

UDC 339

FORECASTING ANALYSIS OF MOBILE PHONE SALE WITH EXPONENTIAL SMOOTHING METHOD TO DETERMINE THE ACHIEVEMENT OF TURNOVER TARGETS

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ABSTRACT

Forecasting Sale as an alternative way to improve the student's skills in sales forecasting material. This quantitative research uses descriptive approach. The information from the data are collected in the form of documentation as an illustration of sales forecasting using the exponential smoothing method and turnover targets. This study was conducted at the Bola-Bola mobile store. This study focused on how to forecast sales using the exponential smoothing method and the accomplishment of turnover targets. Data analysis using single exponential smoothing method with alpha values of 0.5 and 0.7 to determine the smallest error value, the Mean Absolute Error and Mean Square Error which is the difference between actual sales and the predicted results, the value is squared. The results show that the Mean Square Error value is $\alpha = 0.7$ it is caused by the difference between the total sales and the predicted results. The smaller MSE value, the more accurate the forecasting results will be. This sales forecast prediction will provide an overview on the Bola-Bola mobile about the situation that will occur in the following year. It can provide an evaluation and anticipate things that are beyond the control of the Bola-Bola mobile considering that in 2020 Indonesian country is encountering the Covid-19 pandemic and increasingly fierce market competition. So that the mobile sales business can be further increase and still get the profits.

KEY WORDS

Sales forecasting, exponential smoothing, turnover target.

Selling is the activity carried out by a company in maintaining its business to develop rapidly in order to get the desired profit. In the industrial world there must be competition between one company and another, this is very normal, so what we needs to be done in winning the competition is to carry out a special strategy so that consumers can use the product. Sales forecast is an activity carried out to determine amount of demand for products to be sold. The purpose of forecasting sales is to provide information that the company can use in making a decision. Poor forecasting will result in wrong decisions and make the company unprepared for future demands that will endanger the company.

The forecasting method has considered some factors such as cost and ease of use. One of the most important factors is the accuracy of forecasting, the most common way is to find the best two or three methods and then test them historically to see the most accurate forecasting method. One of the methods used is the exponential smoothing method in which this method states that it is quite suitable for short-term or medium-term forecasting, especially if a large number of forecast results are required at the company's operating level.

In today's world, Smartphone is very loved by the community, especially young millennial. From time to time there are sophistication offered by smartphones, for example today's modern smartphones which include a high-resolution touch screen and a web browser to display the standard web pages along with sites that support mobile devices. High speed of accessing data are provided by Wi-Fi and mobile broadband connections and other advancements. Sales are a major factor in supporting the survival of a company. Because of the high level of sales in a company, it can compensate and even provide benefits for the company. Therefore the company must be able to determine policies related to sales activities carried out by the company. To deal with sales problems to match the company's targets, it is necessary to have a sales forecast. The forecasting is very important to be considered as an effort to improve the company's financial performance for the better, because with better financial performance is one indicator of the company's success in running the business (Zainurrafiqi and Rachmawati, 2018; Zainurrafiqi, et al, 2020), Surya, 2017) and Putri, 2020).

Based on the problems, the pattern of cell phone sales data in Bola-Bola store, the price of mobile phone experiencing up and down every month. Therefore, the method suitable for predicting the number of cell phone sales thru forecasting method (exponential smoothing) so that it can be seen when the demand is constantly increasing, and the situation is decreasing. By using forecasting, it can be conclude that the number of buyers is quite large.

LITERATURE REVIEW

Forecasting comes from the word forecast which means a situation or condition that is predicted to occur in the future. Forecasting is a form of activity to predict something based on a variety of methods, namely the single exponential smoothing method, the double exponential smoothing method, and the triple exponential smoothing method. Those are known as the forecasting method (Puspita, 2018). Forecasting aims to estimate the economic prospects and business activities as well as the environmental impact on these prospects. Forecasting is an early stage of production planning. It can be concluded that forecasting is a calculation that is carried out to predict (plan) future events using reference data from the past.

