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DETERMINE THE MATERIAL INVENTORY FORECASTING METHOD BASED ON THE SMALLEST ERROR

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Abstract: The research was conducted at TB Bina Karya which is engaged in the sale and purchase of building materials. This research was conducted to predict building materials for the next period. The forecasting methods used in this study are single moving average (SMA), weighted moving average (WMA), and single exponential smoothing (SES). This study also discusses the error calculation of the forecasting method, the forecasting method which produces the smallest error value is used for making decisions in purchasing materials. The purpose of this research is to speed up the decision making for purchasing material inventory. Another goal is to produce more accurate forecasts by comparing 3 (three) methods.

Keywords: forecasting; single moving average; weighted moving average; and single exponential smoothing

Abstrak: Penelitian dilakukan pada TB Bina Karya yang bergerak dibidang penjualan dan pembelian bahan material bangunan. Penelitian ini dilakukan untuk forecasting bahan material bangunan periode selanjutnya. Metode forecasting yang digunakan dalam penelitian ini yaitu single moving average (SMA), weighted moving average (WMA), dan single exponential smooting (SES). Penelitian ini juga membahasan perhitungan error dari metode forecasting, metode forecasting yang menghasilkan nilai error terkecil digunakan untuk pengambilan keputusan dalam pembelian bahan material. Tujuan dari penelitian ini untuk mempercepat dalam pengambilan keputusan pembelian persediaan bahan material. Tujuan lainnya adalah agar menghasilkan forecasting lebih akurat dengan membandingkan 3 (tiga) metode.

Kata kunci: forecasting; rata-rata pergerakan tunggal; rata-rata pergerakan tertimbang; dan pemulusan eksponensial tunggal

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INTRODUCTION

This research was conducted at the Building Store (TB) Bina Karya which is engaged in the business of selling and purchasing materials. Materials sold at TB Bina Karya include bricks, cement, sand, iron, nails, ceramics and others. Activities that occur at TB Bina Karya are buying material inventory and selling material goods. TB Bina Karya is currently purchasing material goods inventories by estimation (manually) not using methods and applications that can facilitate calculations and determine estimates of material goods inventories for the next period. The consequences that arise from how to determine the current inventory of material goods are difficulties in making decisions about how much material inventory to buy, there are some material goods that are overstocked, and there are also supplies of material goods that run out when there are customers who are looking for and need these material goods. The current method makes activities at TB Bina Karya less effective in the process of buying inventory and selling material goods.

The solution to overcome the problems faced by TB Bina Karya, researchers have developed a way to determine estimates for purchasing materials, by applying forecasting methods that are implemented in the applications built. Forecasting is a process for estimating how much demand will be in the future which includes needs in terms of quantity, quality, time and location required in order to meet demand for goods or services [1]. The methods used in forecasting are the single moving average (SMA) method, the weighted moving average (WMA) method, and the single exponential smoothing (SES) method. The single moving average (SMA) method is a forecasting method that is carried out by taking a group of observation values, looking for the average value as a forecast for the coming period [2]. The weighted moving average (WMA) method is the method used for the prediction process, in the WMA calculation formulation using the weighting of each data, greater weight is given to the last data compared to the previous data [3]. The single exponential smoothing (SES) method is a method that provides a moving average exponential weighting of all previous observation values [4]. The forecasting methods used in this study will be compared, out of these 3 (three) methods they will produce 1 (one) method that will be used for making decisions in purchasing material goods inventories for the next period. How to determine which method to use in forecasting by calculating the error or difference in each method, the method that produces the smallest error to be used in forecasting. The purpose of this research is to determine a suitable method for forecasting the purchase of material goods inventory, to simplify, and speed up decision making for forecasting the purchase of material goods inventory for the next period.

