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Analysis forecasting sales of tart products

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Abstract

Sales forecasting is an effective and efficient tool for organizations or business people to predict the products that will be produced. Sales forecasting is a method that uses historical data as a reference to get a picture of future value. This research was conducted at the Kuwenak Shop, which produces in the food sector, to be precise, cakes or birthday cakes. On the occasion of this research, there are three forecasting methods used, including moving average, exponential smoothing, and linear trend, taking into account the smallest error rate or error in each method. The linear trend forecasting method is the best choice because it has a low error rate. Specifically, the MAD error value is 2.4, the MSE error is 6.6, the MAPE error is 5.9% and the standard error is 9.3. From the data management on the selected method, the linear trend sales forecasting method for cake products predicts that for the next week, Kuwenak Shop s can produce 40.6 or 41 products. This means that Kuwenak Shop can provide 41 tarts the following week or even each week.

Keywords: Sales forecasting; moving average method; exponential smoothing method; linear trend method

INTRODUCTION

Currently, almost all countries are affected by the COVID-19 outbreak. Almost all sectors, such as education, the economy, agriculture, and even the exchange of goods and services, are increasingly limited. Of course, a company or business engaged in sales and distribution of goods and services does not want to experience losses. One fact that has become common among the public is that by doing business, surely someone focuses on seeking the maximum profit possible with spending as little as possible. To face sales challenges in this pandemic situation, of course, a business in the field of production urgently needs an effective sales forecasting strategy for the production of its products. This is commonly known as sales forecasting, (Pangestuti, 2018).

Techniques for predicting or estimating product sales against consumer demand both in the long and short term are indispensable for an entrepreneur. With regards to the sales plan that has been planned by an entrepreneur, forecasting sales will contribute greatly to knowing the product picture that will be the demand for products by consumers in the market and provide an overview of the products that will be produced (Wardah & Iskandar, 2016).

The Forecasting method is one alternative way to predict in quantitative form or value what will occur in the future by using data from the past or historical as a reference in predicting (Lestari et al., 2012). This method is indeed very useful for providing an overview for making systematic and efficient production planning. But as the name implies, forecasting is still a prediction that is not certain, almost happens, will not even happen.

The reality of the results of a forecast as a whole is almost never absolute and accurate with the results that occur. Of course, this is caused by uncertainty in the future, which several factors can affect uncertainty. However, a sales forecast will certainly be close to the actual value if all the important factors affecting production and sales are contested and carefully calculated, the estimated results are close to the actual value (Wardah & Iskandar, 2016).

Kuwenak Shop, located at Jalan Prepedan Raya No. 64, Kalideres, West Jakarta, is one of the shop that focuses on food production, or more precisely, the sale of tart products. The Tart Shop was founded by a businessman who started his business. Throughout his business, he experienced sales volumes that every week were volatile, so that the bakery was faced with a condition of uncertainty in producing his products against consumer demand. For that, sales forecasting is needed to be a picture for the Kuwenak Shop as a prediction of the product to be produced. Competitive business competition makes an entrepreneur required to be able to estimate consumer demand in the future by paying attention to the planning of the purchase of staples or raw materials that are in accordance with the needs that mean the material does not experience a surplus or deficit (Yanti et al., 2016).

Literatur review

Sales forecasting is an attempt to predict a value in the future using some valid historical data in the past. According to researchers, forecasting activities are a use in doing business to try to predict the sale and use of products so that the product can be produced with the right quantity (Maulana, 2017). In order for forecasting to be called good forecasting, it is necessary to do the right procedure by following good steps. With the expectation that a good preparation will provide useful quality. There are 3 stages that need to be considered in forecasting, (Babenko, 2017):

Conducting an analysis of historical data. This step aims to see patterns or images that occurred in the past.

Select the data to use. It is said that the method is good if the method produces a prediction that does not hit or if the error rate is not large.

Project historical data using the method to be used, and consider the existence of several factors of change, including the following:

Economic conditions

The economic sector is one part of the factors that have the potential to be considered in forecasting sales because various policies made by local to central governments can affect economic

conditions. Moreover, conditions in the economy are also affected by global conditions such as inflation, war in certain countries and others.

