Forecasting Demand for Electric Batik Stoves Using Moving Average Method In CV. A B C

Gunawan Budi Susilo[1]
[1] Industrial Engineering Study Program at UIN Sunan Kalijaga Yogyakarta
Email: gunawanbudisusilo@gmail.com

Abstract

Today's economic problems cause companies to be able to manage finances. For companies engaged in production, it is essential to manage finances so that the company does not experience losses. To overcome this, companies need to make optimal production and demand planning. Demand planning, in general, is better known as forecasting. The single-moving average method uses actual demand data to generate forecast values for future demand. This method will be effectively applied if the product's market demand remains stable. This method has two unique properties: making a forecast requires historical data within a certain period, and the longer the moving average, the smoother the moving average will be. The results showed three samples of stoves, namely, type A-AS001 with a MAD value of 118.16, an MSE value of 44015.27, and a MAPE value of 3.93. The type A-AS002 stove shows a MAD value of 7.81, an MSE value of 92.23, and a MAPE value of 0.27. The type A-SD001 stove has a MAD value of 16.16, an MSE value of 550.75, and a MAPE value of 3.72.

Keywords: forecasting, moving average, MSE, MAD, MAPE

INTRODUCTION

Today's economic problems cause companies to be able to manage finances. For companies engaged in production, it is essential to manage finances so that the company does not experience losses. To overcome this, companies need to make optimal production and demand planning. Demand planning, in general, is better known as forecasting. Forecasting is an objective calculation that uses past data to determine something in the future. Forecasting is essential in the company, namely, the consumer demand for products. Knowing product demand forecasting can help companies determine the amount of product that should be produced.

Forecasting is the art or science of predicting future events. This can be done by projecting historical data into the future with systematic modeling. Alternatively, you can also use a combination of mathematical models that are adjusted to the reasonable judgment of a manager (Hudaningsih, 2020).

The forecasting method used is adjusted to the needs and type of forecasting to be carried out. This study forecasts the demand for electric stove products at CV. ABC is done using the moving average method. Moving average is a forecasting method that uses several actual demand data to generate forecast values for future demand. The moving average method is suitable for long-term data, with forecasting, CV. ABC can estimate the number of electric stove products to be produced for the next period so that the company will not experience a loss.

LITERATURE REVIEW

Forecasting is thinking about a quantity, for example, the demand for a product or several products in the future. Forecasting is just a thought (guess), but by using specific techniques, forecasting becomes more than just an estimate. Forecasting is a scientific estimate (educated guess). Every future decision-maker must have a forecast underlying decision-making (Nurlifa, 2017).

Widya Risnawati Siagian et al. (2018) research forecasting the number of tourist arrivals to Batam in 2015 produces an MSE of 198983051, while the Winter method produces an MSE of 114349.6717. Another research on forecasting the number of students using the moving average method. The research results show that the best model used is the weight-moving average model with the most negligible forecasting accuracy (MSE, WMA, EMA) of 5807.963, 55.88889, and 0.0524132. (Prapcoyo 2018)

Forecasting is usually done to reduce uncertainty about something that will happen in the

future. An attempt to reduce this uncertainty is carried out by using forecasting methods. Forecasting methods are divided into two main categories: qualitative and quantitative. Qualitative methods are used when past data is unavailable, so forecasting cannot be done. In a qualitative method, experts' opinions will be considered in making decisions as a result of forecasting that has been done. However, if past data is available, forecasting with quantitative methods will be more effective than qualitative methods. (Nasution 2018)

METHOD

The single moving average method uses a number of actual demand data to generate forecast values for future demand. This method will be effectively applied if we assume that the product's market demand will remain stable over time. This method has two unique properties; namely, to make forecasts, it requires historical data within a certain period, the longer the moving average will produce smoother moving averages (Murahmawati, 2009); systematically moving averages are:

$$St + 1 = \frac{Xt + Xt - 1 + \cdots . Xt - n + 1}{n}$$

Where :
St + 1 = Forecast for period t+1.
Xt = Data

The measure of the accuracy of forecasting results, which is a measure of forecasting error, is a measure of the degree of difference between the results of requests and actual requests. Several methods have been used to show errors caused by a particular forecasting technique. Almost all of these measures use the average of some function of the difference between the actual and forecast values. The difference between the actual and forecast values is usually referred to as the residual. The equation for calculating the original or residual error value from each forecasting period is as follows:

$$et = Xt - St$$

Where
et = Forecasting error in period t.
Xt = Data in period t.
St = forecasting value in period t.

