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by Indah Yayuk

MOVING AVERAGE COMPARISON AND PROJECTION TREND AS A PRODUCTION PLANNING MEASUREMENT AT UD. MAYONG SARI PROBOLINGGO

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ABSTRACT
The research was conducted on the company UD. Mayong Sari Probolinggo with the aim of knowing the comparison of forecasting calculations using a moving average and trend projection as a measuring tool in production planning. This type of research is descriptive quantitative. Quantitative descriptive is a report that is an explanation and reference to describe what is stated in the research. The results showed that the value of MAD(*Mean Absolute Deviation*)*trend projection* amounting to 6,390,887and MSE (*Mean Square Error*)*trend projection* amounting to 274,523,957while MAD *moving average* amounting to 76,222.91, and MSE *moving average* amounting to 273,838,079.3, so companies better use *moving average* because when viewed from the comparison of MAD *(Mean Absolute Deviation)* and MSE, the value of MAD and MSE trend projection has a smaller error rate than MAD and MSE trend projection. So it can be concluded that the moving average method should be used in planning bread production at UD. MAYONG SARI PROBOLINGGO.

Keywords : Production planning, forecasting, moving average, and trend projection

PRELIMINARY
Background
Every company is required to meet the increasingly complex needs of consumers. To meet these demands, the producer, in this case the company must be able to increase work effectiveness and efficiency, otherwise the company will not be able to compete with other companies and even fall behind. Therefore all companies need capable leaders to be able to make the right decisions in facing an uncertain future, so that the company can achieve its success. One of the tools needed is the forecasting method.According to Heizer and Render (2017: 113) "Forecasting (forecasting) is an art and science in predicting events in the future".

Forecasting is important in planning and serves as an input (input) to many other business decisions. Such a decision will be better off using the right forecasting method. With the selection and use of the right forecasting method, the company's success in offering its products will be obtained in the form of profits that will be generated. This forecasting will also provide a comparison of the use of methods that have the smallest error value, so that companies can apply them in company management.

Forecasting is the initial stage of overall production planning. The uncertainty of consumer demand in the future causes this forecasting activity to be needed as input for the production planning process.According to Sofyan (2013: 73) "Production planning is an activity to get products according to the needs of both parties, namely companies and consumers".

Demand forecasting is also closely related to the amount of raw materials required. So that by predicting the demand for a product, the company can find out the amount of raw material needed. Production planning can be done if the level of demand is constant and the product production process is running normally, meaning there is no time limit for product completion. However companies often experience many obstacles in carrying out their operational activities,To overcome these obstacles, it is necessary to predict the possibility of a decrease or increase in sales in the coming period using accurate information so that the company can prepare strategies that must be taken to face certain conditions. For this reason, it is necessary to design a decision-making strategy in production planning so as to create optimal production capacity. The strategy deals with the amount of capacity required, timing of changes, the need to maintain balance across the system, and the degree of flexibility of facilities and workforce. Also considerations regarding demand expectations and production costs.There is business competition and there is also a very large amount of stock accumulation because the product is not sold out on the market, so it makes the company lose money due to the remaining products that are fit for sale or not. For this reason, a forecasting system is made using the moving average and trend projection methods which produce a forecasting system to determine the next month's production target. The forecasting results of the two methods are compared with the aim of knowing the accuracy of the production planning forecasting results. The parameters used for comparison are MAD and MSE of each method.The absolute mean percentage error (MAD) is the average of the absolute difference between the forecast and the actual value, expressed as a percentage of the actual value.*Mean Squared Error* (MSE) an estimator is the expected value of the error.

LITERATURE REVIEW
Forecasting
Definition of Forecasting

The initial part of a decision-making process is to forecast, both demand forecasting or production forecasting, where before forecasting the problems that occur must be known in order to obtain optimal decisions according to needs. According to Heizer and Render (2017: 113) "Forecasting (forecasting) is an art and science in predicting events in the future".

One of the most misunderstood aspects of forecasting is uncertainty. Generally, company managers believe that the more resources and time they put into forecasting, the lower the degree of uncertainty they get. But in most situations, simply spending more time and energy on forecasting will have the opposite result. The process of forecasting the future itself opens up new possibilities and this often means more uncertainties that have to be considered.

