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Utilization of Weighted Moving Average for Decision Support Systems for Sales Services and Stock Management Case Study: Soes Merdeka Bread Shop

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Abstract: Business owners are leveraging the rapidly developing advancements in information technology to simplify sales and inventory management. Increasingly dynamic business competition demands that companies provide products at the right time and in the right quantities to meet consumer needs. Toko Roti Soes Merdeka, a MSME specializing in bread and cake sales, faces challenges in managing stock availability without causing excess or shortage of inventory. Based on these problems, the purpose of this study is to design a web-based decision support system using the Weighted Moving Average (WMA) method to forecast sales based on historical data collected from May 18–24, 2025. The WMA method assigns different weights to each period, resulting in more accurate predictions in determining stock requirements for the following period. The results show that the system developed is capable of assisting transaction recording, stock management, and presenting forecasting results automatically and in a structured manner, thereby supporting more effective and efficient decision-making.

Keywords: Decision Support System, Inventory Management, Weighted Moving Average, Web-Based System, Stock Management.

1. Introduction

Business owners are leveraging the rapid advancement of information technology in line with the times to facilitate sales activities [1]. The changing and diverse needs and desires of consumers make business competition in the global market today very dynamic and difficult to predict. The expanding business world in the market requires companies to provide products at the right time and place in order to maintain an advantage in facing market competition [2].

Toko Soes Merdeka is one of the micro, small, and medium enterprises (MSMEs) engaged in the sale of bread and cakes. This business offers a variety of products, but the soes cake is the flagship product most favored by customers. Toko Roti Soes Merdeka must manage the inventory of raw materials by ensuring sufficient availability to support sales and minimizing the time and costs required [3]. Inventory is an important aspect in the operations of every business entity, including Toko Soes Merdeka. The company risks being unable to meet customer needs and facing demand uncertainty if the inventory is insufficient [4]. An inventory forecasting system is needed to determine the correct quantity. Weighted Moving Average (WMA) is used to help ensure the timely availability of products [5]. Forecasting is the process of predicting future events based on previous

data to reduce prediction errors [6]. The forecasting approach used in this research is the Weighted Moving Average Method [7]. The Weighted Moving Average (WMA) is a time series forecasting method that uses historical data with different weights for each period, where the determination of weights depends on experience and data analysis considerations [8]. The objective of this research is to assist Toko Roti Soes Merdeka in planning stock more accurately and systematically thru a forecasting system capable of predicting future demand and presenting data automatically and computerized [9]. This system is expected to process sales data and support decision-making regarding raw material purchases, which is anticipated to be done more neatly, quickly, and with minimal errors [10]. The system can also help display sales data and forecast results in an easily understandable format, making it usable by various parties in the store, such as cashiers and administrators. This research is expected to provide a solution for Toko Roti Soes Merdeka in the form of an integrated, efficient decision support system that can adapt to changes in market demand, while also maximizing the use of the WMA method in forecasting sales and managing inventory.

2. Materials and Methods

System Development Method

The decision support system for predicting stock and sales services was developed by applying the Weighted Moving Average (WMA) method[11]. The Weighted Moving Average is a moving average method that uses weights, with each data point assigned a different weight[12]. The most recent data is considered the most relevant in the forecasting process, so it is given a higher weight. The total weight is determined so that the overall sum equals one[13]. This research includes 6 stages, as shown in the flowchart in the figure below.