One way to evaluate forecasting techniques is to use a measure of the degree of difference between forecasting results and actual demand. There are several sizes commonly used, namely:

a. Average Mean Absolute Deviation (MAD)

Mean Absolute Deviation is the average absolute error over a certain period regardless of whether the forecasting results are greater or smaller than the reality. Mathematically, MAD is formulated as follows*:*

$$MAD = \sum \left| \frac{At - Ft}{n} \right|$$

Where :

At = Actual Demand in the period –t.
Ft = Demand Forecast (Forecast) in period t
n = the number of forecasting periods involved

b. Mean Square Error (MSE)

Mean Square Error is an alternative method in a forecasting method. This approach is important because this technique produces a moderate error which is preferred over a forecast that produces a very large error. MSE is calculated by adding up the squares of all forecasting errors in each period and dividing by the number of forecasting periods.

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$$MSE = \frac{\sum ei^2}{n} = \frac{\sum (Xi - Fi)^2}{n}$$

Where:
Xi = actual value of period i
Fi = forecasting value of period i
n = number of periods

c. Mean Absolute Percentage Error (MAPE)

Mean Absolute Percentage Error is a measure of relative error. MAPE usually means more than MAD because MAPE expresses percentages. MAPE is in the form of forecasting error results against actual demand during a certain period which will provide information on the percentage of errors that are too high or too low. Mathematically, MAPE is expressed as follows:

$$MAPE = \left(\frac{100}{n}\right) \sum \left| A_t - \frac{Ft}{At} \right|$$

Where :
At = actual demand in the t-period
Ft = demand forecast (forecast) in period t
n = the number of forecasting periods involved

RESULTS AND DISCUSSION

Below is the stove request data in CV. ABC in the last year

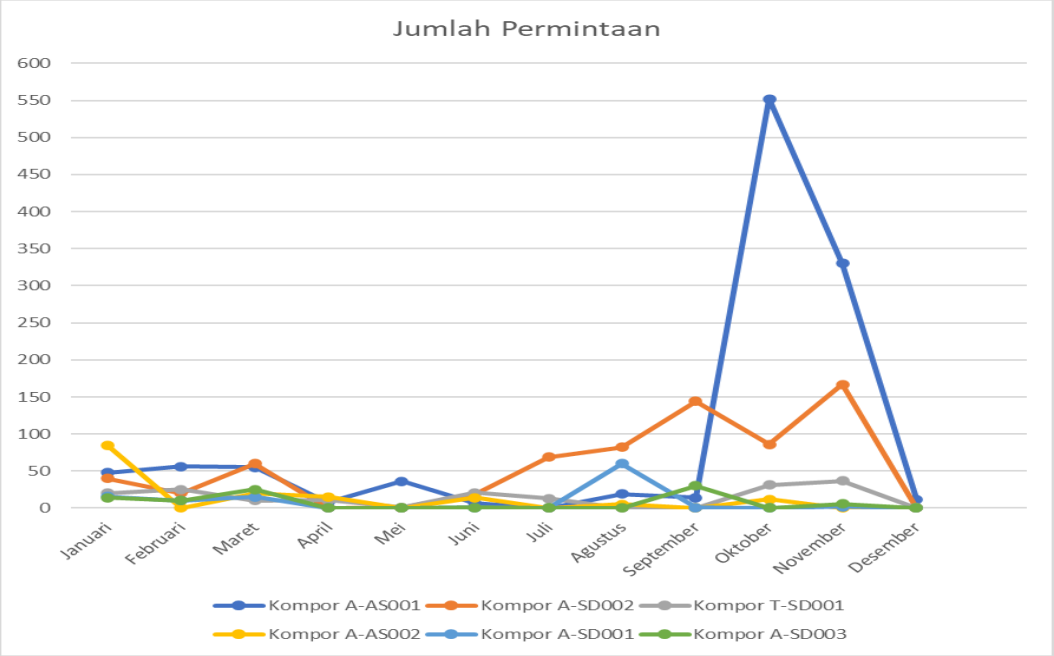

Figure 1. Stove Demand Graph

From Figure 1, it can be seen that the pattern of demand for electric batik stoves at CV ABC shows fluctuating market demand. This can be judged from the data from January 2020 to December 2020, which tended to fluctuate. For the type A-AS 001 stove, the highest demand was in October, with 552 pcs, and the lowest was in July, which was 0 pcs. For type A-SD 002, the highest demand was in