The exponential smoothing method is a procedure that continuously improve forecasting by smoothing (smoothing = smoothing) the past value of time series data in an exponential manner. Exponential smoothing analysis is a time series analysis, and is a method of forecasting by giving weight to a series of previous observations to predict future values (Suryawati Said, 2011). Broadly speaking, the Exponential Smoothing method is divided into 3 methods, namely;

Single Exponential Smoothing (simple exponential smoothing). The method used in short-term forecasting is usually only the next one month. The model assumes that data fluctuates around a fixed mean, without a consistent trend or growth pattern. Single exponential smoothing adds an alpha parameter to the model to reduce the randomness factor (Eddy Herjanto, 2006; De Livera et al., 2011; Tratar et al., 2016; Mi et al., 2018; Seong, 2020; Smyl, 2020). The forecast value can be found using the Simple exponential smoothing formula as follows:

$$\hat{Y}_{t+1} = \alpha \times X_t + (1 - \alpha) \times \hat{Y}_t$$

Where: X_t = demand data in t period; α = smoothing factor / constant; \hat{Y}_{t+1} = forecast for t period.

The error error can be calculated using the mean absolute error and mean square error. Mean absolute error is the average absolute value of the error in predicting (regardless of the positive or negative sign).

$$\text{Mean Absolute Error} = \frac{\sum(X_t - F_t)}{n}$$

Mean square error is the average square of the forecast errors:

$$\text{Mean Square Error} = \frac{\sum(X_t - F_t)^2}{n}$$

Where X_t : the data actually happened; F_t : Forecast data is calculated from the model used at t year time; n: a lot of forecast data.

The principle of calculating forecast errors is that a good model is a model that has the smallest error than the actual observational data in the field.

Sales budget According to Justine (2006), Shcherbina & Tamulevičienė (2016), Yatsenko & Kudriavets (2019), Aryshev & Ivanyuk (2020), Iurieva et al. (2020), is the basis for the implementation of other activities, and in general, the sales budget is compiled first from other budgets. The main goal of the company is to make a profit. Profits will be obtained if the company sells goods or services at a price higher than the cost. The main problems faced when going to sell a good or service.

METHODS OF RESEARCH

This research uses descriptive quantitative where the information from the data are collected in descriptive form to determine sales forecasting using exponential smoothing. Quantitative descriptive is data recording accompanied by numbers which represent values and can be given an objective picture of the problem being analyzed (Sugiyono, 2013). The data used in this study comes from sales data in January-December 2019 on Bola-Bola mobile in Pamekasan:

1. Sales forecast is an activity that carried out to find how much the demand for a product to be offered by the company;
2. Exponential Method is a method of forecasting with a moving average where the data used weighs past data. In this study, researchers used the single exponential smoothing method with alpha values of 0.5 and 0.7 to determine the smallest Mean Square Error value;
3. Turnover target is the achievement of the amount of money (proceeds) from the sale of merchandise during a certain sales period.

The data analysis techniques in this study are as follows:

- Clarify sales data from January-December 2019;
- Researcher used the single exponential smoothing method with alpha values of 0.5 and 0.7 to determine the smallest Mean Square Error value;
- Calculating Single Exponential Smoothing.

$$\hat{Y}_{t+1} = \alpha \times X_t + (1 - \alpha) \times \hat{Y}_t$$

Where: X_t = demand data on a t period; α = smoothing factor / constant; \hat{Y}_{t+1} = forecast for t period.

- Determine the Mean Absolute Error which is the difference between actual sales and the predicted results:

$$\text{Mean Absolute Error} = \frac{\sum(X_t - F_t)}{n}$$

Where: X_t = the data actually happened; F_t = Forecast data is calculated from the model used at time of t year; n = a lot of forecast data.

- Determine the Mean Square Error which is the square value of the Mean Absolute Error:

$$\text{Mean Square Error} = \frac{\sum(X_t - F_t)^2}{n}$$

Where: X_t = the data actually happened; F_t = Forecast data is calculated from the model used at time of t year; n = a lot of forecast data;

- Predict the sales forecast on Bola-Ponsel. In 2019.

RESULTS AND DISCUSSION

Calculating the Sales Forecast $\hat{Y}_t + 1$ with $\alpha = 0.5$, and Calculating MAE and MSE.

