect to the average value.
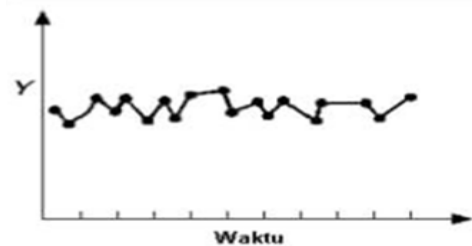

Figure 1. Horizontal Data Pattern

2. *Seasonality*(S) seasonal data pattern proves that the data value is determined by seasonal factors such as: day, week, month, semester and year.
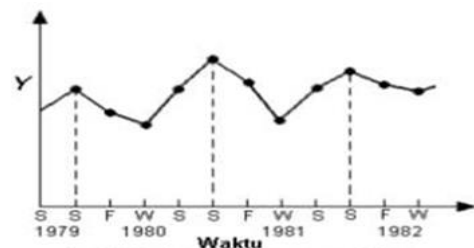

Figure 2. Seasonality Data Pattern

3. *Cycles*(C), cycle is a data pattern that occurs every few years, usually determined by long-term economic fluctuations related to the business cycle.
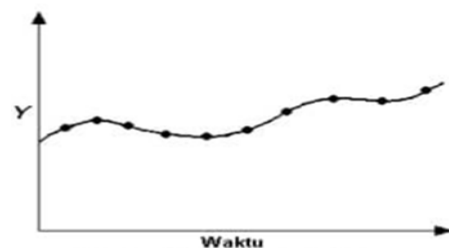

Figure 3. Cycle Data Pattern

4. *Trends*(T), occurs If there is an increase or decrease in the data gradually from the movement of the data in brackets when it is long.
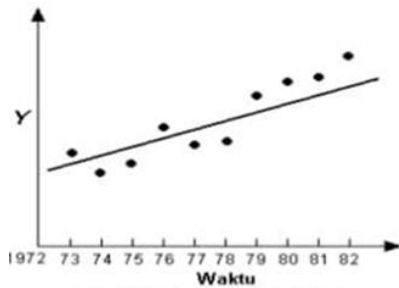
Figure 4. Trend Data Pattern

Types of Forecasting

Forecasting methods can be divided into two main categories, namely[9]:

1. The qualitative method is forecasting based on the opinion of a party and the data cannot be represented explicitly as a number/value.
2. Quantitative methods are forecasts that are suitable for past data (historical data) and can be designed in the form of numbers.

Basically this quantitative forecasting method can be distinguished into:

A. The time series method is a forecasting method based on the use of correlation pattern analysis between variables that are estimated using time variations, which means time series.

The following are various time series divided into 5 methods, namely:[4]:

1. The Smoothing method is used to adjust past data according to seasonal data that occurs, by averaging a series of data so that the distance and amount of data tend to be / almost balanced.
   A. *Moving Average*, consist of:
      a) *Simple Moving Average* (Simple Moving Average). Is a forecasting method that uses the average of a number of (n) recent data to forecast the future period.

      b) *Weighted Moving Average* (Moving Average) This method is widely used to determine the trend of a time series.

B. *Exponential Smoothing*, consist of:
   a) *Single Exponential Smoothing*This method is used for the short term and the data are relatively stable.
   b) *Double Exponential Smoothing*is the method used when the data shows a trend. Double Exponential Smoothing is divided into two, namely with one parameter of brown and two parameters of holt.

2. Regression method, is a method of forecasting calculations based on trend lines, so that things can be projected in the future. The regression method is divided into two methods, namely constant and quadratic.
3. Seasonal method (seasonal), this method is strongly influenced by seasonal factors, which describe the pattern of sales that repeats each period.
4. Trend method, this method occurs when the data has a tendency to go up or down continuously. Trend models that can be used are: Linear Trend and Exponential Trend.

   5. Decomposition method, is a forecasting method that is determined by a combination of existing functions so that this method can only be used if it is brought close to a linear or cyclical function and then divided into either time or based on existing data patterns.

