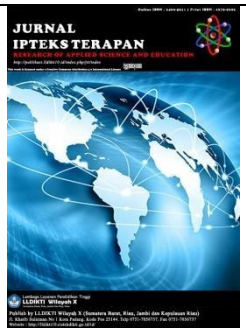

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APPLICATION OF SINGLE MOVING AVERAGE METHOD TO PREDICATE TEMPE SALES IN HOME INDUSTRY GEDANGAN VILLAGE

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Abstract

The purpose of following developments is in maintaining life, developing and obtaining results. Home industry for making tempeh is one of the businesses engaged in the sale of tempe products. Activities in the industry include the production of tempe sales and purchase transactions. The problem that occurs in the industry is to determine each production of the amount of tempeh sales which often have difficulty in determining how much to sell for the next period. This results in frequent shortages of stock or even a large amount of tempe sales stock remaining so that it cannot meet customer needs and buildup in warehouses for a long period of time. The purpose of this study was to predict the sale of tempe in the home industry of Gedangan Village to meet consumer needs. The method used in this study is the Single Moving Average (SMA) method, which is a forecasting method carried out by taking observations from the past, then looking for the average value as a forecast for the coming month. The results of this study are the application of the Single Moving Average method produces predictions of tempe sales in January 2022 as many as 9106.67 sold with an accuracy of 5% MAPE error and the system created can facilitate the prediction of tempe sales quickly and accurately. The conclusion obtained is that the Single Moving Average method can help forecast sales of tempe in the following month.

Keywords: Forecasting, Sales, Single Moving Average, Supply

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INTRODUCTION

In this era of globalization, the increasingly rapid development of technology in the corporate world, inevitably must be able to use current technology. The purpose of following developments is in maintaining life, developing and obtaining results. In achieving this goal, it is determined by several supporting factors both from outside and within the company. Likewise, from a company in handling data processing problems, it is also inseparable from the development of information technology.

A company engaged in sales services or product distribution, always wants success in its activities in the future. This shows that every company is always trying to keep growing in its business field in the future. Leaders who have the ability to be able to make the right decisions in the face of an uncertain future, so that the company can achieve its goals. One of the most important things to make this happen is estimating or forecasting (forecasting) the amount of sales of the goods or services produced.

Home industry for making tempe is one of the businesses engaged in the sales of tempe products, which is located at Jl. Gedangan Village, Kec. Gedangan, Kab. Asahan, North Sumatra. Every employee who works in this industry must follow what has been applied to the home industry. Where the industry provides tempe, and stores it in the warehouse. Activities in the industry include the production of tempe sales and purchase transactions.

The problem that occurs in the industry is to determine each production of the amount of tempe sales which often have difficulty in determining how much to sell for the next period. This results in frequent shortages of stock or even a large amount of tempe sales stock remaining so that it cannot meet customer needs and buildup in warehouses for a long period of time. Sales predictions made by the industry are only based on estimates, resulting in increased warehouse storage and maintenance costs. Likewise with less so that there is a bottleneck in sales, in which the industry will get a loss. To meet consumer needs, the industry has not found the right strategy in estimating the amount of tempe production demand in the future. Problems like this make activities in the industry less effective in selling tempe.

Based on this problem, sales forecasting is very necessary in business management in order to develop the business, both in the service and trade sectors, making it easier for the industry to determine the amount of tempeh sales stock that must be provided in order to meet customer needs and not cause a buildup of sales stock. tempeh in the long term and can be a consideration for industrial owners in procuring stock for the amount of tempeh sales in the future.

The single moving average method is a forecasting method that uses a number of new actual demand data to generate forecast values for future demand [1]. The SMA method is a forecasting method that is carried out on past data for a period that already has an average pattern [2].

Several previous studies, among others, research by Siti Wardah & Iskandar produced a forecasting system that can estimate or forecast (forecasting) the

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amount of sales or customer demand for goods or services produced [3]. Research by Solikin resulted in the application of the SMA method and computerized technology being more effective because it was easier to predict the purchase of stock in the next period [4]. Research by Ria Rizkiawati produces an information system that can facilitate the head of the procurement department in determining the amount of raw materials to be used and facilitate the head of the warehouse section in the distribution process by scheduling product delivery [5]. Research by Herlina, Yohansen, Fransiska Prihatini Sihotang got the results of the development and analysis of supply chain management information systems that can help companies plan a lot of production better and faster [6]. Research by Saefudin, Susandi and Nafis resulted in a forecasting system for block plot sales with using the Single Moving Average method can assist the company in determining the amount of production in the next period [7]. Research by Irawan, Sumijan and Yuhandri produced a total forecast for 2021 as much as 200,749 tons with a MAPE of 10% [8].

RESEARCH METHODS

This study uses research methods, namely quantitative methods that use various mathematical models and uses historical data in the form of sales data for making tempeh in the last 12 months to forecast sales of raw materials for production and the programming language used is PHP. The following are the stages of the research, namely

1. Problem Analysis

   Problem analysis is the stage of solving problems that are happening in the tempe-making industry in Gedangan village, namely there is still no system that can predict future sales of tempeh.