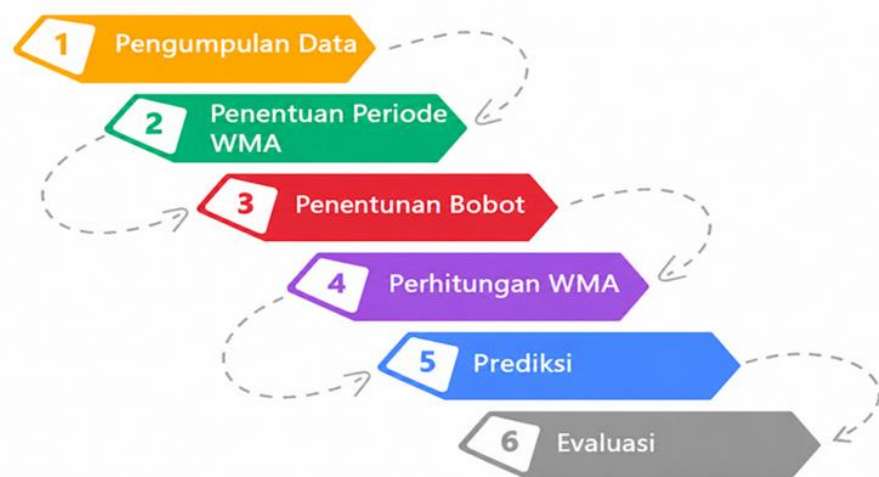


Figure 1. Stages of Research Method WMA.

- Data collection

This research conducted data collection in the initial stage through interviews with the Soes Merdeka Bakery, direct observation of the sales process and stock management, as well as literature studies from research relevant to inventory management information systems. The collected data, particularly the historical sales data, serves as the basis for analysis and calculations in this research. Sales data during the research period can be seen in Table 1.

Table 1. Sales Data of Soes Merdeka Bakery.

Date	Sales Data				
	Chocolate Choux	Rum Horn	Vanilla Choux	Chocolate Molen	Cheese Dry Choux
18-May-25	30	7	78	35	8
19-May-25	8	11	20	70	3
20-May-25	6	1	34	30	3
21-May-25	16	1	40	35	8
22-May-25	30	17	56	40	1
23-May-25	4	14	54	70	8
24-May-25	42	9	14	55	3

- Determination of the WMA period

The WMA period used is one week, utilizing the sales data from the last seven days (May 18–24, 2025) as the basis for calculation to represent the current sales trend. The data in the table shows the daily sales figures for five types of products, namely Rum horn, Chocolate Soes, Vanilla Soes, Chocolate Molen, and Cheese Dry Soes. This information serves as the main reference in the forecasting process, where the latest data is given more weight compared to previous data.

- Weight determination

Weight determination is carried out by assigning weighting values to each day in a one-week period, where the highest weight is given to the most recent sales data. The total weight is adjusted to equal one, so that the calculation results can accurately reflect the proportion of each day [14]. The weight results for one week:

- Day 1: $1/28 = 0.036$
- Day 2: $2/28 = 0.071$
- Day 3: $3/28 = 0.107$
- Day 4: $4/28 = 0.143$
- Day 5: $5/28 = 0.179$
- Day 6: $6/28 = 0.214$
- Day 7: $7/28 = 0.250$

- WMA Calculation

Each sales data for each period is multiplied by the predetermined weight, then the result of the multiplication is summed and divided by the total weight. This process produces a predicted value that takes into account the importance level of each period [15]. The formula for calculating the Weighted Moving Average (WMA) can be written as follows:

$$WMA : \frac{\sum(D_t \times Bobot)}{\sum Bobot} \quad (1)$$

Where:

Dt = Actual data in the t-th period

Weight = The weight value assigned to each period

Prediction Calculation Results

Table 2. WMA Prediction Results.

Product	WMA Prediction (25 May 2025)
Chocolate Choux	21.31
Rum Horn	9.57
Vanilla Choux	38.67
Chocolate Molen	50.34
Cheese Dry Choux	4.60

Table 2 shows the estimated number of sales for each product on May 25, 2025. Products with higher predicted values are expected to sell more, such as Chocolate Molen and Vanilla Soes, while products with lower values, such as Cheese Dry Soes, are expected to have less demand. This result can be used to determine the quantities of products and stock needed to match demand.