   B. The casual method is a forecasting method based on the use of pattern analysis of the relationship between variables.

Forecasting Error Test

Forecasting Error Test is used by comparing forecasting results with actual data. The smaller the error value, the higher the level of forecasting accuracy, and vice versa.

Accurate projection results are forecasts that can minimize forecast errors. The magnitude of the forecast error is calculated by subtracting the real data from the size of the forecast[10].

$$eror\ (e) = A_t - F_t$$

Information:

At   : Actual demand for period t

Ft   : Forecasting value for the t-th period

Forecast error calculation using:

1. *Mean Absolute Deviation*(MAD)

$$MSE = \sum_{t=1}^{n} \frac{(A_t - F_t)^2}{n}$$

Information:

At   : Actual demand in period t

Ft   : Forecasting value in period t

N   : Number of periods

2. *Mean Square Error*(MSE)

$$MAD = \sum_{t=1}^{n} \frac{|A_t - F_t|}{n}$$

Information:

At   : Actual demand in period t

Ft   : Forecasting value in period t

N   : Number of periods

3. *Mean Absolute Percentage Error*(MAPE)

$$MAPE = \frac{\sum_{t=1}^{n} \frac{|A_t - F_t|}{At} \text{ x } (100\%)}{n}$$

Information:

At   : Actual demand in period t

Ft   : Forecasting value in period t

N   : Number of periods.

2. Method

Data collection is done by interviewing someone and observing the object of research, namely at PT. Jampalan Baru in order to obtain the required data. The following is a description of the framework in the research that will be carried out so that it always focuses on the research objectives.
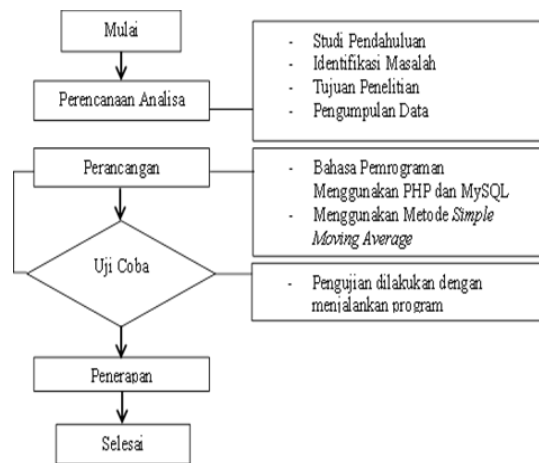

Figure 5. Framework

RESULTS AND DISCUSSION

This study uses past data, namely PKS soap demand data in order to predict the PKS soap demand for the future. The following is data on the demand for PKS soap from December 2020 to November 2021, which can be seen in the following table:

Simple Moving Average Forecasting Method

The following is a calculation by forecasting using the Simple Moving Average method which can be seen in the following table:

1. Oranges Per Carton

Table 1. Citrus Detergent Cream Calculation Results

Bulan	Aktual	Peramalan	Eror	MAD	MSE	MAPE
Dec-20	23000					
Jan-21	22521					
Feb-21	22625					
Mar-21	23850	22715,33	1134,67	1134,67	1287468,44	0,048
Apr-21	23643	22998,67	644,33	644,33	415165,44	0,027
May-21	22670	23372,67	-702,67	702,67	493740,44	0,031
Jun-21	23445	23387,67	57,33	57,33	3287,11	0,002
Jul-21	23100	23252,67	-152,67	152,67	23307,11	0,007
Agu-21	23520	23071,67	448,33	448,33	201002,78	0,019
Sep-21	22653	23355,00	-702,00	702,00	492804,00	0,031
Oct-21	24630	23091,00	1539,00	1539,00	2368521,00	0,062
Noc-21	25450	23601,00	1849,00	1849,00	3418801,00	0,073
Des-21		24244,33				

With :
Total MAD = 7230.00/ 9 = 803.33
Total MSE = 8704097.33/9 = 967121.93
Total MAPE = (0.30 / 9)*100 = 3.33
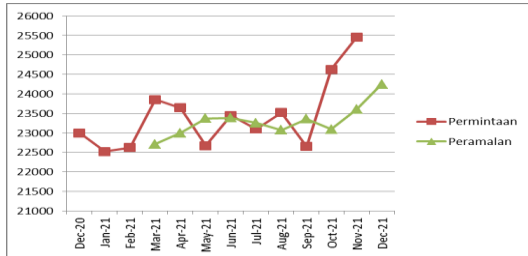
And it can be seen in the following graph:

Figure 6. Orange Detergent Cream Demand
Graph

From the results of the calculation of the simple moving average method, it is predicted that December 2021 will produce a demand for orange detergent cream with a total of 24244.33 with an accuracy of 3.33% MAPE error.