November, which was 167 pcs, and the lowest demand was in April and December, 0 pcs. For the T-SD 001 type stove, the highest demand was in November for 37 pcs, and the lowest demand was in December, which was 0 pcs. For the A-AS 002 type stove, the highest demand was in January for 85 pcs, and the lowest demand was in February, May, July, September, November, and December; namely, 0 pcs. For the A-SD 001 type stove, the highest demand was in August 60 pcs, and the lowest demand was in April, May, July, October, and December, namely as many as 0 pcs, namely 0 pcs, and for the type A-SD 003 stove the highest demand was in September as many as 30 pcs, and the lowest demand was in April, May, July, August, September, October, and December; namely 0 pcs.

From Figure 1, 3 stoves were selected for sampling: A-AS001, A-AS002, and A-SD 001.

1. Stove Type A-AS001
   a. Measure Moving Average 3

Measure	Value
Error Measures	
Bias (Mean Error)	34.19
MAD (Mean Absolute Deviation)	118.26
MSE (Mean Squared Error)	44015.27
Standard Error (denom=n-2=7)	237.89
MAPE (Mean Absolute Percent	3.93
Forecast	
next period	298

Figure 2. Measure Moving Average 3 Stove type A-AS001

Based on the results of the forecasting test above using the POM for windows software, it can be seen that the forecasting results using the Moving average method with n=3 for the request for the A-AS 001 stove on C.V ABC obtained a Mean Absolute Deviation (MAD) value of 118.26, Mean Squad Error (MSE) of 44015.27 and the Mean Absolute Percent Error (MAPE) of 3.93. Furthermore, the results for forecasting demand for the next period of 298 pcs.

   b. Graph Forecasting Moving Average 3

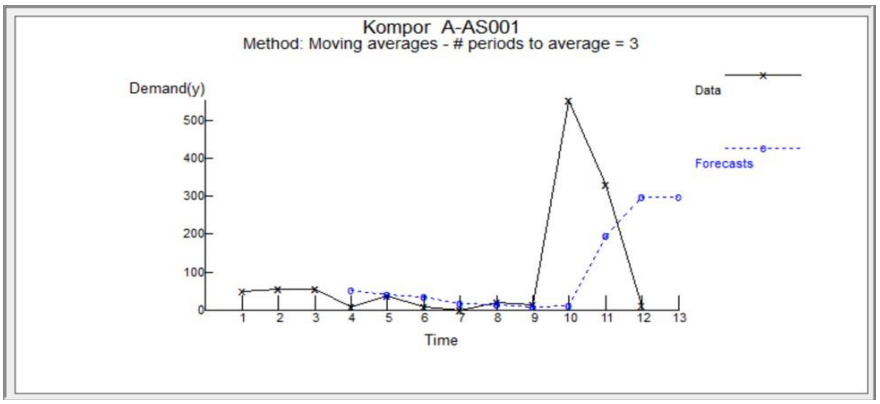

Figure 3. Graph of 3 Stove Moving Average Forecasting A-AS001

Based on the data processing performed with the POM for windows software, Figure 3 shows a graph of demand and forecasting. The black line shows demand data, and the blue line shows the forecasting results using the n=3 moving average method.

c. Hasil Peramalan Moving Avarage 3

Kompor A-AS001 Solution						
	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
January	48					
February	56					
March	55					
April	8	53	-45	45	2025	5.63
May	36	39.67	-3.67	3.67	13.44	.1
June	7	33	-26	26	676	3.71
July	0	17	-17	17	289	0
August	19	14.33	4.67	4.67	21.78	.25
September	14	8.67	5.33	5.33	28.44	.38
October	552	11	541	541	292681	.98
November	330	195	135	135	18225	.41
December	12	298.67	-286.67	286.67	82177.77	23.89
TOTALS	1137		307.67	1064.33	396137.4	35.35
AVERAGE	94.75		34.19	118.26	44015.27	3.93
Next period forecast		298	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	237.89	