So it can be concluded that forecasting is the first step in making decision-making and planning steps. With this forecasting, data for the present or future will be obtained through testing data in the past.

Forecasting Purpose

The main purpose of forecasting is to make decision makers and policy makers understand the uncertainties in the future, so that uncertainties and risks that may arise can be considered when making planning or future-oriented decisions. By doing forecasting, planners and decision makers will be able to consider broader alternative strategies than without forecasting. Thus, various strategic and action plans can be developed to deal with various possibilities that may occur 6 the future.

According to Sofyan (2013: 14) "The main purpose of forecasting is to predict future demand, so that an estimate is obtained that is close to the actual situation".

When viewed from the time horizon, the forecasting objectives can be classified into 3 (three) groups, namely:

1. Short-term forecasting: This forecast has a time span of up to 1 year, but generally less than 3 months. Used for purchase planning, job scheduling, labor force level, job assignment, 5 d production level.
2. Medium-term forecasting: Medium range, forecasting generally ranges from 3 months to 3 years. Useful in sales planning, production planning, budgeting, cash budgeting, and analysis of operational plan variations.
3. Long-range forecasting: Generally 3 years or more in the span of time, long-term forecasting is used in planning for new products, capital expenditures, location of facilities or expansion, and research and development.

The use of forecasting is generally to determine or plan the number of results to be produced so as to estimate or forecast the total long-term demand and short-term demand estimates for each product.

Forecasting Methods

In the forecasting system, the use of forecasting methods greatly affects the forecasting results obtained. The distribution of forecasting methods can be divided into several aspects depending on the point of view (Sofyan, 2013: 17)

1. When viewed from the nature of its users, forecasting can be divided into two types, namely:
   a) Subjective forecasting, namely forecasting based on the user's intuition or feelings. The point of view, nature and characteristics of forecasting users greatly influence whether or not the forecasting results are obtained.
   b) Objective forecasting, namely forecasting based on past data that can be collected. The use of this method is carried out by using certain calculation techniques followed by analysis of forecasting results
2. When viewed based on the nature of the forecasts compiled, in general, there are two types of forecasting methods, namely:
   a) Qualitative Forecasting, which is a forecasting method which does not use mathematical calculations, this qualitative forecasting method is based on considerations of common sense and experience which are generally subjective, influenced by one's intuition, emotions, education, and experiences.
   b) Quantitative Forecasting, which is a method of forecasting using mathematical calculations. Quantitative forecasting can only be used if there is past information and this information can be quantified in the form of data where the data can be assumed as a pattern that will continue in the future.

Meanwhile, according to Render and Heizer in Wibowo (2010: 21), there are two types of approaches in forecasting:

a. Quantitative Methods
   11
   This method uses various mathematical models that use historical data and / or causal variables to forecast demand.
   Time Series Model:
   a) Single Moving Averages Method.
   b) Exponential Smoothing Method.
   c) Weighted Moving Averages Method.
b. Clause model
   1) Trend Projection

2) Linear Regression Analysis
c. Qualitative Techniques
That is forecasting that combines important factors such as decision-making intuition, personal experience, emotions, and value systems (Render and Heizer in Wibowo, 2010: 23). Qualitative forecasting techniques that can be used are as follows:
1) Decision from the Executive Jury Opinion (Jury of executive opinion).
2) Delphi method (delphi method)
3) Combination of Sales Techniques (seles force composite)
4) Consumer Market Survey

Factors Affecting the Forecasting Method
The results of forecasting calculations are expected to be able to minimize the deviations obtained from the actual reality. To get this, it is necessary for users to pay attention to the procedure for selecting an appropriate forecasting method, this method can be obtained by knowing the factors that influence the selection of the forecasting method. (Sofyan, 2013: 15).
The factors that affect the forecasting method include:
1. Time horizon
2. Level of accuracy
3. Data availability
4. Data pattern form
5. Cost
6. Types of models
7. Its use and application