- Stock Forecasting

The WMA calculation results in predicting the amount of stock needed in the next period. This stage aims to avoid stockouts and overstock.

- Result Evaluation

The accuracy of the prediction results is assessed by comparing them with actual data; if significant differences are found, the weights or periods can be adjusted to make future predictions more accurate.

Admin Flowchart

The flowchart in Figure 2 shows the process flow carried out by the admin in the sales processing and stock management system at Toko Roti Soes Merdeka. The process begins with the admin logging in for authentication before entering the system. The system displays the dashboard as the central access point for features if the login is successful. The dashboard accessed by the admin is the master item menu for viewing and editing item information. The admin manages cashier data in the user menu, in addition to managing incoming and outgoing item data and viewing recorded transaction history through the transaction menu. In stock management, the admin monitors the availability of stock in the store. The calculation of the Weighted Moving Average (WMA) allows the admin to predict sales based on the available historical data, resulting in a prediction value that can be used as a basis for inventory decision-making.

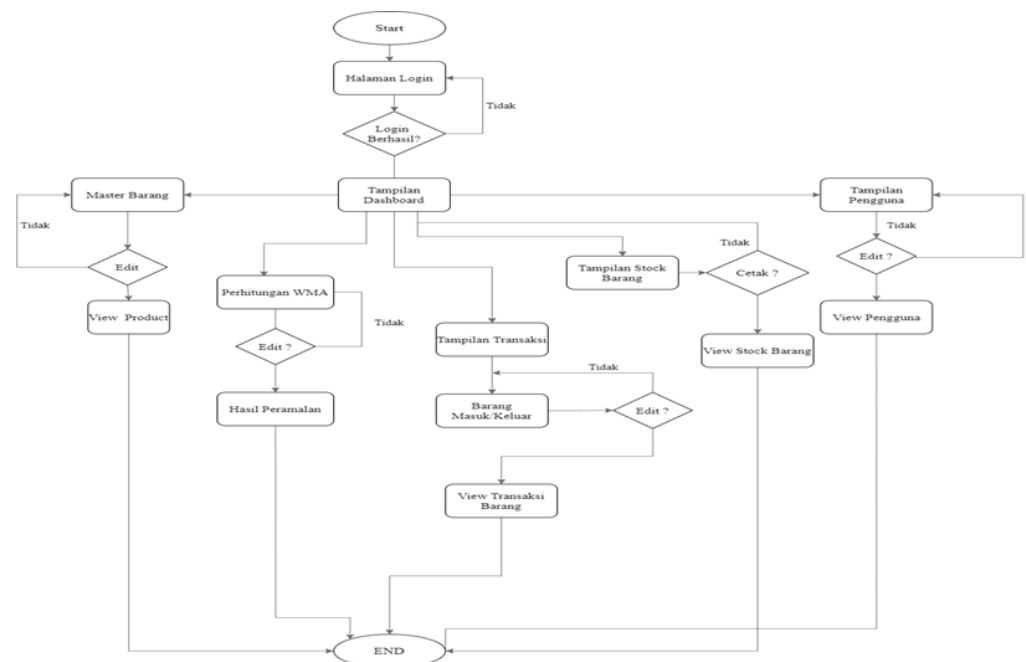


Figure 2. Admin Flowchart.

Cashier Flowchart Figure 3 shows the process flow carried out by the cashier. The process starts from the start, then the system displays the login page for authentication. The system displays the dashboard as the central access point for features if the login is successful. The cashier can access the transaction menu to record incoming and outgoing goods. The cashier then accesses the stock menu to monitor stock availability by selecting

the product to be checked, after which the system displays the stock data. The cashier can also access the WMA calculation menu to predict sales; in addition, the cashier can edit the calculation data or directly view the forecasting results to determine the order quantity. The cashier then conveys the results to management as a basis for decision-making, after which the production department prepares the goods.