Figure 4. Moving Average Forecasting Results of 3 Stoves A-AS-001

2. Stove type A-SD002
   a. Measure Moving Avarage 3

Measure	Value
Error Measures	
Bias (Mean Error)	-4.93
MAD (Mean Absolute Deviation)	7.81
MSE (Mean Squared Error)	92.23
Standard Error (denom=n-2=7)	10.89
MAPE (Mean Absolute Percent	.27
Forecast	
next period	4

Figure 5. Measure Moving Average 3 Stoves A-AS002

Based on the results of the forecasting test above using the POM for windows software, it can be seen that the forecasting results using the Moving average method with n=3 for the request for the A-AS 002 stove on C.V ABC obtained a Mean Absolute Deviation (MAD) value of 7.81, Mean Squad Error (MSE) of 92.23 and the Mean Absolute Percent Error (MAPE) of 0.27. Furthermore, the results for forecasting demand for the next period are four or equal to 4 pcs.

b. Moving Average Forecasting Chart 3

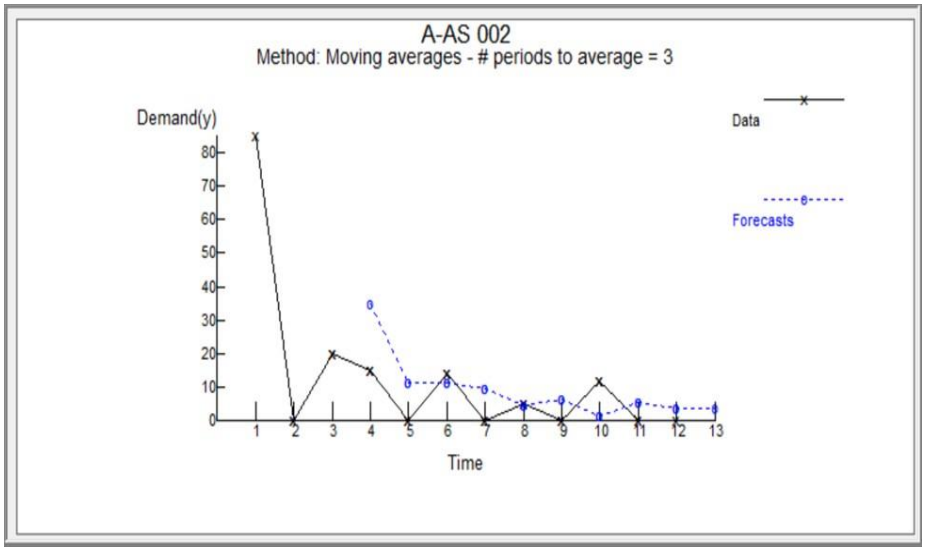

Figure 6. Graph of 3 Stove Moving Average Forecasting A-AS002

Based on the data processing performed with the POM for windows software, the graph above shows a graph of demand and forecasting. The black line shows demand data, and the blue line shows the forecasting results using the n=3 moving average method

c. Moving Average Forecasting Results 3

	A-AS 002 Solution					
	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
January	85					
February	0					
March	20					
April	15	35	-20	20	400	1.33
May	0	11.67	-11.67	11.67	136.11	0
June	14	11.67	2.33	2.33	5.44	.17
July	0	9.67	-9.67	9.67	93.44	0
August	5	4.67	.33	.33	.11	.07
September	0	6.33	-6.33	6.33	40.11	0
October	12	1.67	10.33	10.33	106.78	.86
November	0	5.67	-5.67	5.67	32.11	0
December	0	4	-4	4	16	0
TOTALS	151		-44.33	70.33	830.11	2.43
AVERAGE	12.58		-4.93	7.81	92.23	.27
Next period forecast		4	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	10.89	

Figure 7. Forecasting Results of the 3 Stove A-AS001 Moving Average

3. Stove A-SD 001
   a. Measure Moving Avarage 3

Measure	Value
Error Measures	
Bias (Mean Error)	-2.85
MAD (Mean Absolute Deviation)	16.11
MSE (Mean Squared Error)	550.75
Standard Error (denom=n-2=7)	26.61
MAPE (Mean Absolute Percent	3.72
Forecast	
next period	.67