2.   Lemon Per Carton

Table 2. Lemon Detergent Cream
Calculation Results

Bula n	Aktua l	Peramala n	Eror	MAD	MSE	MAP E
Dec-20	2234 9					
Jan-21	2352 2					
Feb-21	2454 0					
Mar-21	2449 0	23470,33	1019,6 7	1019,6 7	1039720,1 1	0,042
Apr-21	2385 0	24184,00	- 334,00	334,00	111556,00	0,014
May -21	2276 2	24293,33	- 1531,3 3	1531,3 3	2344981,7 8	0,067
Jun-21	2478 0	23700,67	1079,3 3	1079,3 3	1164960,4 4	0,044
Jul-21	2397 5	23797,33	177,67	177,67	31565,44	0,007
Agu-21	2384 0	23839,00	1,00	1,00	1,00	0,000
Sep-21	2532 0	24198,33	1121,6 7	1121,6 7	1258136,1 1	0,044
Oct-21	2645 1	24378,33	2072,6 7	2072,6 7	4295947,1 1	0,078
Noc-21	2532 3	25203,67	119,33	119,33	14240,44	0,005
Des-21		25698,00				

With :
Total MAD = 7456.67 / 9 = 828.52
Total MSE = 10261108.44 / 9 =
1140123.16
Total MAPE = (0.30 / 9)*100 = 3.35

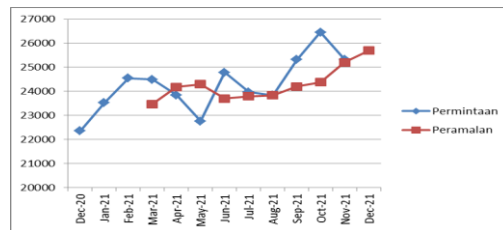And it can be seen in the following graph:

Figure 7. Lemon Detergent Cream Demand
Graph

From the results of the calculation of the simple moving average method, it is predicted that December 2021 will result in a demand for lemon detergent cream totaling 25698 with an accuracy of 3.35% MAPE error.

3.   Lemongrass Per Carton

Table 3. Calculation Results of
Lemongrass Detergent Cream

Bula n	Aktua l	Peramala n	Eror	MAD	MSE	MAP E
Dec-20	2242 5					
Jan-21	2354 0					
Feb-21	2334 2					
Mar-21	2435 1	23102,33	1248,6 7	1248,6 7	1559168,4 4	0,05
Apr-21	2232 4	23744,33	1420,3 3	1420,3 3	2017346,7 8	0,06
May -21	2435 2	23339,00	- 1013,0 0	1013,0 0	1026169,0 0	0,04
Jun-21	2246 3	23675,67	1212,6 7	1212,6 7	1470560,4 4	0,05
Jul-21	2236 1	23046,33	685,33	685,33	469681,78	0,03
Agu-21	2378 5	23058,67	- 726,33	726,33	527560,11	0,03
Sep-21	2249 6	22869,67	373,67	373,67	139626,78	0,02
Oct-21	2453 0	22880,67	- 1649,3 3	1649,3 3	2720300,4 4	0,07
Noc-21	2447 2	23603,67	- 868,33	868,33	754002,78	0,04
Des-21		23832,67				

With :
Total MAD = 9197.67 / 9 = 1021.96
Total MSE = 10684416.56 / 9 =
1187157.40
Total MAPE = (0.39 / 9)*100 = 4.34

And it can be seen in the following graph:

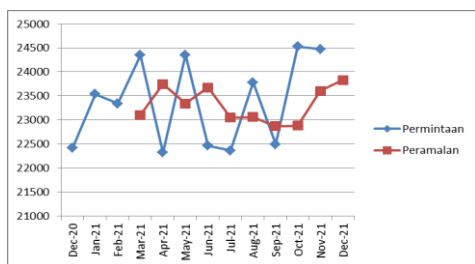
Figure 8.Lemongrass Detergent Cream Demand Graph

From the results of the calculation of the simple moving average method, it is predicted that December 2021 will result in a demand for lemongrass cream amounting to 23832.67 with an accuracy of 4.34% MAPE error.