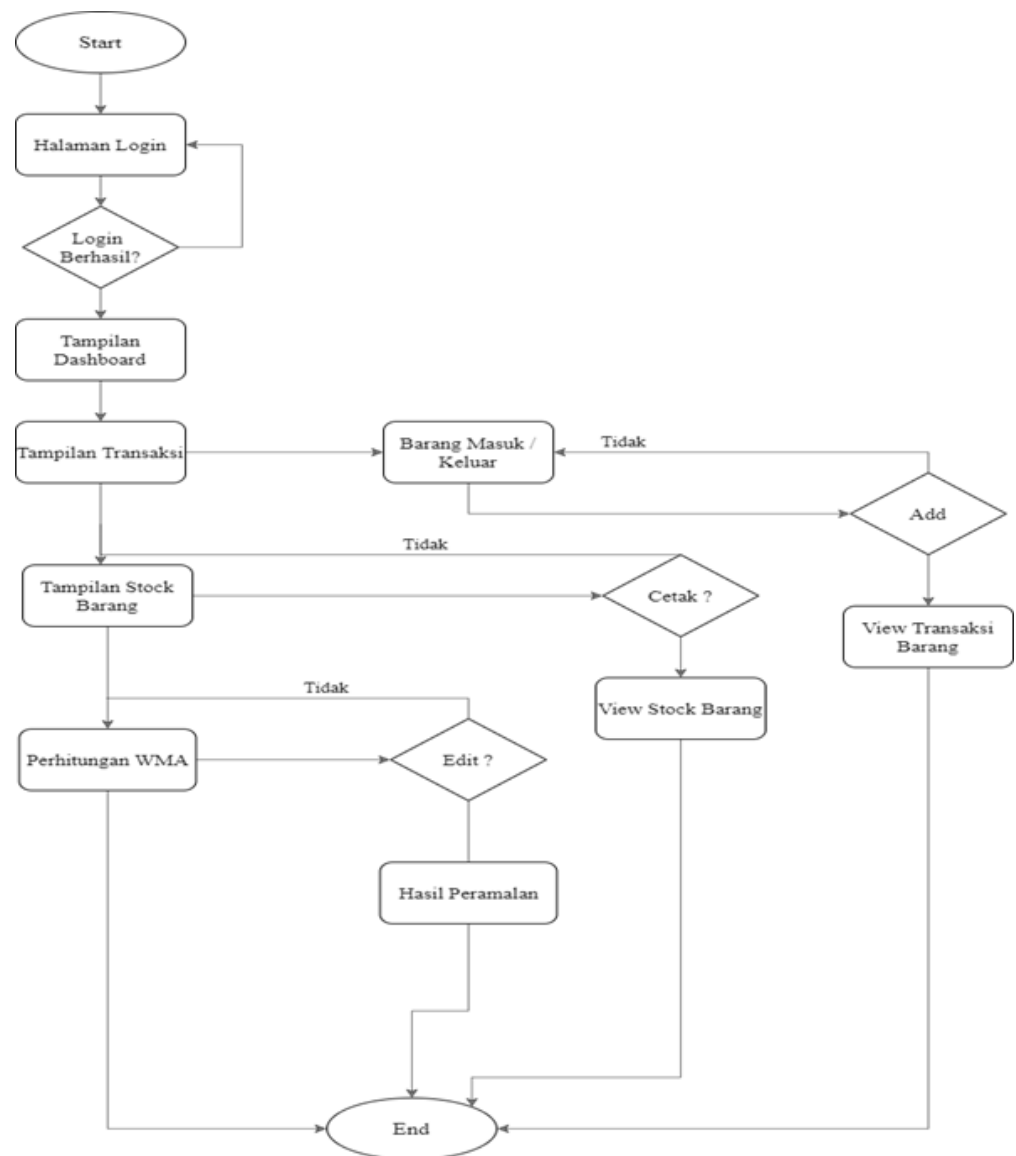


Figure 3. Cashier Flowchart.

