

PREDICTION OF GOODS STOCK SYSTEM IN SANTI ELECTRONIC SHOP WITH DOUBLE MOVING AVERAGE METHOD

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Abstract : Santi Electronic Store is one of the shops that sells the needs of electronic products for the community. This store requires predictions that can estimate the number of items to be sold, this shop often experiences a shortage of electronic products that will be purchased by customers. In designing the system using the Double Moving Average (DMA) forecasting method to support decisions in determining the amount of stock of electronic products to be sold for the next month. This forecasting application is made using Visual Basic Net 2010 programming language with Microsoft Office Access database. From making the system an application can be produced that can control optimal and economical demand and with a high level of accuracy and can predict the number of requests for electronic products in the coming period at the Santi Electronic Store so that the forecast results can help trading businesses so that stock does not occur requests for electronic products at the Santi Electronics Store.

Keywords : Hole; Multiple Moving Average; Prediction.

Abstrak : Toko Elektronik Santi merupakan salah satu toko yang menjual kebutuhan produk elektronik bagi masyarakat. Toko ini memerlukan prediksi yang bisa memperkirakan jumlah barang yang akan dijual, pada Toko ini sering mengalami kurangnya persediaan produk elektronik yang akan dibeli pelanggan. Dalam perancangan sistem menggunakan metode peramalan *Double Moving Average* (DMA) untuk proses pendukung keputusan dalam menentukan jumlah stok produk elektronik yang akan dijual untuk bulan berikutnya. Aplikasi Peramalan ini dibuat menggunakan bahasa pemrograman *visualbasic net 2010* dengan *database microsoft office acces*. Dari pembuatan sistem dapat dihasilkan sebuah aplikasi yang dapat mengendalikan permintaan yang optimal dan ekonomis dan dengan tingkat akurasi yang tinggi serta dapat memprediksi jumlah permintaan produk elektronik pada periode yang akan datang di Toko Elektronik Santi sehingga hasil prakiraan peramalan tersebut dapat membantu usaha dagang agar tidak terjadi kehabisan stok permintaan produk elektronik pada Toko Elektronik Santi.

Kata kunci : Multiple Moving Average; Prediksi; Permintaan.



INTRODUCTION

Competition between companies is getting tougher along with advances in science and technology. This will spur entrepreneurs to improve their company's performance in an effort to maximize profits. The purpose of The establishment of a company is basically to get the maximum profit in order to survive [1].

The Double Moving Average (DMA) method has been widely used in several case studies including "Application of the Double Moving Average Method to Predict Railway Ticket Sales" prediction or forecasting is very useful for seeing pictures of the future so that leaders can anticipate future events. For example, the company can estimate the number of passengers during the Eid al-Fitr season in 2019 [2].

Research Comparison of Double Moving Average with Double Exponential Smoothing in Forecasting Medical Consumption. The results of this study are: used as a tool for budget decision making for the provision of These Medical Consumable [3].

Subsequent research Forecasting the Poverty Line using the Double Moving Method Average in West Sumatra Province. The results of this research are: obtained a model to predict the poverty line according to the area of residence in West Sumatra (rupiah/capita/month) [4].

Subsequent research Application of Double Moving Average and Double Exponential Smoothing Method in Forecasting Crude Palm Oil (CPO) Production at PT. Perkebunan Nusantara IV Unit Dolok Sinumbah. The results of this research are: produce forecasts that have the smallest MSE

and MAPE values, so to forecast the amount of CPO production at PTPN IV Dolok Sinumbah units in 2017 the Double Exponential Smoothing method will be used [5].

Subsequent research Forecasting Bulk Olein Sales in Palm Oil Processing Companies Using Double Moving Average. The results of this study are: can give input to palm oil processing companies in planning olein production activities [6].

Subsequent research Application of the Double Moving Average Method to Forecast Rice Production Results in Gorontalo Province. The results of this study are: forecasting for the next 5 years 2019 is 326318.5 Tons, 2020 is 32094.5 Tons, and so on until 2023 of 304826.5 Ton [7].

Subsequent research Application of Moving Average and Exponential Smoothing Methods in Forecasting Garment Industry Production. The results of this study are: to determine the amount of production of goods that must be provided by company, general business and economic conditions, reactions and actions of competitors, actions government, market trends, product life cycle, style and fashion, demand changes and consumers of technological innovation [8].

Subsequent research Comparison of Double Exponential Smoothing and Double Moving Average Methods for Forecasting Retail Rice Prices in Pamekasan Regency. The results of this research are: eceran bulanan untuk tahun 2019 dengan menggunakan metode DMA sebesar Rp.12169,-

Subsequent research Implemen-tation of Information

Systems for Predicting Sales Results of Computer Equipment Using the Double Exponential Smoothing Method. The results of this research are: accurate sales prediction information system, use determine the inventory of existing goods in accordance with demand (demand) so that there is no overstock or shortage future supplies [10].