Forecasting the Moving Average (Moving average)
According to Heizer and Render (2017: 120) "The moving average (moving average) is a forecasting method that uses the average of the current period against the data to predict the next period".
Forecasting the moving average (moving average) uses a number of actual historical data values to produce a forecast. Moving averages are useful if we can assume that market demand will remain fairly robust over the years. The 4-month moving average is found by adding up the demand for the past 4 months and dividing by 4. With each past month, the most recent month's data is added to the data count for the previous 3 months, and the earliest month is derived. This tactic tends to smooth out distortion in a series of data.
Mathematically, a simple moving average (which serves as an estimate of demand for the next period) is reflected by the formula for the forecast function as follows: (Heizer and Render, 2017: 121)

$$\text{Pergerakan rata} - \text{rata} = \frac{\sum \text{Permintaan dalam periode n sebelumnya}}{n}$$

The main purpose of using moving averages is to eliminate or reduce randomness in a time series. This goal can be achieved by averaging several data values together, in a way that possible positive and negative errors can be excluded or eliminated.
To get the value of the previous moving average, the number of periods (n) is determined first. After determining the number of periods that will be used in the observation on each average, the average value can be calculated. The results of the moving average will then serve as a forecast for future periods. Moving averages do not use the previous data continuously, every time there is new data, the new data is used and no longer uses the longest observed value, because the use of the number of periods is always constant.
The selection of several correct values of n is the most important thing in this method. The smoother the change in the value of the moving average from period to period, the better, on the contrary, the smaller the value of n, the forecast will be more aggressive in anticipating the latest calculated data changes. If demand changes significantly from time to time, the forecast must be aggressive enough in anticipating these changes, so that a small value of n will be more suitable. On the contrary, if demand tends to be stable over a long period of time, then the large value of n is used.

Trend projection
According to Heizer and Render (2017: 134) "Trend projection is a time series forecasting method that matches a trend line for a sequence of historical data points and then projects the line into forecasting the future". The trend projection method is also called the least squares method. According to Handoko (2012: 272) "The least squares method is one of the most widely used methods to determine the data trend line equation because this method produces what is mathematically described as the line of best fit".
This technique matches the trend line with a series of historical data points and then projects the slope of the line into future forecasts or in the medium to long term. A line of least squares is described in terms of its own

interception or y-intercept (the height at which it crosses the y-axis) and its changeable expectation (slope). Calculating the y intercept and the slope, illustrates the following equation line: (Heizer and Render, 2017: 134)

Gambar 1: Grafik garis kecondongan

$y = a + bx$
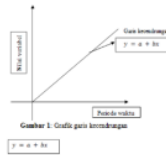
Where :
Y = the value of the variable that has been calculated and then predicted (referred to as the dependent or dependent variable)
a = the intersection of the axes y
b = the slope of the regression line (or the rate of change in for a given change in) $y x$
x = the independent (unbound) variable (where in this case time
Statisticians have developed equations for finding values and for regression lines. The slash is found by: (Heizer and Render, 2017: 135) $a b b$

$$ b = \frac{\sum xy - n\overline{xy}}{\sum x^2 - n\overline{x^2}} $$

Where:
 = the slope of the regression line b
 $\sum$ = number mark
 x = the value of the known independent variable
 y = the value of the known dependent variable
 n = number of data points or observations
The y-intercepts are as follows:

a

The advantage of the trend projection method compared to other methods lies in the use of the x parameter used, so there is no difference whether the data used is even or odd historical data, because the value in parameter x always starts with a value of 0 as the first sequence.

Measuring Forecasting Errors
According to Heizer and Render (2017: 126) "The absolute mean deviation(mean absolute deviation-MAD) is a measure of the overall forecast error for the model. " This value is calculated by taking the sum of the absolute values of individual forecast errors (deviation) and dividing by the number of data periods (n):

$$ MAD = \frac{\sum |aktual - peramalan|}{n} $$

According to Nasution in Wibowo (2010: 27), one way of evaluating forecasting techniques is to use a measure of the level of difference between forecasting results and actual demand. There are four sizes commonly used, namely:
a. Mean Absolute Deviation (MAD)
   MAD is the average absolute error over a certain period regardless of whether the forecast results are greater or smaller than the reality.
b. Mean Square Error (MSE)
   MSE is an alternative method in a forecasting method. This approach is important because this technique generates moderate errors, preferably by a forecast that produces very large errors. MSE is calculated by summing the squares of all forecast errors in each period and dividing by the number of forecast periods.
c. Average Forecast Error (Mean Forecast Error = MFE)
   MFE is very effective in knowing whether a forecasting result during a certain period is too high or too low. If the forecast results are not biased, the MFE value will be close to zero. MFE is calculated by adding up all forecast errors during the forecast period and dividing by the number of forecast periods.

