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# DEVELOPMENT OF A SYSTEM FOR FORECASTING THE AMOUNT OF DODOL SALES USING THE WEIGHTED MOVING AVERAGE METHOD

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**Abstract*:*** Dodol is a type of sweet food made from palm sugar that is processed with various flavors and takes a long time to complete. Dodol is also a type of food in great demand by the public due to its elasticity and characteristic taste. The manufacture and sale of this lunkhead are produced by UD. Maya Sari is located in the Kisaran area, especially in the Tanjung Alam Village, Dusun 3, Asahan Regency. Forecasting (forecasting) is thinking about a quantity, for example. The number of product requests for the future. Difficulties in forecasting inventory are often experienced by businesses, including UD. Maya Sari is difficult to predict the supply of lunkhead for the future. The research conducted by this author aims to build a system that can predict sales for the future in increasing a business's income. The system is well designed with PHP and UML for system workflow.

**Keywords:** Dodol sales; Forecasting System; Weighted Moving Average Method

**Abstrak:** Dodol merupakan salah satu jenis makanan manis berbahan dasar gula aren yang diolah dengan berbagai rasa dan membutuhkan waktu yang lama dalam pembuatannya. Dodol juga merupakan jenis makanan yang banyak diminati oleh masyarakat karena kekenyalan dan rasa yang khas. Pembuatan dan penjualan dodol ini diproduksi oleh UD. Maya Sari yang berada di kawasan Kisaran khususnya di Desa Tanjung Alam Dusun 3 Kabupaten Asahan. Peramalan (forecasting) adalah memikirkan kuantitas. Misalnya Jumlah permintaan produk untuk masa yang akan datang. Kesulitan dalam peramalan persediaan seringkali dialami oleh para pelaku usaha, termasuk UD. Maya Sari sulit memprediksi pasokan dodol untuk masa depan. Penelitian dilakukan. Hal ini bertujuan untuk membangun sebuah sistem yang dapat memprediksi penjualan dimasa yang akan datang guna meningkatkan pendapatan usaha. Sistem ini dirancang dengan baik dengan PHP dan UML untuk alur kerja sistem.

**Kata Kunci** : Metode Weighted Moving Average; Penjualan dodol; Sistem Peramalan

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## INTRODUCTION

The rapid advancement of technological development can be utilized in the business world to support the forecasting process in predicting the stock of goods needed by each company.

UD. Maya Sari is a business group engaged in the manufacture and sale of lunkhead in the Kisaran area, especially in the Tanjung Alam Village, Dusun 3, and Asahan Regency. In the operation of making and selling dodol, UD. Maya Sari is one of the business groups that is considered very successful in processing and making lunkhead. It can be seen from the number of enthusiasts and the number of lunkheads that are successfully sold every month and produce good profit _ a lot.

Dodol It has a sweet, savory, and legit taste which is processed using brown sugar, glutinous rice, and coconut. Dragon fruit and pineapple are used as ingredients base for making lunkhead.[1]

A continuous stirring process is needed in the manufacture of lunkhead so that there is no deposition of flour, but after the material thickens, the stirring is done. What you do can make it easier to deliver hot, so cooking evenly and avoiding Dodol becomes scorched. Temperature can also affect the texture of dodol making; low temperatures and a long time will make the texture of dodol softer.[2]

To avoid dodol stock vacancies at UD . Maya Sari, forecasting of dodol sales is carried out using the WMA method.

Forecasting is an estimate of a quantity, for example, the demand for some products for the future. Forecasting can also be said to be an *educated guess* (a scientific estimate ). For decision-making in the future, there will be a forecast that underlies the decision-making.[3]

WMA (*Weighted Moving Average)* is widely used in previous studies; in research conducted for "Forecasting, Paving Request Using Weighted Moving Average and Exponential Smoothing Method, from the method the obtained results Request by 26206 use Weight Moving Average method for a period next and 25927.93 using method *Exponential Smoothing* for a period next. MSE calculation for *Weight Moving Average* error value of 20599041 and for *Exponential Smoothing error* as big as 30480430 [4].