Government

The government can be said to be the determining system in decision making against sales forecasting methods. Because all regulatory systems in a country are regulated by the government. All these regulatory systems can certainly affect the organization or company.

Quality and use of products

According (Marwanto, 2015), a good and quality product is a product that is able to satisfy the expectations of consumers. Product quality covers various categories, namely marketing, planning, product creation, and proper product maintenance. Quality products encourage consumers to think faster about the decision to buy a product because the product is indeed good in terms of consumer desire and usefulness, (Nurhidayah et al., 2021).

Production costs

There are two classifications of costs, direct costs and indirect costs. A Direct cost is a cost that is not difficult to associate with the cost of an object or product. Direct costs have benefits for a specific project. Direct costs consist of direct material costs and direct labor costs, and the characteristic of direct costs is that they are easily shared with specific cost objects. While with indirect or ordinary costs, known as indirect costs, which are costs that can not be allocated to a certain cost object. While the notion of distribution is an activity to distribute one or various types of products, be they goods or services, from producers to consumers, so that the product expands in accordance with the place that has been set (Mulyadi, 2009).

People's tastes

Taste is an activity that a person does to spend money, energy, and time getting a product, be it goods or services. Consumer tastes are often dynamic, which means that they change from period to period. This trait can also be called seasonal. When the market has a lower supply than demand, it proves that the demand for the market is increasing rapidly. On the contrary, if a market has a very high supply than demand, it proves that consumer demand for the market is not so great. It is said that if the consumer's appetite for a product is high, it will have the potential to affect the rapid decision-making actions taken by a consumer.

The sales budget is planning for the sale of the company in detail for the period to come, starting from the selling price of goods, the quality of goods to be sold, the number of goods to be sold, and others. The schedule plan is the result of the conversion of a sales forecast that has taken into account various things, such as the following: 1). Arguments on the part of management, 2). Planned corporate strategy, 3). Directly related to the resources at your disposal, and 4). Company management provisions in an effort to achieve sales targets.

Management in a company can take a step forward better and definitely because of the forecasting of sales. An overview of sales forecasts for the upcoming period is needed by the management division in a company, because the company's policy will always run with regard to the large sales of its goods or services (Pangestuti, 2018).

While there are some principles that need to be considered in doing sales forecasting: Forecasting must include the error rate of each method, commonly called an error. Forecasting will help minimize uncertainty, but it actually does not eliminate it;

It would be nice to do forecasting using forecasting error benchmarks. The user must know the small number of errors described by the unit or the percentage of actual requests that will fall in the forecasting interval;

Family forecasting has a higher level of accuracy compared to individual product forecasts;

Forecasting sales in a shorter period of time has a higher accuracy rate compared to a long period of time. This is due to conditions that affect consumer demand that tend to be constant or the changes are relatively stable and do not change quickly. So, this makes forecasting in a short period of time more accurate; and

If possible, we can try to do the calculation of the demand rather than forecasting the demand.

There are several characteristics of good forecasting, (Wardah & Iskandar, 2016):

Accuracy, row rupiah cost of software purchase or development, low computer time requirements, low computer storage requirements and on-line capabilities.

Sales forecasting methods

In forecasting, there are many methods that can be used. However, in this study, used three forecasting methods selected to forecast sales of tart products in the Kuwenak Shop, namely moving average, exponential smoothing, and linear trend.

Moving average method

Many researchers are conducting sales forecasting using the time series method. The time series method consists of various methods, including the moving average method. The moving average method can be used if past data is not data that has a trend element or seasonal factors. The main purpose of using this method is to minimize or eliminate randomness in the time series (Assauri, 1984).

In order to obtain output results from the previous moving average method, we must first determine the number of periods (T). The next step that can be taken is to use calculations on the value of the latest data while deleting historical data that has long been deleted. Furthermore, the moving average value can be determined from the price of 1 to the value of T data that we have (Nurlifa & Kusumadewi, 2017).