Use Case Diagram

Use case diagram for the Weighted Moving Average system at Soes Merdeka Bakery. Admin and cashier log in according to their respective access rights. The admin manages user data and master data such as products, units, and categories, as well as product stock. Additionally, the admin can perform inventory forecasting calculations using the weighted moving average method through the WMA menu. The cashier is responsible for recording operational transactions, such as incoming goods, outgoing goods, and returns from customers. After finishing using the system, the admin and cashier log out. With this division of roles, the admin is responsible for data management, stock, and forecasting, while the cashier handles daily operational transactions.

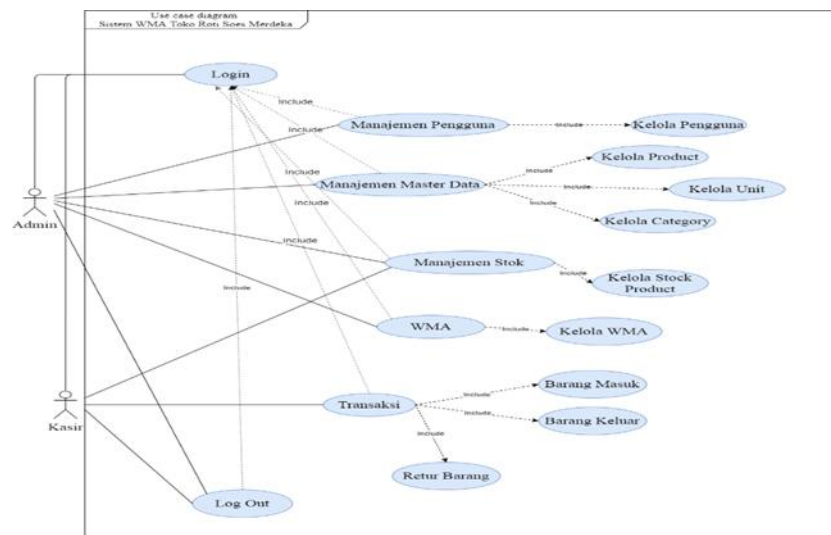


Figure 4. Use Case Diagram.

Activity Diagram

The Activity Diagram in the WMA system of Roti Soes Merdeka store illustrates the workflow of the Admin, System, and Cashier in a single process as shown in Figure 5. Admin and cashier log in, then the system verifies the account. The system displays the dashboard as the central access point for features if the login is successful. The cashier manages operational transactions, such as recording incoming goods, outgoing goods, returns, and viewing stock. The admin has broader access, which includes managing user data, product master data, stock management, and performing forecasting calculations using the Weighted Moving Average method. Admin can also view data before ending the process by logging out. This diagram shows the systematic process flow, the differences in access rights, and the responsibilities between the cashier and the admin.