Then, research about "Product Distribution Planning and Forecasting System Based on the Number of Demand Using the Method *Weighted Moving Averages*." Research conducted uses method *weight moving average this produces a* distribution forecasting system products at Purnama Souvenir Center teak. This system can predict the number of products that are distributed at each outlet in the future period based on request data for the product in the period before. Based on test results _ we obtained results forecasting with levels of different accuracy _ different for every outlet. Accuracy value for each outlet separately _ whole range between 71% - 76% and MAPE values ranged from between 24% - 29% so that system planning and forecasting distribution product including in category worthy enough for used [5].

There is also a study regarding " Forecasting Goods Inventory Using the *Weighted Method" moving Average* and Method *Double Exponential Smoothing. "* This inventory forecasting system can facilitate the supply process goods for in the future, from the value of *er r or* MSE it can be seen that the method the WMA

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is more because it can minimize per problem in overcoming accumulation or whatever deficiency bar g [6].

Study with title *Forecasting* Production Rubber Use Method Aimed *Weighted Moving* Average for To do forecasting about production rubber use WMA method which has a level *error* by 2.25% so that appropriately applied into the system later [7]. The study entitled P application Method *Weighted Moving Average* For Forecasting Supply Product Aimed Pharmacy _ for build system that can predict score sale product Pharmacy at Pharmacy ASEAN in Century front that produces appropriate and accurate prediction _ so that information the could be input data for optimization distribution next [8].

Then, there is also research regarding " Rice Price Forecasting " Monthly in Milling Rate With Method *Weighted Moving Averages."* Study this use combination weight best with see criteria error MAD, MSE and MAPE forecasting with score smallest are use weight 36 with score weights 10,2,1. Study this produce score from the average price rice monthly in rate milling in one period next that is on the month December 2017 that is is worth Rp 9,227.94/kg [9].

A study regarding "Inventory Forecasting Applications Use Method *Weighted Moving Average* (WMA) in Metrojaya Computer" discuss question forecasting using Weighted Moving Average method to predict how many amounts of must-have stock item was bought for the next period. Study this aim to help Metrojaya Computer predict purchase stock goods for the period next, so that can minimize error amount purchase stock goods [10].

Research "System Forecasting Supply Goods With *Weight Moving Average* In-Store *The Kids* 24" aims to simplify the service process owner shop in providing stuff on the moon next from information obtained _ from moving average calculation, with data retrieval in 3 months' time to the back [11].

In the research " System " Forecasting Supply Drug With Method *Weight Moving Average* And *Reorder Point* ( Study Case: Puskesmas Soropia )" which results in forecasting about amount supply drug in the moon next, so that making planning procurement drug for one month next could be known and avoided from problem *stockout* and *overstock* [12]. Study about "Forecasting Motorcycle *Stock at PT* Thamrin Tugu Branch *Brothers* Mulyo Use This *Weighted Moving Average* (WMA)" produce forecasting booking motorcycle stock at PT Thamrin Tugu Branch *Brothers* Mulyo, so could make it easy for management agencies to process predictive data booking motorcycle [13].

## METHOD

The purpose of forecasting is to be able to predict the amount of demand for *independent* items *needed* in the future.[14]

How to calculate results forecasting using the WMA method *(weighted over _ Average)* _ :

WMA = ((Dt * weight) / ( weight ) [1]

Description :

Dt: Actual data in the period

Weight: Given weight _ for every month

After obtaining data regarding sales forecasting for the coming month, then calculating MSE regarding the calculation of errors ( *errors* ) from forecasting, following the error calculation *formula* :

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MSE = Et2 / n [2]

Description :
Et 2: Error value square
n: lots of data

There are 3 most widely known calculations in calculating forecasting errors, namely:

**1. Absolute Average Deviation ( *Mean Absolute Deviation* – MAD)**

MAD is a calculation to find out the average absolute error. The MAD formula is:

$$MAD|\boldsymbol{At}-\boldsymbol{Ft}n \quad [3]$$

Where :
At = actual demand in the period to t
Ft = demand forecast on period t
N = number period forecasting involved _

**2. Squared Average Error ( *Mean Squared Error* – MSE)**

MSE is an alternative method of forecasting. MSE is the calculation of the mean squared. The formula for Mean Square Errors is:

$$\textbf{MSE} = \frac{\sum_{t=1}^{n}(A_t - F_t)^2}{n} \quad (4)$$

where :
$A_t$ = Actual demand period to - $t$
$F_t$ = *Forecasting value of* $t$ period
$n$ = Amount period $t$
$t$ = period