Subsequent research Java-Based Inventory Control System Design for PT Kalibesar Artah Perkasa. The results research are: can display reports quickly and accurately according to company needs [11].

Subsequent research Forecasting Videotape Rental Using Moving Average. The results research are: find out the rental of video cassettes for the 25th week, which is 772 units [12]. Santi EElectronic Store is a store engaged in the sale of eElectronic equipment such as air conditioners, refrigerators, washing machines, televisions, rice cookers, blenders, dispensers, sound systems, eElectric ovens, fans, mixers, infocus, irons, and several electrical components. Santi's Electronic Store is located in XI market, Air Joman District, Asahan Regency. In this store, there are often many purchases of goods by buyers that are not available or are out of stock.

So the problem faced by the Santi Electronic Store is that it is difficult to control irregular demand/supply because they do not observe the existing inventory. Table 1 is the stock data at the Santi EElectronics Store.

Based on the existing problems, it is very necessary to have a sales strategy, one of which is by predicting the stock of goods and a system is needed to predict the stock of goods at the Santi Electronic Store

using the Double Moving Average (DMA) method, to predict the stock in the next month, to match the purchase and customer requests.

Table 1. Stock Data at Santi EElectronics Store

Type	Stok / Brand		Date	
	Panasonic	Sharp		
AC	35	43	Ags21	
	39	30	Sep21	
	48	45	Okt21	
	31	42	Nov21	
	25	49	Des21	
	35	45	Jan 22	
	20	50	Feb22	
	26	37	Mar22	
	42	35	Apr22	
	32	34	Mei22	
	39	40	Jun 22	
	35	41	JuI 22	
	Washing Machine	51	40	Ags21
		59	49	Sep21
38		51	Okt21	
35		59	Nov21	
40		38	Des21	
49		45	Jan22	
40		35	Feb22	
49		39	Mar22	
51		48	Apr22	
59		31	Mei22	
38		25	Jun 22	
35	35	JuI22		

METHOD

The Double Moving Average (DMA) method is obtained from the calculation of the second Moving Average, which is calculated from the first Moving Average. Double Moving Average is symbolized by MA (M x N), it can be interpreted that M and N are the period of MA. The Double Moving Average method is used for forecasting data with a better linear trend pattern. The linear moving average procedure can be described [13]

The steps used in the Double Moving Average method to get the forecast value, consist of several steps, namely starting with calculating the Single Moving Average (first moving average) using equation (1), in this step calculating the average data actual according to the number of periods used.

$$M = \frac{Y_t + Y_{t-1} + Y_{t-2}}{n} \quad (1)$$

Where Y_t is the order of time (period) to be used, and n is the actual data. After calculating the first moving average, the next step is to calculate the second moving average from the forecasting results generated from the first moving average indicated by the use of the variable S , using the equation

$$M = \frac{Y_t + Y_{t-1} + Y_{t-2}}{n} \quad (2)$$

Then the next step after getting the value of M (Double Moving Average), successively is to determine the value of the constant (a_t) using equation and followed by determining the value of the trend coefficient (b_t) using equation

$$a_t = 2M_t - M'_t \quad (3)$$

$$b_t = \frac{2}{n-1} (M_t - M'_t) \quad (4)$$

The final step taken in the Double Moving Average method is to determine the value of the forecast using equation (5), namely by adding up

the results of the constant value (a_t) and the trend coefficient (b_t).

$$F_{t+1} = a_t + b_t \quad (5)$$

There are several ways to evaluate forecasting techniques using the addition of absolute errors, including the following:

1. Average Square Error (Mean Square Error = MSE). MSE is calculated by adding up the squares of all forecasting errors in each period and dividing by the number of forecasting periods. Mathematically, MSE is formulated:

$$MSE = \sum \left(\frac{X_t - F_t}{n} \right) \quad (6)$$

2. Average Absolute Percent Error (Mean Absolute Percent Error = MAPE) MAPE is the average percent error over a certain period regardless of whether the forecast results are greater or less than the reality. Mathematically, MAPE is expressed

$$MAPE = \left(\frac{1}{n} \right) \sum \left| \frac{X_t - F_t}{F_t} \right| \times 100 \quad (7)$$

3. Average absolute deviation (Mean Absolute Deviation = MAD) Mean Absolute Deviation (MAD) measures the accuracy of forecasting by averaging the forecasting error (the Absolute Value). This MAD is very useful if an analyst wants to measure the forecast error in the same unit of measure as the original data. The

formula for calculating MAD is presented:

$$MAD = \frac{\sum_{t=1}^n (X_t - F_t)}{n} \tag{8}$$

4. Draw the MSE Square Root (Root Square Mean Error = RSME) Another alternative is to take the square root of the MSE, or what is commonly called the Root Mean Squared Error (RMSE). RMSE is a more intuitive alternative to MSE because it has the same measurement scale as the data being evaluated. For example, twice the RMSE value means the model has twice the error as before. While twice the MSE value does not mean that. If MSE can be analogized as variance, then RMSE can be analogized as standard deviation.