Production Planning
Definition of Production Planning
Planning is a management function that plays a very important role in determining the achievement of management objectives. The completeness and accuracy of planning is strongly influenced by the scope, technology or planning tools, and the time a plan takes effect to achieve management goals and objectives to be achieved. Thus, planning is a series of future decision processes to solve management problems in achieving predetermined goals and objectives (Soeparno, 2009: 69)

According to Sofyan (2013: 73) "Production planning is an activity to get a product according to the needs of 2 (two) parties, namely companies and consumers." Meanwhile, according to Sinulingga (2009: 26) "Production planning is an activity related to determining what is must be produced, how much is produced, when it is produced, and what resources are needed to get the product that has been determined. "There are three main objectives as well as a barometer of the success of production planning, namely:

1. The achievement of customer satisfaction as measured by the fulfillment of orders for products on time, on quantity, and on quality.
2. The maximum utility level of production resources is achieved by minimizing setup time, transportation, waiting time, and time for rework.
3. Avoidance of procurement methods that are rush order and excess inventory.

Production planning can be interpreted as a statement of the overall production plan which contains an agreement between top management and the manufacturing section which is arranged based on the demand and needs of resources in the company. Production planning can be done if the level of demand is constant and the product production process is running normally, meaning there is no time limit for product completion. Production planning in general is to provide the desired number of products at the right time and at the minimum cost with the quality that meets the requirements. Planning can be concluded as an attempt to determine actions and decisions regarding activities in the future.

Production planning objectives
Planning is the first step in the management process which includes setting goals and objectives to be achieved and decisions about how to achieve these goals and objectives. For this reason, production planning has several objectives (Sofyan, 2013: 74), namely:

a. To prepare a production plan starting from the aggregate level of all activities in industrial companies to include market forecasts and sales projections.
b. To plan production and pegadaan resources required in the production system.
c. To cope with fluctuations in demand for products.

In addition, the purpose of production planning is to plan the production and procurement of components needed from outside, to schedule the completion of each product, to schedule the operation of each order at the relevant workstation, and to convey the schedule for completing each order to the customer. In this case, these objectives can be carried out perfectly if the main objectives of production planning are successfully carried out, and one of the main objectives of the production planning is the achievement of customer satisfaction which can be measured by fulfilling each product request in a timely manner according to the number and time of ordering and achieving the level of utility maximum production resources by minimizing the time of each production activity and avoiding over-inventory in the company,

15 SEARCH METHODS
Types of research
This type of research used in this research is descriptive quantitative. Quantitative descriptive is a report that is an explanation and reference to describe what is stated in the research. According to Sugiyono (2017: 147) "Descriptive research is research that is used to analyze data by describing or describing the collected data as it is without intending to make generalized conclusions or generalizations."

Population and Sample
Population
According to Sunyoto (2013: 146) "Population is the number of all object units or individuals whose characteristics are to be suspected in research". Meanwhile, according to Nawawi in Soewadji (2012: 129) "Population is the whole object of research which can consist of humans, objects, animals, plants, symptoms, test scores or events as data sources that have certain characteristics in a study. ". The population in this study were all production data at UD. MAYONG SARI PROBOLINGGO from 2017 to June 2019.
Sample
According to Sugiyono (2017: 81) "The sample is part of the number and characteristics of the population". In this study, the sample used was production data for the period January 2017 to June 2019.

Data Sources and Data Collection Methods
Data source
8 Secondary Data
Secondary data is generally in the form of evidence, records or historical reports that have been compiled in archives (documentary data) which are published and which are not published. The secondary data source in this report is UD production data. MAYONG SARI PROBOLINGGO from 2017 to June 2018.