**3. Absolute Average Percent Error ( *Mean Absolute Percent Error* – MAPE)**

MAPE is a measure of relative determination in knowing the percentage of the predicted results of a forecast. The MAPE formula is as follows :

$$\textbf{MAPE} = \frac{100x\sum_{t=1}^{n}\frac{|A_t - F_t|}{A_t}}{n} \quad (4)$$

where :
$A_t$ = Actual demand period $t$
$T$ = period[15]
$F_t$ = *Forecasting value of* $t$ period
$n$ = Amount period $t$

WMA method ( *Weighted Moving Average) is* suitable for *time data series* (changes from time to time u ) [16]. The advantage of WMA is that the weighting can be adjusted, but determining the optimal weight is difficult.[17]

The weighting is done differently in each past historical data, and the latest data has a greater weight than the old data because the most recent data is the most relevant data for forecasting. Here's the *weighted* formula *moving averages* :$\boldsymbol{Weight}\ (\boldsymbol{n}) = \frac{\sum(\boldsymbol{data\ X\ bobot})}{\sum(\boldsymbol{bobot})}$ (5)

Where :
actual demand in a period
Weight = weight[18]

## RESULTS AND DISCUSSION

In forecasting dodol sales, manual data calculations are carried out with calculations using the WMA method, which is then included in the system design in order to make it easier for dodol sellers to forecast dodol supplies for the future. The data from dodol sales in the period February 2021 - January 2022 and dodol sales forecasting data for the future. as shown in table 1, table 2, and table 3.

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**Table 1 Dodol Sales Data Period February 2021-January 2022**

| Month | Year | Sales Data ( Kg ) | | | Amount (Kg) |
|---|---|---|---|---|---|
| | | Original | Pandan | Durian | |
| February | 2021 | 35 | 20 | 18 | 28 |
| March | 2021 | 30 | 22 | 22 | 28 |
| April | 2021 | 26 | 27 | 19 | 23 |
| May | 2021 | 40 | 28 | 28 | 30 |
| June | 2021 | 34 | 25 | 22 | 30 |
| July | 2021 | 33 | 23 | 16 | 27 |
| August | 2021 | 32 | 17 | 20 | 27 |
| September | 2021 | 27 | 18 | 17 | 26 |
| October | 2021 | 28 | 22 | 19 | 29 |
| November | 2021 | 28 | 26 | 21 | 31 |
| December | 2021 | 36 | 21 | 23 | 28 |
| January | 2022 | 32 | 25 | 22 | 25 |

**Table 2 Forecasting Dodol Data Sale By Type of Dodol Flavor**

| Month / Year | Sales Data | | | *Weighted moving Average* | | | MSE |
|---|---|---|---|---|---|---|---|
| | Original | Pandan | Durian | Original | Pandan | Durian | |
| February /2021 | 35 | 20 | 18 | - | - | - | |
| March /2021 | 30 | 22 | 22 | - | - | - | |
| April/2021 | 26 | 27 | 19 | - | - | - | |
| May/2021 | 40 | 28 | 28 | 29 | 24 | 20 | |
| June /2021 | 34 | 25 | 22 | 34 | 27 | 24 | |
| July /2021 | 33 | 23 | 16 | 35 | 26 | 24 | |
| August / 2021 | 32 | 17 | 20 | 35 | 25 | 20 | |
| September / 2021 | 27 | 18 | 17 | 33 | 20 | 19 | |
| October / 2021 | 28 | 22 | 19 | 30 | 19 | 18 | |
| November / 2021 | 28 | 26 | 21 | 28 | 20 | 19 | |
| December /2021 | 36 | 21 | 23 | 28 | 23 | 20 | |
| January /2022 | 32 | 25 | 22 | 32 | 23 | 21 | |
| February /2022 | - | - | - | 33 | 24 | 22 | |