This study uses previous research as a reference, research that is used as a reference, among others, according to [5] and according to [6]. The reason why these two studies are used as references is because the two studies contain the same forecasting materials as ongoing research. The first difference is with ongoing research, which is related to the research object, the research object that is currently running at TB Bina Karya is related to materials, while the research that is used as a reference object is at Inti Jaya Block related to baving block materials. The second difference relates to the forecasting method, in the ongoing re-

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search the forecasting methods used are three methods, namely single moving average (SMA), weighted moving average (WMA), and single exponential smoothing (SES), while research [5] only uses the single moving average (SMA) method and research [6] only use the weighted moving average (WMA) method. Other studies that are used as references are according to [7] and according to [8], the two studies are still the same, namely discussing forecasting. The difference from the first study relates to the object of research [7], namely the Denpasar branch of the retail company PT Gieb Indonesia relating to sales of goods, research [8], namely AMIK Royal Kisaran relating to student admissions. The second difference relates to forecasting methods, research [7] and research [8] using the single exponential smoothing (SES) method, while ongoing research uses three methods, namely single moving average (SMA), weighted moving average (WMA), and single exponential smoothing (SES). Based on previous studies, the researcher made developments in the forecasting process by comparing several methods to produce forecasts so that the results obtained were maximized.

METHOD

Single Moving Average (SMA) Method

Single Moving Average (SMA) is one of the time series forecasting methods (time series), single moving average mathematical equation [9]:

$$F_1 = \frac{A_t + A_{t-1} + ... + A_{t-n+1}}{N} \quad (1)$$

Information:
A_t = observation data period t
N = Number of time series used
F_{t+1} = forecasting value for period t+1
N = Period used

Weighted Moving Average (WMA) Method

The weighted moving average (WMA) method or the weighted moving average method, which first determines the data management weight (weighted factor) of the existing data, formulates the weighted moving average method [10]:

$$F_1 = \sum_{i=1}^{n} W_i A_i \quad (2)$$

$$F_1 = W_1 A_{t-1} + W_2 A_{t-2} + ... + W_n A_{t-n} \quad (3)$$

Information:
W_i = weight (probability) of the 1st activity in the future
A_{t-1} = volume of requests in the past
A_{t-2}' A_{t-3}' A_{t-3}' = demand volume two, three or n periods ago
F_t = forecast of demand volume at the t-th time to come

Single Exponential Smoothing Method

Exponential Smoothing Smoothing is a moving average forecasting method with sophisticated weighting, but still easy to use. This method records very little past data. The equation for the single exponential smoothing method can be written in formula [11]:

$$F_{t+1} = \alpha X_t + (1-\alpha) F_{t-1} \quad (4)$$

Information:
Ft+1 = Forecast for period t+1
Xt = real value of t period
α = Weight indicating smoothing constant ($0 < \alpha < 1$)
Ft-1 = Forecast for period t-1

Application Development Methods

The application development method used in this study is the waterfall

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method [12], the stages of the waterfall method can be seen in image 1.

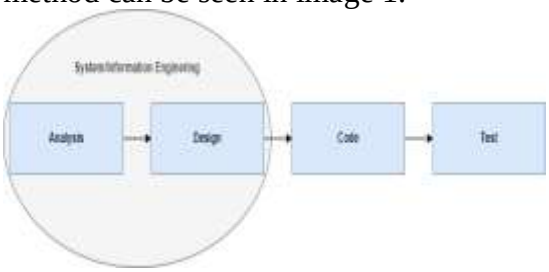

Image 1. Waterfall method

a. Analysis,
   At this stage the researcher collects data related to the needs of the application to be built and the existing system problems. Data collection is done through interviews, then the data can be analyzed so as to produce the required data.
b. Design,
   At this stage the researcher designs the application using a flowchart diagram, the flowchart explains the flow of the application.
c. Code,
   At this stage the researcher developed it into the application, based on the design that was made.
d. Test,
   At this stage, the researcher conducted the test, the test was carried out using the blackbox method.

Method of Collecting Data

Data collection was carried out using the discourse method which was carried out to the owners and employees of TB Bina Karya, the essence of the interviews related to the types of materials sold, the sale of materials, and the supply of materials.

RESULT AND DISCUSSION

Analysis

Analysis is the first stage of application development, at the analysis stage the researcher analyzes problems related to the purchase of material supplies faced by TB Bina Karya. TB Bina Karya is currently purchasing material goods inventories by estimation (manually) not using methods and applications that can facilitate calculations and determine estimates of material goods inventories for the next period. The consequences that arise from how to determine the current inventory of material goods are difficulties in making decisions about how much material inventory to buy, there are some material goods that are overstocked, and there are also supplies of material goods that run out when there are customers who are looking for and need these material goods. . The next analysis is the analysis of the integrity of the system, from the results of the problem analysis, the researcher gets the idea to build an application with the forecasting method so that the process of purchasing material inventory can be controlled and fast in making decisions to purchase material inventory for the next period.