The system display from the results of this study can be seen in the following figure:

1. Admin Login Page Display
The login page display is the display where the user performs the login process to be able to enter using this system.
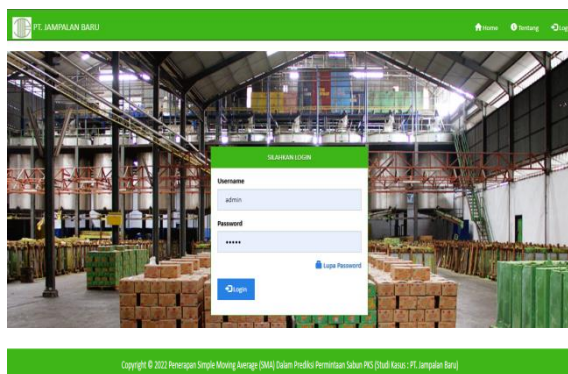

Figure 9. Admin Login Page Display

2. Soap Type Data Page Display
The soap type data page display is a display where the user sees the soap type data in the system.
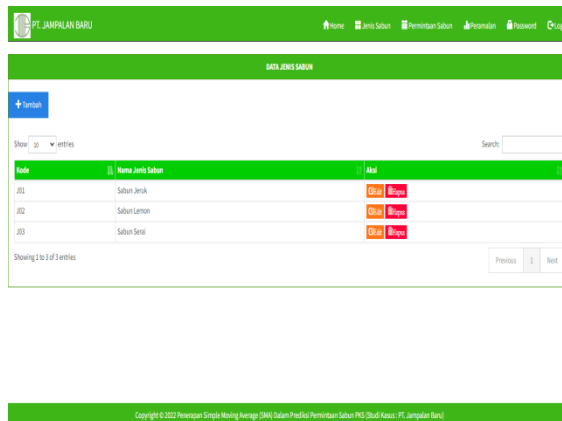

Figure 10. Soap Type Data Page Display

3. Forecasting Page Display
Forecasting page display is a display where the user performs the process of calculating the simple moving average method in the system.
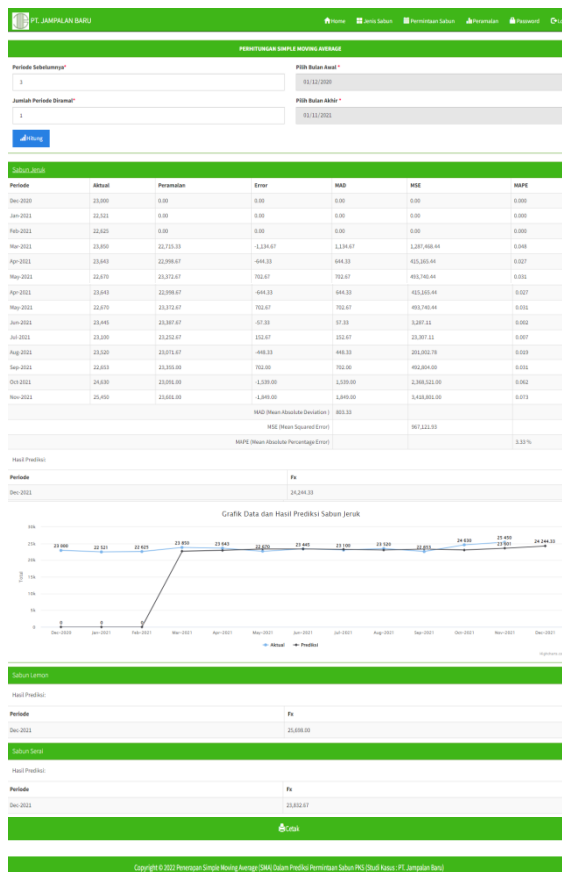

Figure 11. Forecasting Results Page Display

The impact of this research is to use the simple moving average method can employ, all depending on the demand for soap PKS. And the benefit of this research is to make it easier to predict future demand for PKS soap.