$$RMSE = \sqrt{\sum \frac{e_t^2}{n}} \tag{9}$$

RESULTS AND DISCUSSION

$$M = \frac{35+39+48}{3}$$

$$M = 313$$

Perform a 3-month moving average calculation :

$$M = \frac{Y_t + Y_{t-1} + Y_{t-2}}{n}$$

Calculation for July 2021:

$$M = \frac{35+39+48}{3}$$

$$M = 313$$

Calculation for August 2021:

$$M = \frac{39+48+31}{3}$$

$$M = 391$$

Calculation for September 2021:

$$M = \frac{48+31+25}{3}$$

$$M = 434$$

Perform calculations until the calculation of June 2022. The following are the results of the calculation of the 3rd period moving average Perform the calculation of the double moving average, the calculation of the double moving average is obtained from the calculation of the moving average:

$$M' = \frac{Y_t + Y_{t-1} + Y_{t-2}}{n}$$

Note:

M'=double moving average

Calculation of double moving average for June 2021

$$M' = \frac{313+391+434}{3}$$

$$M' = 380$$

Calculation of double moving average for July 2021

$$M' = \frac{391+434+475}{3}$$

$$M' = 433$$

Calculation of double moving average for August 2021

$$M' = \frac{434+475+505}{3}$$

$$M' = 471$$

Perform the calculation of the double moving average until January 2022. Here

are the results of the double moving average calculation:

Calculation of the value of the coefficients a and b, to be used in forecasting methods

$$a_t = 2M_t - M'_t \tag{10}$$

$$b_t = \frac{2}{n-1} (M_t - M'_t) \tag{11}$$

Note:

at : Coefficient value a to t

bt : Coefficient value of b to t

The following is the calculation of the coefficient of a:

Calculation of coefficient a in July 2021:

$$a_t = 2(434) - 380$$

$$a_t = 488$$

The calculation of coefficient a until March 2022. The result of calculating coefficient.

Calculating Error In making forecasts, efforts are made so that the influence of uncertainty can be minimized. In other words, the forecast aims to make the forecasts that are made can minimize.

Tabel 3. is the calculation of the Mean Absolute Deviation (MAD)

error to measure the accuracy of the forecast by averaging the estimated error (the absolute value of each error) and the Mean Absolute Percentage Error (MAPE) is calculated using the absolute error in each period divided by the actual observed value. for that period. Then, average the absolute percentage error and then multiply by 100 to find the percent value (%). The following are the results of the MAD and MAPE calculations based on the overall results of the calculations.

Table 2. The Calculation Of Coefficient A Until March 2022

No.	BIn/Thn	AC	MA 3	DMA 3	at
1	JuI-21	35			
2	Agu-21	39			
3	Sep-21	48	41		
4	Okt-21	31	39		
5	Nov-21	25	35	38	31
6	Des-21	35	30	35	26
7	Jan-22	20	27	31	23
8	Feb-22	26	27	28	26
9	Mar-22	42	29	28	31
10	Apr-22	32	33	30	37
11	Mei-22	39	38	33	42
12	Jun-22	35	35	35	35

Table 3. The Results Of The Calculation Of The Prediction Of The Stock Of Electronic Goods For 3 Months

JuI-21	AC	MA 3	DMA 3	at	bt	ft	err	errorr	Err/Yt
Agu-21	35								
Sep-21	39	41							
Okt-21	48	39							
Nov-21	31	35	38	31	-4				
Des-21	25	30	35	26	-4	28	-7	7	0,213
Jan-22	35	27	31	23	-4	21	1	1	0,072
Feb-22	20	27	28	26	-1	19	-7	7	0,274
Mar-22	26	29	28	31	2	25	-17	17	0,405
Apr-22	42	33	30	37	3	33	1	1	0,021
Mei-22	32	38	33	42	4	40	1	1	0,031
Jun-22	39	35	35	35	0	46	11	11	0,317
Agu-22						35			
								MAPE	0,19
								MAD	7



Image 1. Period Form

Display of the calculation (forecasting) form that will appear when the admin clicks the calculation menu. An activity where the admin can input the period to be forecast and the moving average period. There is a count button that displays the data that has been inputted on the form for the past period, the output is the forecasting result and the absolute error results, namely MAD, MAPE and MSE. There is a print button that displays the forecasting report to be printed and given to the owner of the Santi EElectronic Store. Also exit button to close the calculation form (forecasting).



Image 2. Calculation Form (Forecasting)

The calculation report (forecasting) form will appear when the admin clicks the print button. The system will display a report on the results of the calculation (forecasting). The display of the calculation (forecasting).



Image 3. Calculation Report Form (Forecasting)

CONCLUSION

Forecasting system is designed as a solution for Santi Electronic Stores to make it easier to manage electronic sales more accurately due to electronic price volatility resulting in shortages and excess sales, and also presenting more effective and efficient electronic sales reports. With this design, it can help Santi Electronic to predict electronic goods, so as to avoid losses caused by both lack of stock and excess stock of goods.

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