Table 1 – Forecasting sales of Vivo Mobile Phones with a value of $\alpha = 0.5$

Period	Month	Vivo	Total	MAE
1	Jan-19	38.745	29.058,8	807,188
2	Feb-19	38.745	33901,9	403,594
3	Mar-19	41.615	37758,4	321,38
4	Apr-19	44.485	41121,7	280,273
5	May-19	35.815	38468,4	-221,11
6	Jun-19	43.225	40846,7	198,193
7	Jul-19	45.695	43270,8	202,013
8	Aug-19	48.165	45717,9	203,923
9	Sep-19	49.400	47559	153,42
10	Oct-19	51.870	49714,5	179,627
11	Nov-19	53.105	51409,7	141,272
12	Dec-19	58.045	54727,4	276,469

Source: Processed data.

Table 2 – Forecasting sales of Oppo mobile phones with a value of $\alpha = 0.5$

Period	Month	Oppo	Total	MAE
1	Jan-19	50.372	50372	0
2	Feb-19	48.573	49472,5	-74,958
3	Mar-19	53.970	51721,3	187,396
4	Apr-19	59.367	55544,1	318,573
5	May-19	49.271	52407,6	-261,38
6	Jun-19	59.465	55936,3	294,06
7	Jul-19	62.863	59399,6	288,613
8	Aug-19	67.960	63679,8	356,682
9	Sep-19	67.960	65819,9	178,341
10	Oct-19	74.756	70288	372,337
11	Nov-19	78.154	74221	327,752
12	Dec-19	86.649	80435	517,834

Source: Processed data.

Table 3 – Forecasting sales of Samsung mobile phones with a value of $\alpha = 0.5$

Period	Month	Samsung	Total	MAE
1	Jan-19	34.000	34000	0
2	Feb-19	36.000	35000	83,3333
3	Mar-19	36.000	35500	41,6667
4	Apr-19	40.000	37750	187,5
5	May-19	40.000	38875	93,75
6	Jun-19	38.000	38437,5	-36,458
7	Jul-19	48.000	43218,8	398,438
8	Aug-19	54.000	48609,4	449,219
9	Sep-19	58.000	53304,7	391,276
10	Oct-19	70.000	61652,3	695,638
11	Nov-19	76.000	68826,2	597,819
12	Dec-19	84.000	76413,1	632,243

Source: Processed data.

Calculating the Sales Forecast $\hat{Y}_t + 1$ with $\alpha = 0.7$, and Calculating MAE and MSE.

Table 4 – Forecasting sales of Vivo Mobile Phones with a value of $\alpha = 0.7$

Period	Month	Vivo	Total	MAE
1	Jan-19	38.745	38745	0
2	Feb-19	38.745	38745	0
3	Mar-19	41.615	40754	71,75
4	Apr-19	44.485	43365,7	93,275
5	May-19	35.815	38080,2	-188,77
6	Jun-19	43.225	41681,6	128,62
7	Jul-19	45.695	44491	100,336
8	Aug-19	48.165	47062,8	91,8508
9	Sep-19	49.400	48698,8	58,4302
10	Oct-19	51.870	50918,7	79,2791
11	Nov-19	53.105	52449,1	54,6587
12	Dec-19	58.045	56366,2	139,898

Source: Processed data.

Table 5 – Forecasting sales of Oppo mobile phones with a value of $\alpha = 0.7$

Period	Month	Oppo	Total	MAE
1	Jan-19	50.372	50372	6,06E-13
2	Feb-19	48.573	49112,7	-44,975
3	Mar-19	53.970	52512,8	121,433
4	Apr-19	59.367	57310,7	171,355
5	May-19	49.271	51682,9	-200,99
6	Jun-19	59.465	57130,4	194,552
7	Jul-19	62.863	61143,2	143,316
8	Aug-19	67.960	65915	170,42
9	Sep-19	67.960	67346,5	51,1259
10	Oct-19	74.756	72533,1	185,238
11	Nov-19	78.154	76467,7	140,521
12	Dec-19	86.649	83594,6	254,531

Source: Processed data.