The method of moving averages is algebraically formulated as follows:

$$F_{T+1} = \frac{x_1 + x_2 + \ldots + x_T}{T} = \frac{1}{T} \sum_{i=1}^{T} X_i$$

With the explanation that T is the final value and T +1 is the next period during which the forecasting time is made.

 F_{T+1} = forecast for the next period

N = the number of periods used to calculate the moving average

Exponential smoothing method

Exponential smoothing is a forecasting method used for stationary data or relatively constant or fixed levels. Almost the same as the moving average method, this method also uses the latest data weighting given a relatively large value compared to past histories data. However, this method uses an exponential weighting system against all previous observational values (Hartono et al., 2015). This method has the following formula:

$$\widehat{Y}_{t+1} = \alpha Y_t + (1-\alpha)\widehat{Y}t$$

 \hat{Y}_{t+1} = Output forecasting in the next period

 $\hat{Y}t$ = Forecasting value for period t

 Y_t = Request for period t

 α = smoothing weight factor (0 < α < 1)

Linear trend method

This method separates the three separate components from the archetypes that tend to characterize the series of economic and business data. These components are trend, cyclical and seasonal factors. This analysis is one of the statistical tools often used to analyze and interpret the influence of a free variable on a response variable. With this method, one can easily find out the changes by looking for relationships between 2 different variables (Susanti et al., 2019). The linear trend line of the a-calorie series is formulated as follows:

Xt = a + bt $b = \frac{n\sum_{t=1}^{n} txdt - \sum_{t=1}^{n} dt \sum_{t=1}^{n} t}{n\sum_{t=1}^{n} t^2 - (\sum_{t=1}^{n} t)^2}$

$$a = \frac{\sum_{t=1}^{n} dt - b \sum_{t=1}^{n} t}{n}$$

a = interception
b = slope

Forecasting results measure

In making a decision on the sales forecasting method, the evaluation of size is required in several sales forecasting methods. Of course, in doing forecasting there must be errors. For this reason, this measurement focuses on the error of each forecasting method. Measurement of error forecasting can be useful for comparing the accuracy of two or more methods used, measuring the reliability and usefulness of the forecasting methods used, and determining the forecasting methods that are most appropriate for the organization (Binus, 2018).

There are several methods used to measure error forecasting:

MAD (Mean Absolute Deviation)

MAD serves to measure the level of accuracy of the forecasting method we use, by equalizing the magnitude of error at absolute value.

The MAD formula is as follows:

$$MAD = \frac{1}{n} \sum_{t=1}^{n} |Y_t - \widehat{Y}_t|$$

Yt = Actual value in period t

 \hat{Y}_t = The value of the forecast in the period t

MSD (Mean Squared Deviated)

Squared means square. As the name implies, MSD is a squared error. MSD is often used to measure the level of accuracy of values in the forecast method that you want to calculate. Based on research, MSD has a greater effect than MAD.

The MSD formula is as follows:

$$MSD = \frac{\sum_{t=1}^{n} |Y_t - \widehat{Y}_t|^2}{n}$$

Yt = Actual value in period t

 \hat{Y}_t = The value of the forecast in the period t

MAPE (Mean Absolute Percentage Error)

As the name implies, MAPE is used to measure the percentage error rate of absolute values in each period, which is divided by the actual observation value in the period, and make an average of the errors of the absolute value.

The MAPE formula is as follows: $n \to n$

$$MAPE = \frac{1}{n} \sum_{t=1}^{n} \frac{|Y_t - \widehat{Y}|}{Y_t}$$

Yt = Actual value in period t

 \hat{Y}_t = The value of the forecast in the period t

METHOD

This research is quantitative research. And the study time is for 7 (seven) weeks. The object of the research is Kuwenak Shop, located at Jalan Prepedan Raya No. 64, Kalideres, West Jakarta, which is one of the shop s that focuses on food production, or more precisely, the sale of tart products. The stages passed in conducting this research are as follows:

Introduction. Before doing research, first find out the problems that occur in Kuwenak Shop engaged in food production;