Method of collecting data
As for the methods for obtaining data in this research report, data collection techniques are used as follows:
Documentation
According to Riduawan in Sunyoto (2013: 147), "Documentation is a method of collecting data by taking notes and other documents regarding secondary data that are related to this research." The documentation needed in this study is in the form of production data at UD. MAYONG SARI PROBOLINGGO.

Data analysis method
The method of data analysis is carried out by performing calculations that are relevant to the problem under study, and the calculations made by the author are as follows:
a. Moving average (moving average)
Mathematically, a simple moving average (which serves as an estimate of demand for the next period) is reflected by the formula for the forecast function as follows: (Heizer and Render, 2017: 121).

$$\text{Pergerakan rata} - \text{rata} = \frac{\sum \text{Permintaan dalam periode n sebelumnya}}{n}$$

b. Trend projection
   a. Calculate the y-intercept and slope

      Calculating the y intercept and the slope, illustrates the following equation line: (Heizer and Render, 2017: 134)

$$y = a + bx$$

   b. Finds the value and for the regression line ab

      Finds the value and for the regression line. The slash is found by: (Heizer and Render, 2017: 135)abb

$$a = \bar{y} - b\bar{x} \qquad b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

RESEARCH RESULTS AND DISCUSSION
Data analysis
The data used is historical data from bread production for 3 years, namely 2017 to 2019 which will be used as a reference in predicting bread production in 2020 at UD. MAYONG SARI PROBOLINGGO, to obtain optimal results can be done by using several suitable forecasting methods based on existing historical data. The following is a collection of historical data on bread production for 3 years from 2017 to 2019 at UD. MAYONG SARI PROBOLINGGO

Tabel 1
Data Produksi (Kuantitas) Roti Manis
Periode 2017-2019

No	Triwulan		Jumlah Produksi (Unit)
1	2017	I	42.450
		II	42.690
		III	43.252
		IV	44.955
		Total	173.347
2	2018	I	44.794
		II	44.755
		III	45.095
		IV	45.470
		Total	180.114
3	2019	I	45.000
		II	44.810
		III	45.255
		IV	45.774
		Total	180.839
Jumlah Produksi 3 tahun			887.761

Sumber: Data sekunder UD. Mayong Sari Kabupaten Probolinggo.

Moving Average (moving average)
The number of periods to be used in this study can be seen from the number of periods (n) and the average value is calculated. The results of the moving average values will then become the forecast for future periods. The smaller the value of n, the more aggressive the forecast will be in anticipating changes in the latest calculated data.
a. Calculation *Moving Average*
   In calculating the moving average, researchers use a 3-quarter moving average. The moving average calculation is as follows:

No	Triwulan		Jumlah Produksi	MA 3 triwulan
1	2017	I	42.450	-
		II	42.690	42.797,33
		III	43.252	43.632,33
		IV	44.955	44.333,67
2	2018	I	44.794	44.834,67
		II	44.755	44.881,33
		III	45.095	45.106,67
		IV	45.470	45.188,33
3	2019	I	45.000	45.095,33
		II	44.810	45.021,67
		III	45.255	45.279,67
		IV	45.774	45.559,67
4	2020	I	45.050	45.323,67
		II	45.147	45.276,78
		III	-	45.320,04
		IV		45.306,83

Sumber: Data yang diolah, 2020

Based on table 2 above, it can be seen that the actual data used is actual data from 2017 to 2019.By using the moving average method, it can be seen that the production forecast in 2020, the first quarter of 45,323.67, the second quarter was 45,276.78, the third quarter was 45,320.04, and the fourth quarter was 45,306.83.

b. Forecasting Error Rate Calculation

To find out how much the level of forecasting is used, the following calculations are carried out:

No	Triwulan		Aktual (A)	Ramalan MA 3 triwulan (F)	Deviasi (A - F)	Deviasi Absolut [A - F]	Kuadrat Kesalahan (A - F)²
1	2017	II	42.690	42.797,33	-107,33	107,33	11.520,44
		III	43.252	43.632,33	-380,33	380,33	144.653,44
		IV	44.955	44.333,67	621,33	621,33	386.053,11
2	2018	I	44.794	44.834,67	-40,67	40,67	1.653,78
		II	44.755	44.881,33	-126,33	126,33	15.960,11
		III	45.095	45.106,67	-11,67	11,67	136,11
		IV	45.470	45.188,33	281,67	281,67	79.336,11
3	2019	I	45.000	45.095,33	-95,33	95,33	9.088,78
		II	44.810	45.021,67	-211,67	211,67	44.802,78
		III	45.255	45.279,67	-24,67	24,67	608,44
		IV	45.774	45.559,67	414,33	414,33	171.672,11
4	2020	I	45.050	45.323,67	-273,67	273,67	74.895,44
		II	45.147	45.276,78	-129,78	129,78	16.842,27
		III	-	45.320,04	-45.320,04	45.320,04	2.053.905.757,84
		IV		45.306,83	-45.306,83	45.306,83	2.052.708.587,21
	Total		582.047	672.705,98	-90.708,98	93.343,64	4.107.571.189,66

Sumber: Data yang diolah, 2020

a. Calculation of MAD (*Mean Absolute Deviation*)

$$MAD = \sum \left| \frac{A - F}{n} \right|$$
$$MAD = \frac{93.343,64}{15}$$
$$MAD = 6.222,91$$

So that the MAD value with the moving average method is 6,222.91.

b. MSE calculation (*Mean Absolute Error*)

$$MSE = \sum \frac{(A - F)^2}{n}$$
$$MSE = \frac{4.107.571.189,66}{15}$$
$$MSE = 273.838.079,3$$

So that the MSE value using the moving average method is 273,838,079.3.

Trend projection

The use of the x parameter used in the trend projection method starts with the value of 1 as the first order, so there is no difference whether the data used is even or odd in number.

No	Triwulan		Indeks Waktu (x)	Aktual (y)	x²	x.y
1	2017	I	1	42.450	1	42.450
		II	2	42.690	4	85.380
		III	3	43.252	9	129.756
		IV	4	44.955	16	179.820
2	2018	I	5	44.794	25	223.970
		II	6	44.755	36	268.530
		III	7	45.095	49	315.665
		IV	8	45.470	64	363.760
3	2019	I	9	45.000	81	405.000
		II	10	44.810	100	448.100
		III	11	45.255	121	497.805
		IV	12	45.774	144	549.288
	Total		78	534.300	650	3.509.524

Sumber: Data yang diolah, 2020

c. Find the And Value for the Regression Lineab

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$b = \frac{12(3.509.524) - (78)(534.300)}{12(650) - (78)^2}$$

$$b = \frac{438.888}{1.716}$$

$$b = 255{,}762$$

Then it can be seen that the value of b is 255,762 and the calculation of the value of a is as follows:

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{534.300(650) - (78)(3.509.524)}{12(650) - (78)^2}$$

$$a = \frac{73.552.128}{1.716}$$

$$a = 42.862{,}545$$

d. Calculating the y Intercept

For requests for the next period in 2018, the third quarter, namely:

$$y = a + bx$$
$$= 42.862{,}545 + 255{,}762(15)$$
$$y = 46.698{,}979$$

e. Forecasting Error Rate Calculation

Tabel 5

Perhitungan Kesalahan Peramalan

(tahun 2017 – 2020)

No	Triwulan		Aktual (A)	Peramalan (F)	Deviasi (A - F)	Deviasi Absolut |A - F|	Kuadrat Kesalahan (A - F)²
1	2017	I	42.450	43.118	-668	668	448.635
		II	42.890	43.374	-684	684	467.952
		III	43.252	43.630	-378	378	142.757
		IV	44.955	43.886	1.069	1.069	1.143.628
2	2018	I	44.794	44.141	653	653	425.943
		II	44.755	44.397	358	358	128.079
		III	45.095	44.653	442	442	195.469
		IV	45.470	44.909	561	561	315.121
3	2019	I	45.000	45.164	-164	164	27.029
		II	44.810	45.420	-610	610	372.305
		III	45.255	45.676	-421	421	177.182
		IV	45.774	45.932	-158	158	24.867
4	2020	I	45.050	46.187	-1.137	1.137	1.293.803
		II	45.147	46.443	-1.296	1.296	1.680.178
		III	-	46.699	-46.699	46.699	2.180.794.842
		IV	-	46.955	-46.955	46.955	2.204.747.727
	Total		624.497	673.630	-96.087	102.254	4.392.383.317