Figure 8. Measure Moving Average 3 Stoves A-SD001

Based on the results of the forecasting test above using the POM for windows software, it can be seen that the forecasting results using the Moving average method with n = 3 for the request for the A-SD 001 stove on C.V ABC obtained a Mean Absolute Deviation (MAD) value of 16.11, Mean Squad Error (MSE) of 550.75 and the Mean Absolute Percent Error (MAPE) of 3.72. and the results for forecasting demand for the next period are 0.67 or equal to 1 pcs

   b. Grafik Peramalan Moving Avarage 3

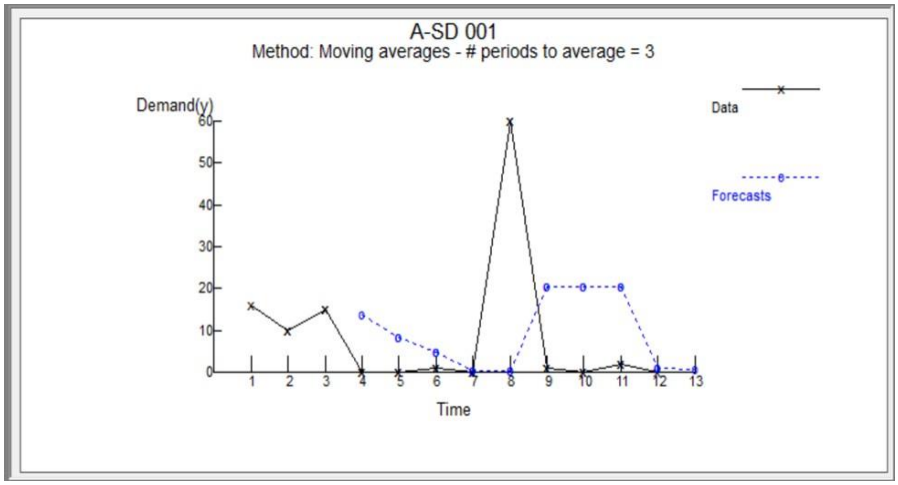

Figure 9. Graph of 3 Stove Moving Average Forecasting A-SD001

Based on the data processing performed with the POM for windows software, the graph above shows a graph of demand and forecasting. The black line shows demand data, and the blue line shows the forecasting results using the n=3 moving average method.

c. Moving Average Forecasting Results 3

A-SD 001 Solution						
	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
January	16					
February	10					
March	15					
April	0	13.67	-13.67	13.67	186.78	0
May	0	8.33	-8.33	8.33	69.44	0
June	1	5	-4	4	16	4
July	0	.33	-.33	.33	.11	0
August	60	.33	59.67	59.67	3560.11	1
September	1	20.33	-19.33	19.33	373.78	19.33
October	0	20.33	-20.33	20.33	413.44	0
November	2	20.33	-18.33	18.33	336.11	9.17
December	0	1	-1	1	1	0
TOTALS	105		-25.67	145	4956.78	33.49
AVERAGE	8.75		-2.85	16.11	550.75	3.72
Next period forecast		.67	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	26.61	

Figure 10. Forecasting Results of the Moving Average of 3 Stoves A-SD001

CONCLUSION

1. Based on the demand graph, it is known that the pattern of demand for electric batik stoves at CV ABC shows fluctuating market demand. This can be judged from the data from January 2020 to December 2020, which tended to fluctuate. For the type A-AS 001 stove, the highest demand was in October for 552 pcs, and the lowest demand was in July for 0 pcs.
2. Based on the criteria for the lowest error value through the MAD, MSE, and MAPE values which are based on the fact that the smaller the error value, the more accurate the results. The results showed three samples of stoves, namely, type A-AS001 with a MAD value of 118.16, an MSE value of 44015.27, and a MAPE value of 3.93. The type A-AS002 stove shows a MAD value of 7.81, an MSE value of 92.23, and a MAPE value of 0.27. The type A-SD001 stove has a MAD value of 16.16, an MSE value of 550.75, and a MAPE value of 3.72..

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