Data Collection. The step of data collection is in order to address the need for primary data and secondary data. Primary data comes from interviews and observations in the field with the owners and workers of Kuwenak Shop, while secondary data is obtained from companies in the form of documents or company records. The data that needs to be managed in this study, Kuwenak shop profile data, shop location, management structure, total employees, and workers' working hours schedule. Not only that, for data processing purposes, we need sales data for Kuwenak Shop for 7 weeks;

Data processing. After obtaining data, the next stage is to operate the data using a help program from a computer application, excel. The purpose of data processing is to analyze raw data obtained so that we can easily make decisions and conclusions. This problem is analyzed using several methods of forecasting, the moving average method, exponential smoothing, and linear trend methods; and

Analysis. At this stage, the analysis is done with the aim of researching existing problems and comparing several sales forecasting methods by analyzing the error rate or error of each of the methods used. For this reason, the author used quantitative methods to be able to operate formulas related to the forecasting method used.

RESULTS AND DISCUSSIONS

The Tart Shop is a businessman who is just starting his business. As long as he starts a business, he experiences fluctuating sales volume every week, so that the bakery is faced with a condition of uncertainty in producing his products against consumer demand. For this reason, sales forecasting is needed to be a picture for Kuwenak Shop as a prediction of the product to be produced.

Sales data patterns

Based on data obtained from the beginning of Kuwenak Shop started its business until now, this is a guide for the method of forecasting sales. Can be seen in table 1.

Week To-	Sales (Y)
1	39
2	44
3	40
4	45
5	38
6	43
7	39
8	?

Table 1. Kuwenak shop tart sales data

Historical sales data patterns are useful to be a picture of data harmony. The data pattern from week 1 to week 7 can be seen in figure 1.



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Figure 1. Kuwenak Shop tart sales data pattern

Trending data patterns occur when a data experience a fluctuating movement from left to right data that tends to rise or fall. Trend data patterns only occur if the discovery increases or decreases over a long period of time during the observed period (Ajeng, 2011). However, the data above does not show a pattern of data that is trending, but rather shows data that is stationary. This is indicated by the movement of data that is not at a fixed average garis position (Raharja et al., 2017).

Analysis of sales forecasting of each method Moving average method with weight 3

Based on table 2, it is known that the value of the sales forecast for tart products that can be produced for week eight by Kuwenak Shop is 40 units.

Table 2	Forecastin	o result n	noving av	verage with	weight 3
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Week To-	Sales (Y)	3MA (Y')	Y-Y'	[Y-Y']
1	39	0		
2	44	0		
3	40	0		
4	45	41	4	4
5	38	43	-5	5
6	43	41	2	2
7	39	42	-3	3
8	?	40		

Based on table 3, it is known that the MAD ERROR value is 3.5, the MSE ERROR is 13.5, the MAPE ERROR is 8.6% and the error standard is 10.8. Based on the resulting output, we can interpret that the error rate of use of this method is 3.5 for MAD and 13.5 for MSE.

Table 3. Error result in method moving average with weight 3

Measure		Value
[ERROR]	MAD	3,5
ERROR^2	MSE	13,5
% ERROR	MAPE	8,6
STANDARD ERF	10,8	
Forecast Next Per	40	

Exponential smoothing with α Trend = 0.5

Based on table 4, it is known that the value of the sales forecast of tart products that can be produced for the eighth week by Kuwenak Shop is 40.4 units.

Table 4. Forecasting result exponential smoothing with	$\alpha = 0.5$
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Week To-	Sales (Y)	Forecasting (Ft)	Y-Y'	[Y-Y']
1	39	39	0	0
2	44	39	5	5
3	40	41,5	-2	2
4	45	40,8	4	4
5	38	42,9	-5	5
6	43	40,4	3	3
7	39	41,7	-3	3
8	?	40,4		

Based on table 5, it is known that the MAD ERROR value is 3.0, the MSE ERROR is 11.9, the MAPE ERROR is 7.2% and the error standard is 16.6. Based on the resulting output, we can interpret that the error rate of use of this method is 3.0 for MAD and 11.9 for MSE

Table	5. Error resu	ilt in expone	ntialsmoot	h method with $\alpha = 0$
Mea	sure		Value	
[ERI	ROR]	MAD	3,0	
ERR	OR^2	MSE	11,9	
% EI	ROR	MAPE	7,2	
STA	NDARD ER	ROR	16,6	

40,4

0.5

Forecast Next Period Linear trend method

Based on table 6, it is known that the value of the sales forecast of tarts products that can be produced for the eighth week by Kuwenak Shop is 40.6 units.