2. Data Collection

   Data collection is a technique or method used by researchers to collect the data needed to obtain the information needed to achieve the objectives of the study. Sales data in the home industry for making tempeh for the period January 2021 to December 2021 in table 1 below.

No	Month	Sales
1	Januari 2021	8970
2	Februari 2021	8580
3	Maret 2021	8675
4	April 2021	9360
5	Mei 2021	9750
6	Juni 2021	8892
7	Juli 2021	8543
8	Agustus 2021	8774
9	September 2021	8754
10	Oktober 2021	8672
11	November 2021	8792
12	Desember 2021	9856

Table 1. Sales Data

3. Data Analysis

   Data analysis is an activity to change research results into information that can be used to make decisions in a study. As for how to draw conclusions can be estimated results.

4. System Design

   System Design is an activity to design a web-based system including the design of user interface data and process activities. by using a design tool that is Unified Modeling Language (UML).

5. System Development

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The development of a web-based system is carried out by the author by using the Hypertext Preprocessor (PHP) and MySQL programming languages.

6. System Trial

   System Testing is a process to assess whether what is designed is in accordance with what is expected, or is an activity to evaluate the advantages and disadvantages of a system.

7. System Implementation

   System Implementation is a procedure carried out to complete the design that is in the approved system design document.

Single Moving Average

Single Moving Average is a forecasting method that is carried out by taking a group of observed values, looking for the average value as a forecast for the future period. The special characteristics of this method are:

a. To get or determine a forecast for the future period requires historical data for a certain period of time, for example with a 3 month single moving average, the 5 month forecast can only be made after the 4th month is completed or ends.
b. The longer the timeframe of the single moving average, the more visible the smoothing effect is in the forecast or resulting in a smoother single moving average.

The single moving average mathematical equation can be seen in the following equation [9]:

$$F_{t+1} = \frac{X_1 + X_2 + \ldots\ldots X_t}{n} \qquad (1)$$

Where :

Ft+1 = Forecasting for period t+1

Xt = Real value in period t

n = Number of limits in moving average

Forecasting Error Measurement

Accuracy or accuracy is a criterion for testing the performance of a forecasting method. To test the forecasting performance that will be used, a measure of forecasting error is needed. The best forecasting method is the method that gives the least error rate compared to other methods. There are many models for calculating forecasting errors [10].

Mean Absolute Deviation (MAD) is one way to determine the error value in forecasting. MAD is the average absolute value of the forecast error, regardless of the positive and negative signs. This MAD can be seen in equation.

$$MAD = \frac{\sum_{t=1}^{n} |Yt - Ft|}{n} \qquad (2)$$

Information:
MAD = Mean Absolute Deviation Value
Yt = Actual data in period t
Ft = Forecasting value in period t
n = Number of periods

Mean Squared Error (MSE) is the average of forecasting errors squared.

$$MSE = \frac{\sum_{t=1}^{n} |Yt - Ft|^2}{n} \qquad (3)$$

Information:
MSE = Mean Squared Error Value
Yt = Actual value in period t
Ft = Forecasting value in period t

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n = Number of periods

MAPE is a measure of relative error. MAPE is usually more meaningful than MAD because MAPE expresses the percentage of error forecasting results against actual demand during a certain period which will provide information on the percentage of error is too high or too low.

$$MAPE = \frac{1}{n} \sum_{t=1}^{n} \frac{|Yt - Ft|}{|Yt|} (100) \quad (4)$$

Information:

MAPE = Value Mean Absolute Precentage Error
Yt = Actual data in period t
Ft = Forecasting value in period t
n = Number of periods [10]

RESULTS AND DISCUSSION

Tempe Sales Forecast

The following are the results of forecasting tempeh sales using the single moving average method by calculating the past 3 periods resulting in the forecasting in table 2 below.

No.	Periode	Yt	Ft	e	| e |	e^2	| e |/Yt
1	Jan-21	8970	-				
2	Feb-21	8580	-				
3	Mar-21	8675	-				
4	Apr-21	9360	8741,667	-618,333	618,3333	382336,1	7%
5	May-21	9750	8871,667	-878,333	878,3333	771469,4	9%
6	Jun-21	8892	9261,667	369,6667	369,6667	136653,4	4%
7	Jul-21	8543	9334	791	791	625681	9%
8	Aug-21	8774	9061,667	287,6667	287,6667	82752,11	3%
9	Sep-21	8754	8736,333	-17,6667	17,66667	312,1111	0%
10	Oct-21	8672	8690,333	18,33333	18,33333	336,1111	0%
11	Nov-21	8792	8733,333	-58,6667	58,66667	3441,778	1%
12	Dec-21	9856	8739,3333	-1116,67	1116,667	1246944	11%
13	Jan-22	**Forecast**	9106,67	**Total**	4156,333	3249927	45%
		MAD			461,8148		
		MSE			361103		
		MAPE			5%		

Table 2. Tempe Sales Forecasting Results

In table 2 above, the forecasting results of tempe sales in January 2022 are 9105.67 packs with an accuracy of 5% MAPE error, meaning that the accuracy produced is very good and can be applied in January 2022.