Sumber: Data yang diolah, 2020

Based on the table above 5, it can be seen that the actual data used are actual data from 2017 to 2019 plus limited actual data for 2020 from the first quarter to the second quarter.

By using the trend projection method, it can be seen that the forecasting of production in 2020 is the biggest quarter 46,187, the second quarter was 46,443, the third quarter was 46,699, and the fourth quarter was 46,955.

a. Calculation of MAD (*Mean Absolute Deviation*)

$$MAD = \sum \left| \frac{A - F}{n} \right|$$

$$MAD = \frac{102.254}{16}$$

$$MAD = 6.390{,}887$$

So that the value of MAD with the trend projection method is 6,390.887.

b. MSE calculation (*Mean Square Error*)

$$MSE = \sum \frac{(A - F)^2}{12}$$

$$MSE = \frac{4.392.383.317}{16}$$

$$MSE = 274.523.957$$

So that the MSE value with the trend projection method is 274,523,957.

DISCUSSION

a. Comparison of the Moving Average and Trend Projection Methods

The comparative calculation of the moving average and trend projection methods can be measured by the error rate of the two methods, while the calculation used is the calculation of the MAD value (*Mean Absolute Deviation*), and MSE (*Mean Square Error*) of each of the methods.

Tabel 6
Perbandingan Tingkat Peramalan

No	Moving Average		No	Trend Projection	
1	MAD	6.222,91	1	MAD	6.390,887
2	MSE	273.838.079,3	2	MSE	274.523.957

Sumber: Data yang diolah, 2020

b. Comparison of Forecasting Results with Actual Value

Tabel 7
Perbandingan Hasil Peramalan dengan Nilai Aktual

No	Triwulan	Peramalan (2020)	Aktual (2020)
1	I	45.323,67	45.050
2	II	45.276,78	45.147
3	III	45.320,04	-
4	IV	45.306,83	-

Sumber: Data yang diolah, 2020

From table 7 above, it can be seen that the comparison of the forecast results with the actual value (in 2020), however, the actual data available in 2020 is only limited from the first quarter to the second quarter, and the forecast results show that the forecasting results are not much different from actual data for 2020.

The difference between the actual data and the forecast data is only small. So it can be concluded that this forecasting can be used to forecast production in the next period

c. Analysis Results

The results of the above analysis indicate that the MAD value (*Mean Absolute Deviation*)*trend projection* amounting to 6,390,887 and MSE (*Mean Square Error*)*trend projection* amounting to 274,523,957 while MAD *moving average* amounting to 76,222.91, and MSE *moving average* amounting to 273,838,079.3, so companies better use *moving average* because when viewed from the comparison of MAD *(Mean Absolute Deviation)* and MSE , The MAD and MSE values of the trend projection method have a smaller error rate than the MAD and MSE methods of the moving average.

And if we look at the comparison of forecasting results with actual values in 2017 to 2020, it states that the forecasting results are not much different from the actual data in the previous year. The difference between the actual data and the forecast data is only small. So it can be concluded that this forecasting can be used to forecast production in the next period.

CLOSING
CONCLUSION
The results of the analysis show that the forcasting method with a moving average is suitable for use as a measuring tool for production planning because it has the smallest error rate compared to the trend projection forecasting method.

SUGGESTION
The suggestions that can be drawn based on the results of this study are as follows:
1. UD. Mayong Sari should review the bread production planning that has been done so far.
2. UD. Mayong Sari can use the forcasting method with a moving average because if it is seen from the calculation of the forecast error rate, the moving average method has the smallest forecast error value compared to the trend projection method.
3. It is expected that the company can continue to maintain consistency in controlling the inventory of its products so that the forecast is better managed.

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