Week To-	Sales (Y)	t*dt	t ²	Linear Trends(Y')	[Y-Y')
1	39	39	1	41,6	2,6
2	44	88	4	41,4	2,6
3	40	120	9	41,3	1,3
4	45	180	16	41,1	3,9
5	38	190	25	41,0	3,0
6	43	258	36	40,9	2,1
7	39	273	49	40,7	1,7
8				40,6	
Total	288	1148	140		17,1

Table 6. Forecasting result Linear Trend

With the following calculations:

$$b = \frac{n \sum_{t=1}^{n} tx dt - \sum_{t=1}^{n} dt \sum_{t=1}^{n} t}{n \sum_{t=1}^{n} t^{2} - (\sum_{t=1}^{n} t)^{2}}$$

$$b = \frac{7x1148 - 288x28}{7x140 - 28^{2}} = -0,14$$

$$a = \frac{\sum_{t=1}^{n} dt - b \sum_{t=1}^{n} t}{n}$$

$$a = \frac{288 - (-0,14)x28}{7} = 41,7$$

$$Y' = a + bt$$

Y'= 41,7-0,14t

Based on table 7, it is known that the MAD ERROR value is 2.4, the MSE ERROR is 6.6, the MAPE ERROR is 5.9% and the error standard is 9.3. Based on the resulting output, we can interpret that the error rate of use of this method is 2.4 for MAD and 6.6 for MSE.

Table 7. Error result in linear method trend

Measure		Value
[ERROR]	MAD	2,4
ERROR^2	MSE	6,6
% ERROR	MAPE	5,9
STANDARD ERROR		9,3
Forecast Next Period		40,6

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Analysis of the selection of the best forecasting methods

All three forecasting methods have been used to determine production forecasts by week eight. The next step that can be taken is to determine which method is best for forecasting the sale of Kuwenak shop. The selection of forecasting methods is determined by comparing the error values of each method. The parameters that can be used to compare this method are MAD errors, MSE errors, and MAPE errors. Where the three errors are closest to zero, it can be said to be the best sales forecasting method. Because many values are MAD, MSE, standard error, MAPE, which vary on each method, it needs to be used for weighting values. The next step is that we can communicate and compare each value that has been weighted in each of these forecasting methods.

Based on the analysis and data processing patterns in the results and discussion chapters, we can determine that, in terms of error rate, the linear trend forecasting method has the lowest error value compared to other forecasting methods. The trend linear forecasting method is the best option because it has a low error rate. That is, the error value of MAD is 2.4, THE MSE error is 6.6, the MAPE error is 5.9% and the error standard is 9.3. From the management of data on selected methods, the method of forecasting linear sales trends against tart products predicts that for the next week, Kuwenak shop can produce 40.6 or 41 products. This means that Kuwenak Shop can provide 41 tarts the following week or even each week.

CONCLUTION

To run a good product business, a manager or businessman can use sales forecasts for his products. There are many methods that can be used, including the Moving Average, Exponential Smoothing, and Linear Trend methods. Based on the results of data processing and analysis of Kuwenak Shop products that has been done. So we can conclude that the linear trend method is the best choice method for Kuwenak shop, because this method has the lowest error rate of various forecasting methods. Based on the output produced in the linear trend method, it is estimated that Kuwenak shop can sell 40.6 or 41 tarts in the eighth week or 41 tarts/week. It is expected that Kuwenak shop will continue to forecast sales so as not to experience an excess or lack of products that become consumer demand every week.

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