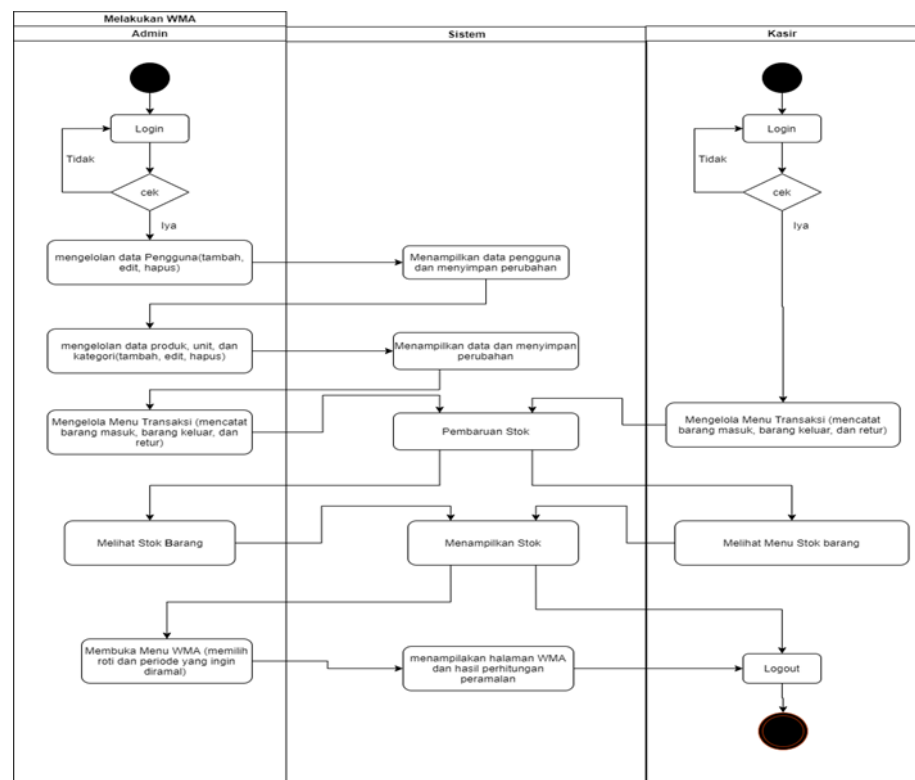


Figure 5. Activity Diagram.

Class Diagram

The Class Diagram in Figure 6 shows the database structure working in the stock management system that uses the Weighted Moving Average (WMA) method at Soes Merdeka Bakery. The system stores unit data in the Unit table, category data in the category table, and main product data in the Product table, which includes code, name, price, unit, category, and status. The system manages transaction data through the Product_Transaction table for sales and the warehouse_Transaction table for the outflow and inflow of goods, which includes product code, date, transaction type, quantity, price, and total. The system stores forecasting results in the Weighted_Moving_Average table, while the system stores calculation details in the Weighted_Moving_Average_Detail table. With this structure, the system can store and manage product, transaction, and forecasting data in one database, making stock management easier and more organized.

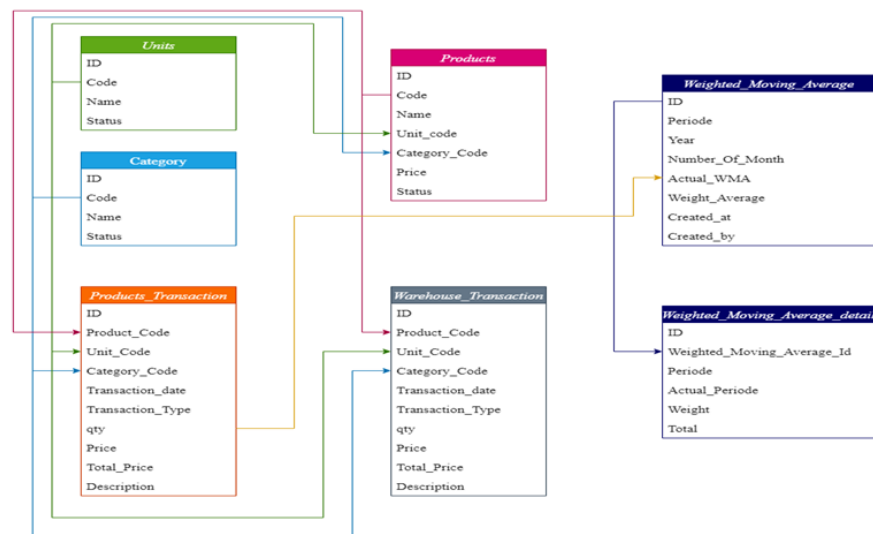


Figure 6 Class Diagram.

3. Results and Discussion

Interface Design

The user interface design for the WMA system at Roti Soes Merdeka store is created to have a simple, clear, and easy-to-use appearance for admins and cashiers in managing sales and inventory. The interface is designed with a focus on user-friendliness when accessing the features available in the system. The interface of this system consists of three main views, namely the login page, dashboard, and menu page, which includes transactions, stock items, master data, and WMA calculations.