Table 6 – Forecasting sales of Samsung mobile phones with a value of $\alpha = 0.7$

Period	Month	Samsung	Total	MAE
1	Jan-19	34.000	34000	0
2	Feb-19	36.000	35400	50
3	Mar-19	36.000	35820	15
4	Apr-19	40.000	38746	104,5
5	May-19	40.000	39623,8	31,35
6	Jun-19	38.000	38487,1	-40,595
7	Jul-19	48.000	45146,1	237,822
8	Aug-19	54.000	51343,8	221,346
9	Sep-19	58.000	56003,2	166,404
10	Oct-19	70.000	65800,9	349,921
11	Nov-19	76.000	72940,3	254,976
12	Dec-19	84.000	80682,1	276,493

Source: Processed data.

Predicting Sales Forecast in 2020 using the Exponential Smoothing method with $\alpha = 0.5$.

Table 7 – Forecasting sales of Vivo Mobile Phones with a value of $\alpha = 0.5$

Period	Month	Sales Forecast Results
1	Jan 2020	55556,78
2	Feb 2020	55764,13
3	Maret 2020	55815,97
4	April 2020	55828,93
5	Mei 2020	55832,17
6	Juni 2020	55832,98
7	Juli 2020	55833,18
8	Agustus 2020	55833,23
9	Sep 2020	55833,24
10	Okt 2020	55833,25
11	Nov 2020	55833,25
12	Des 2020	55833,25

Source: Processed data.

Table 8 – Forecasting sales of Oppo mobile phones with a value of $\alpha = 0.5$

Period	Month	Sales Forecast Results
1	Jan 2020	81988,49
2	Feb 2020	82376,86
3	Maret 2020	82473,96
4	April 2020	82498,23
5	Mei 2020	82504,30
6	Juni 2020	82505,82
7	Juli 2020	82506,19
8	Agustus 2020	82506,29
9	Sep 2020	82506,31
10	Okt 2020	82506,32
11	Nov 2020	82506,32
12	Des 2020	82506,32

Source: Processed data.

Table 9 – Forecasting sales of Samsung mobile phones with a value of $\alpha = 0.5$

Period	Month	Sales Forecast Results
1	Jan 2020	78309,81
2	Feb 2020	78783,99
3	Maret 2020	78902,54
4	April 2020	78932,17
5	Mei 2020	78939,58
6	Juni 2020	78941,43
7	Juli 2020	78941,90
8	Agustus 2020	78942,01
9	Sep 2020	78942,047
10	Okt 2020	78942,05
11	Nov 2020	78942,05
12	Des 2020	78942,05

Source: Processed data.

Predicting Sales Forecast in 2020 using the Exponential Smoothing method with $\alpha = 0.7$.

Table 10 – Forecasting sales of Vivo Mobile Phones with a value of $\alpha = 0.7$

Period	Month	Sales Forecast Results
1	Jan 2020	57188,83
2	Feb 2020	57361,57
3	Maret 2020	57397,85
4	April 2020	57405,47
5	Mei 2020	57407,07
6	Juni 2020	57407,4
7	Juli 2020	57407,47
8	Agustus 2020	57407,49
9	Sep 2020	57407,49
10	Okt 2020	57407,49
11	Nov 2020	57407,49
12	Des 2020	57407,49

Source: Processed data.

Table 11 – Forecasting sales of Oppo mobile phones with a value of $\alpha = 0.7$

Period	Month	Sales Forecast Results
1	Jan 2020	85091,27
2	Feb 2020	85405,56
3	Maret 2020	85471,57
4	April 2020	85485,43
5	Mei 2020	85488,34
6	Juni 2020	85488,95
7	Juli 2020	85489,08
8	Agustus 2020	85489,1
9	Sep 2020	85489,11
10	Okt 2020	85489,11
11	Nov 2020	85489,11
12	Des 2020	85489,11

Source: Processed data.

Table 12 – Forecasting sales of Samsung mobile phones with a value of $\alpha = 0.7$

Period	Month	Sales Forecast Results
1	Jan 2020	82307,86
2	Feb 2020	82649,28
3	Maret 2020	82720,97
4	April 2020	82736,03
5	Mei 2020	82739,19
6	Juni 2020	82739,86
7	Juli 2020	82740
8	Agustus 2020	82740,02
9	Sep 2020	82740,03
10	Okt 2020	82740,03
11	Nov 2020	82740,03
12	Des 2020	82740,03

Source: Processed data.