**Table 3 Forecasting Data Sale Dodol In February 2022 2**

| Month | thn | Sales Data | | | *Weighted moving Average* | | | MSE | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Original | Pandan | Durian | Original | Pandan | Durian | Original | Pandan | Durian |
| 11 | 2021 | 28 | 26 | 21 | 28 | 20 | 19 | | | |
| 12 | 2021 | 36 | 21 | 23 | 28 | 23 | 20 | | | |
| 1 | 2022 | 32 | 25 | 22 | 32 | 23 | 22 | | | |
| 2 | 2022 | - | - | - | 33 | 24 | 22 | 2.18 | 1 , 39 | 1 , 38 |

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**1. Calculation Forecasting _ Dodol Original Flavor**

a. moon _ February 2022 2

WMA = (( 32 * 3)+( 36 *2)+( 28 *1))/6
= ( 96 + 72 + 28 )/6
= 196 /6
= 32,667 rounded up to 33

So that obtained results forecast in February 2022 is 33. For calculation, the error using MSE. MSE value is taken from all data used in calculation *forecasting*. This means from data for May 2021 to the month of January 2022. Formula _ for To make calculation *error* to forecasting sale Dodol original taste, for example for the month of May the year 2021 :

MSE = Et2 / n
= 40 - 29
= 11
MSE = ( 11 ) $^2$ /12
= 1 0, 3912 rounded up be 10

With the same formula _ obtained MSE for the month of June 2021 sd the month of January year 2022:

month June = 0
month October = 0.23
month July = 0.23
November = 0
month August = 0.52
month December = 5.5
September = 2.6
month January = 0

So that for calculate the average MSE dodol original for forecasting month February 2022 :

**MSE** = (10 + 0 + 0.23 + 0.52 + 2.6 + 0.23 + 0 + 5.55 + 0) / 9
= 19,627 / 9 = 2.1808

**2. Pandan Flavor Dodol** *Forecasting*

a. moon _ February 2022 2

WMA = (( 25 * 3)+( 21 *2)+( 26 *1))/6
= ( 75 + 42 + 26 )/6
= 143 /6
= 23,883 rounded up to 24

So that obtained results, the forecast for February 2021 is 24. For calculation, the error using MSE. MSE value is taken from all data used in calculation *forecasting*. This means from data for May 2021 to the month of January 2022. Formula _ for To make calculation *error* to forecasting sale Dodol Pandan flavor, for example, for the month of May the year 2021 :

MSE = Et2 / n
= 28 - 24
= 3.833
MSE = ( 3.833 ) $^2$ /12
= 1 , 2245 rounded up be 1

With the same formula _ obtained MSE for the month of June 2021 sd the month of January year 2022:

- month June = 0.23
- month October = 1.02
- month July = 0.92
- November = 3.16
- month August = 4.68
- month December = 0.45
- September = 0.45
- month January = 0.39

So that for calculate the average MSE dodol *original* for forecasting month February 2022 :

**MSE** = (1.22 + 0.23 + 0.92 + 4.68 + 0.45 + 1.02 + 3.16 + 0.45 + 0.39) / 9= 12,558 / 9
= 1.3953

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**Dodol Forecasting Calculation of Durian Flavor**

a. moon _ February 2022 2
WMA = (( 22 * 3)+( 23 *2)+( 21 *1))/6
= ( 66 + 46 + 21 )/6
= 133 /6
= 22,167 rounded up to22

So that obtained results, the forecast for February 2021 is 22. For calculation, the error using MSE. MSE value is taken from all data used in calculation *forecasting*. This means from data for May 2021 to the month of January 2022. Formula _ for To make calculation *error* to forecasting sale Dodol durian flavor, for example, for the month of May the year 2021 :

MSE = Et2 / n
= 28 - 19.83
= 8.166
MSE = ( 8.166 ) $^2$ /12
= 5 , 557 rounded up be 6

With the same formula _ obtained MSE for the month of June 2021 sd the month January year 2022 as follows:

With the same formula _ obtained MSE for the month of June 2021 sd the month of January year 2022 as following :

- month June = 0.33
- month October = 0.11
- month July = 4.68
- November = 0.52
- month August = 0
- month December = 0.92
- September = 0.33
- month January = 0

So that for calculate the average MSE dodol *original* for forecasting month February 2022 is as following :

**MSE** = (5.55 + 0.33 + 4.68 + 0 + 0.33 + 0.11 + 0.52 + 0.92 + 0) / 9
= 12,481 / 9
= 1.3868

The appearance of the dodol sales forecasting system design using the WMA method can be seen below.