CONCLUSION

From the results of the research process that has been completed, the authors can conclude as follows:

1. From the results of the application of the Simple Moving Average method to predict the PKS detergent cream that has been done, then getting the prediction results in December 2021 resulted in the demand for citrus PKS detergent cream totaling 24244.33 per carton with an error accuracy of 3.33%, lemons amounting to 25698 per carton with an error accuracy of 3 .35% and lemongrass amounted to 23832.67 per cardboard with an error accuracy of 4.34%.

2. The results of the design of the demand forecasting system for PKS detergent cream at PT. Jampalan Baru using the PHP programming language can facilitate the forecasting process quickly and accurately in accordance with the application of the Simple Moving Average method so that it can be used as a forecasting reference in the following month.

BIBLIOGRAPHY

[1] H. Iftitah and Y. Yunus, "Predicting the Acceptance Rate of Vocational Students in Business and Industry Using the Monte Carlo Method,"*J. Information System. and Technol.*, vol. 2, pp. 84–89, 2020, doi:10.37034/jsisfotek.v2i3.71.

[2] F. Dristyan, "Predicting the Number of Motorcycle Credit Sales Using the Backpropagation Algorithm,"*Semin. Nas. R.*, vol. 1, no. 1, pp. 185–190, 2018.

[3] ANS Putro and R. Palupi, "Retail Sales Forecasting Software With Simple Moving Average Method,"*J. Sainstech Politek. Indonusa Surakarta*, vol. 7, no. 2, pp. 46–49, 2020.

[4] A. Lusiana and P. Yuliarty, "APPLICATION OF FORECASTING METHODS ON ROOF DEMAND at PT X,"*eng. Inov. J. Tech. eng.*, vol. 10, no. 1, pp. 11–20, 2020, doi:10.36040/industri.v10i1.2530.

[5] W. Kurniadi, "Decision Support In Forecasting Broiler Sales With Trend Moment Methods And Simple Moving Averages At CV. Merdeka Adi Mighty,*J. Media Inform. Budidharma*, vol. 2, no. 3, pp. 76–90, 2018, doi:10.30865/mib.v2i3.652.

[6] R. Fajri and TM Johan, "Implementation of Double Exponential Smoothing Forecasting in Cases of Child Violence at the Integrated Service Center for the Empowerment of Women and Children,"*J. ECOTYPE*, vol. 4, no. 2, pp. 6–13, 2017, doi:10.33019/ecotipe.v4i2.6.

[7] N. Aini, S. Sinurat, and SA Hutabarat, "ImplementationThe Simple Moving Average Method To Predict The Results Of Carpet Laundry On CV. Homecare," J. Ris. Comput., vol. 5, no. 2, pp. 167–175, 2018.

[8] NE Marlina, K. Oktafianto, and R. Yuliastuti, "Comparison of Trend Moment Methods and Single Moving Averages for Forecasting the Population of Tuban Regency," vol. 02, no. 01, pp. 18–22, 2021.

[9] Y. Safitri, S. Wahyuningsih, and R. Goejantoro, "Forecasting with the Fuzzy Time Series Markov Chain Method (Case Study: Closing Price of PT. Radiant Utama Interinsco Tbk Shares for the Period January 2011 - March 2017),"*J. Exponential*, vol. 9, no. 1, pp. 51–58, 2018, [Online]. Available: http://jurnal.fmipa.unmul.ac.id/index.php/exponensial/article/view/275/127.

[10] D. INDAH RUSPRIYANTY and A. SOFRO, "Forecasting Video Cassette Rentals Using Moving Averages,"*MATHunesa*, vol. 6, no. 2, pp. 75–80, 2018.