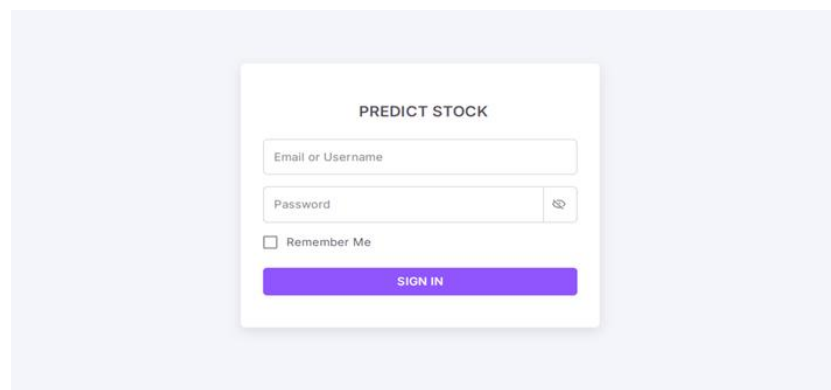


Figure 7. Login Page.

The login page in the system is designed simply so that users can directly enter their username and password to access the system. This page is also equipped with a validation feature to inform users if there is an error during data input, as shown in Figure 7.

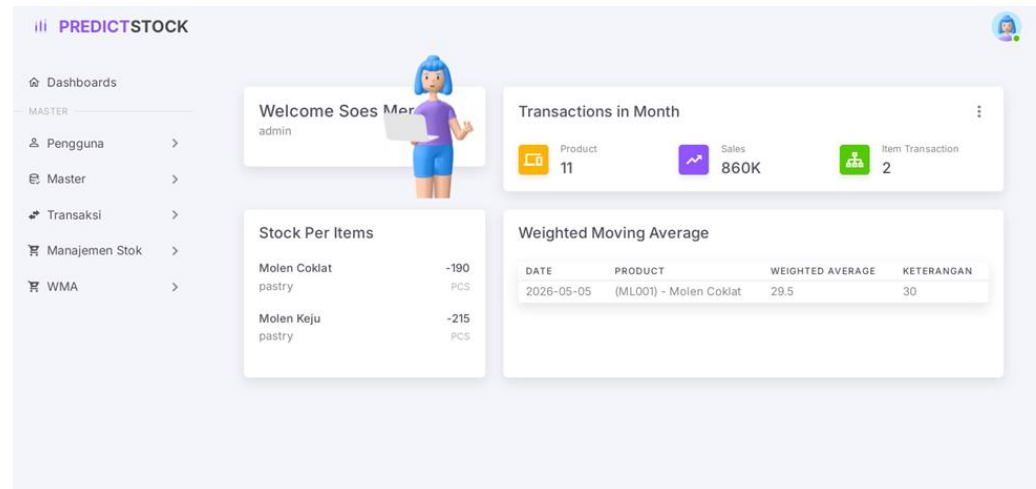


Figure 8. Dashboard Page.

Figure 8 displays the dashboard as the main page of the system. The dashboard displays a summary of important information, such as the number of products, monthly transaction data, stock lists per item, and a table of Weighted Moving Average (WMA) calculations. The cashier menu interface allows access to users, master data, transactions, stock management, and WMA calculations. The dashboard interface is designed to be concise and informative so that users can quickly monitor stock conditions and system activities on a single page.

Weighted Moving Average

Date:

Product:

Total Days:

Figure 9. Weighted Moving Average Page.

The WMA page in Figure 9 displays a data input feature that allows users to perform forecasting calculations based on date, product selection, and the number of calculation days. This feature helps users determine the analysis period before running the calculation process. The display on the page is made simple and neat, and equipped with a calculate WMA button to process the input data, after which the system will display the forecasting calculation results based on the Weighted Moving Average method.