Application View

At this stage the researcher develops the design into an application, according to the design made. The first display that is generated is the login display which can be seen in image 3. In the login display, the admin must enter a valid username and password so that he can successfully access the forecasting application page. Login access is only chosen by the admin from the TB Bina Karya forecasting application.

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Image 3. The TB Bina Karya forecasting application login display

After a successful login, the admin will enter the forecasting application page which contains a sales data collection form menu, sales data, and the forecasting process. The sales data collection form page functions to input the total sales data generated at the end of each period (month). The data that is inputted into the sales data collection form is the name of the material, the date of data input relating to the sales reporting period, and the total amount of material sales in that period. The sales data that is input will later be used to calculate the forecasting value for the next period. A picture of the TB Bina Karya sales data collection form can be seen in image 4.

Data that has been inputted can be displayed on the sales data page. The sales data page displays the name of the material, the date of the reporting period for each period, and the total number of sales of the material for each period. Image sales data can be seen in image 5.

Not only can the data that has been input be displayed, it is also used for the forecasting process. ¬Forecasting results are obtained from previous sales data calculations which are completed using a formula according to the forecasting method used. The forecasting method used in this application is the single moving average (SMA), weighted moving average (WMA), and single exponential smoothing average (SES) method. The forecasting display can be seen in image 6.

Image 4. Display of TB Bina Karya's sales data collection form

Image 5. Display of TB Bina Karya sales data

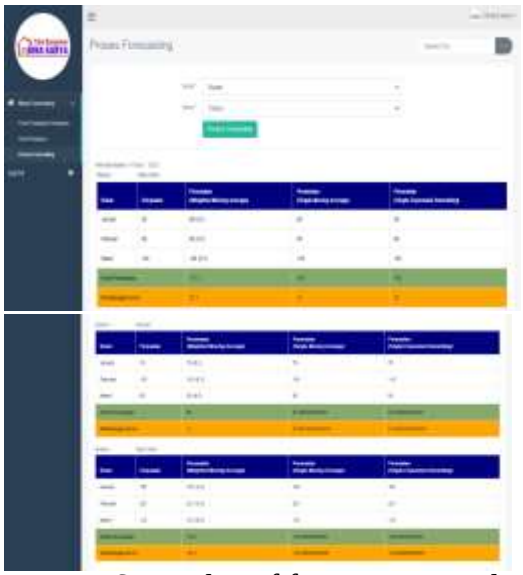

Image 6. Display of forecasting results

Test

At this stage the researcher tested the application using the blackbox method. The blockbox method [13], provides an overview of the input conditions and work on the process in the functional description of the program.

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Table 1. Application testing uses the blackbox method

No	Test scenario	Test result	Conclusion
1	On the login page, the admin successfully logs in when correctly entering the username and password and cannot enter the forecasting page when entering one of the wrong username or password fields.	Login is used successfully according to its function, the admin can login when the access is correct and fails when the access is wrong.	In accordance
2	On the sales data collection form page, the admin managed to input sales data according to the number of textboxes displayed	Sales data collection form page, according to the function, the admin can input data according to the type of field in the textbox.	In accordance
3	In the sales data, the admin managed to display the sales data that has been inputted. The data displayed is the name of the material, the date of the reporting period, and the total amount of sales,	Sales data page according to its function, the admin can display sales data.	In accordance
4	On the forecasting process page, the admin has succeeded in forecasting using 3 (three) methods, namely the single moving average (SMA) method, the weighted moving average (WMA) method, and the single exponential smoothing (SES) method, and generates an error value to determine the forecasting method used in decision making.	The forecasting process page is in accordance with its function, the admin can display forecasting results and error values.	In accordance

CONCLUSION

The conclusion of this research is to produce forecasting applications using the single moving average (SMA), weighted moving average (WMA), and single exponential smoothing (SES) methods. This study also produces an error value for each forecasting calculation. The forecasting method that produces the smallest error value is used for making decisions in purchasing material inventory for the next period. The application built accelerates TB Bina Karya in making decisions to determine material supplies for the next period. Suggestions for

future researchers to be able to add more forecasting methods for comparison, and can develop towards Android-based ap-plicationsf.

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