Current Information System Flow

The flow of information systems is very useful to find out the problems that exist in a system. From here it can be seen whether the information system is still suitable for use or not, is still manual or computerized. If the information system is no longer feasible, it is necessary to make changes in data processing so as to produce fast and accurate information and better decisions [11]

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System Implementation

System implementation is a stage that is carried out after design. This stage is implementing the design into a programming language so that the application is created. First the user will login to the system. The following is the login display on this system as shown in Figure 2 below.

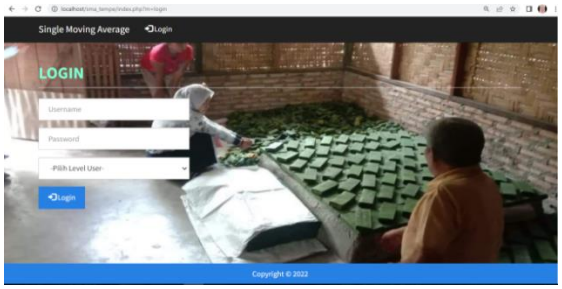

Figure 1. Login Display

After that, the user will input what type of data he wants to predict. In this study, the type of data is tempeh, the following is a picture of the following 3 types of display.

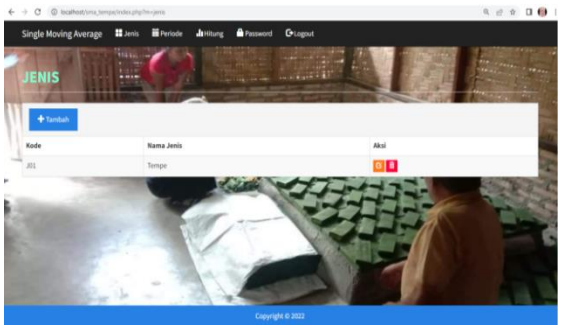

Figure 2. Display Type

After that the user will input the period and sales, which is based on table 1 of sales data. The following figure shows the following 3 sales periods.

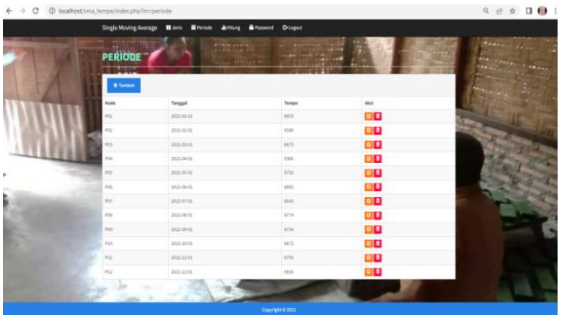

Figure 3. Display of Sales Period

After that, the user will calculate the tempe sales forecast using a single moving average. The following is an image of 5 displaying the following forecasting calculations.

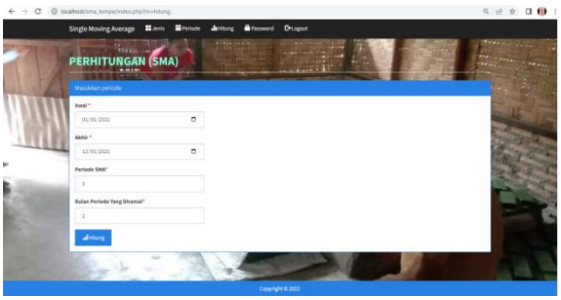

Figure 4. Forecasting calculation display

After that, the user will print the forecast results as shown in Figure 7. The print display of the following forecasting results.

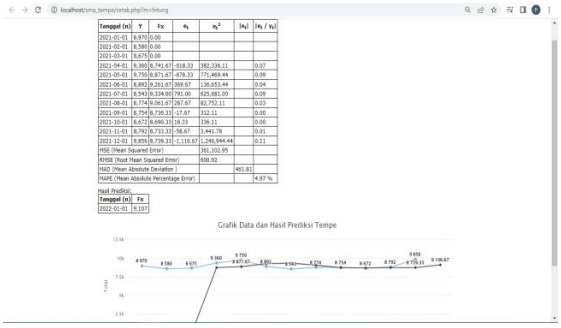

Figure 5. Forecasting Print View

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CONCLUSION

The results of the application of the Single Moving Average method produce predictions of tempe sales in January 2022 as many as 9106.67 packs with an accuracy of 5% MAPE error, it can be concluded that the prediction is very good and can be applied to forecasting tempe sales. The application of the Single Moving Average (SMA) method to predict tempe sales can speed up the process of calculating tempe sales forecasting for the factory owner.

The application created can help make it easier for owners to predict tempe sales in the next period quickly and accurately.

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