Calculation of sales forecasts that have been done using the single exponential smoothing method with the respective values $\alpha = 0.5$ and $\alpha = 0.7$ and calculating the forecast error, the Mean Absolute Error value for Vivo Mobile Phones $\alpha = 0.5$ is obtained at 245.51. for Oppo mobile phones $\alpha = 0.5$ is 208.77 and for Samsung mobile phones $\alpha = 0.5$ is 294.53, while the value of $\alpha = 0.7$ for Vivo phones is 52.44 and for Oppo phones $\alpha = 0.7$ is 98 , 87 and for Samsung mobile phones $\alpha = 0.7$ of 138.93.

From the two α values, it can be seen that the forecast error is at $\alpha = 0.7$, which is Vivo mobile phone products. The smaller the forecast error, the better the sales forecast results. This is because Vivo continues to make updates and releases new products so that the market share is achieved. From the results of the calculation of the prediction of cellphone sales on mobile balls using the single exponential method, it is known that MSE with $\alpha = 0.5$ and $\alpha = 0.7$, namely in table 13

Table 13 – Sales Forecasts

Product name	0,5	0,7
Vivo	1.221.258	45.505,73
Oppo	905.655,1	210.606,2
Samsung	1.814.929	410.120,8

Source: Processed data.

From the table above, it can be explained that the alpha value of 0.7 is smaller than the alpha value of 0.5. The objective of the exponential smoothing method is to determine the α value that minimizes MSE. The MSE value is caused by the difference between the total sales and the predicted results. The smaller the MSE value, the more accurate the forecasting results will be. Of the two values $\alpha = 0.5$ and $\alpha = 0.7$, the smallest MSE value is $\alpha = 0.7$.

Calculating the forecast error is used to observe the overall trend of data over a period of time for only one period or one month. Forecasting errors can be used to predict what condition the data will be in the following month. The principle of calculating forecast error is to use the mean absolute error (MAE) and mean square error (MSE). A good model is a model that has the smallest error error than the actual observed data in the field.

This sales forecast prediction will provide an overview on the mobile football about the situation that will occur in the following year. This can provide an evaluation and anticipate things that are beyond the control of the mobile balls considering that in 2020 our country, namely Indonesia, is experiencing the Covid-19 pandemic and increasingly fierce market competition. So that the mobile sales business can increase and still experience profits. Bola-Bola mobile should determine sales targets that must be achieved are to carry out a larger strategy, namely by increasing marketing skills such as creating advertisements on social media (Facebook, Instagram, etc.), expanding the target market and doing warehouse cleaning so that it will have an impact on the profits obtained.

Trend analysis is an analysis used to observe data as a whole over a long period of time. Trends can be used to predict future data conditions, besides that, it can be used to predict data at a certain time within a certain period of time. Time series data are analyzed to find patterns of past variations that can be used to estimate the value for the future (forecast) because observing time series data will be seen so that it will affect past and present data patterns that are repeated in the future.

Research using the exponential smoothing method has actually been carried out, including research conducted by Suriyawati Said (2011) who predicted the sales volume of concrete at PT Harfia Graha Perkasa which used the α value in the forecasting error, namely $\alpha = 0.1$, 0.2 and 0.3 which results in the residual error value is $\alpha = 0.3$ smaller than the value $\alpha = 0.1$, and $\alpha = 0.2$ so that researchers are also interested in using exponential smoothing but the α value is different from previous researchers.

CONCLUSION

Prediction of cellphone sales for the following year has increased by using $\alpha = 0.5$ and $\alpha = 0.7$ so that business owners can anticipate from now on. Simplyfy the business owners to report monthly turnover so the profits can be achieved and they could be compete with other store owners fairly.

RECOMMENDATIONS

Prediction of cellphone sales on Bola-Bola Mobile Pamekasan using exponential smoothing can be added with other prediction methods such as moving averages so that the prediction results are more accurate than other companies, it can also use double exponential smoothing or by adding other methods in order to obtain more varied information.

To achieve the turnover target Bola-Bola mobile should multiply the marketing strategies such as promotion through social media and recruiting employees who are more experienced in the field of marketing.

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