**Appearance *Forecasting***

A page that has a forecasting feature display that contains options for determining the data to be forecast stored in the *database* and have input by *admin* before. How it looks can be seen in Image 6.


Image 6. Display *Forecasting* (Forecasting)

***Forecasting* Page Views (Forecasting) Weight Determination Stage**

Pages showing an option to assign weights to previously called data from *database* and have input by *admin* before. How it looks can our seen in Image 7.

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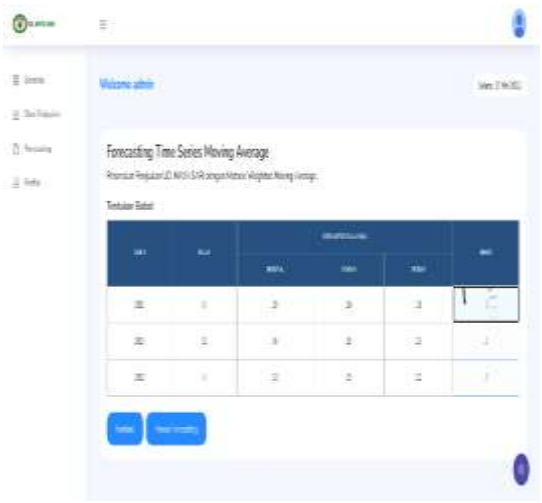

Image 7. Page *Forecasting* Weight Determination Stage

**Results Page View *Forecasting* (Forecasting)**

the page will show The results of the forecasting that has been done on the previous *form* and inputted by the previous admin. Display forecasting results can be seen in Image 8.

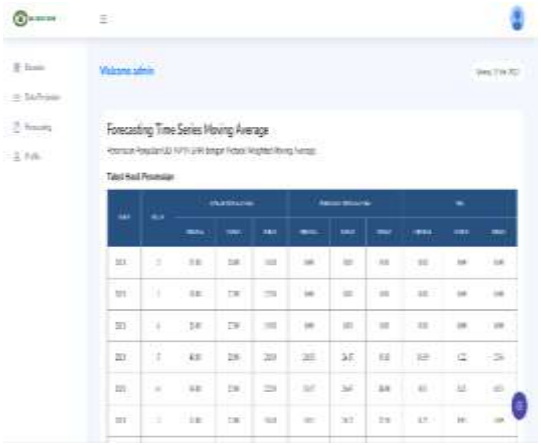

Image 8. Results Page *Forecasting*

**Forecasting Result Conclusion Display**

This page displays the conclusion from the results of the forecasting carried out. The display is the conclusion page of the forecasting result, which can be seen in Image 9.

Image 9 Conclusion Pages From Results *Forecasting* (Forecasting)

**Print Forecast Results Page Display**

This view shows a printout of forecasting from the previous process for reporting to superiors or leaders. T display print the results of this forecast could be seen in Image 10.

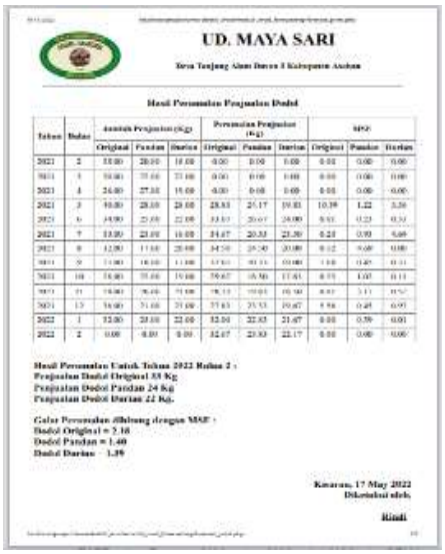


Image 10.Printed Pages of Forecasting Results

**CONCLUSION**

Create system forecasting using _ method *Weighted Moving Average* that can help UD party. Maya Sari for To do forecasting about sale dodol to avoid emptiness stock dodol , give description sale for a month next with accurate with MSE result of 2.18 for dodol original, 1.39 for pandan flavored dodol , and 1.38 for durian flavored dodol .

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