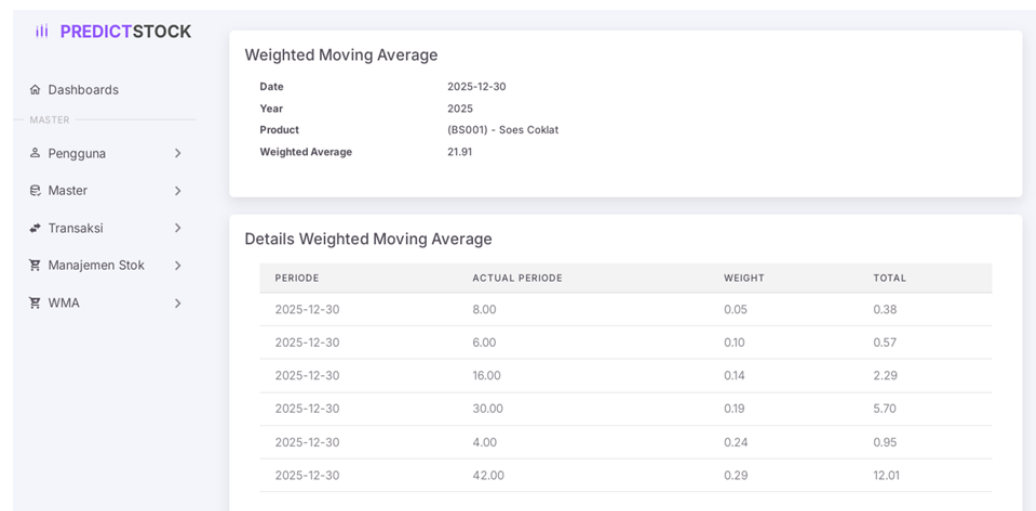


Figure 10. Detailed Calculation Page WMA.

The complete information display regarding the weighted moving average (WMA) calculation results for the selected product is shown in Figure 10. This value is the result of the forecasting conducted and is used to estimate the sales volume for the next period. The Period column shows the date of the data used, the Actual Period contains the actual sales amount that occurred during that period, the weight indicates the level of influence or weight given to each period, and the Total is the result of multiplying the actual sales value by the predetermined weight. All values in the Total column are then summed to produce the final Weighted Moving Average value. Users can see the calculation process transparently and understand how the forecast value is obtained.

4. Conclusion

The development of a web-based decision support system at Soes Merdeka Bakery has been successfully carried out by applying the Weighted Moving Average (WMA) method to assist in the sales forecasting and inventory management processes. This system was created to address the previously unintegrated record-keeping, which often resulted in data errors and inefficiencies in inventory management. The results of the functional testing show that all main features, such as data management, transactions, stock, and WMA calculations, are working as expected. The trial use of the system by the admin and cashier can be easily used and helps make the work process faster and more organized.

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REFERENCES

- [1] D. Erdianita, R. Mumpuni, and F. P. Aditiawan, "Sistem Prediksi Penjualan Menggunakan Metode Weighted Moving Average Dan Economic Order," *J. Inform. Polinema*, vol. 9, no. 4, pp. 363–372, 2023, doi: 10.33795/jip.v9i4.1311.
- [2] S. G. I. Mdp, "Supply Chain Management," vol. 7, no. 2, pp. 349–363, 2020.
- [3] Miftah Fadila, Ruri Ashari Dalimunthe, and Sri Rezki Maulina Azmi, "Prediksi Stok Bahan Baku Roti Pada Toko Karya Bakery Kecamatan Lima Puluh Dengan Metode Single Moving Average," *Decod. J. Pendidik. Teknol. Inf.*, vol. 4, no. 2, pp. 593–608, 2024, doi: 10.51454/decode.v4i2.492.
- [4] Y. I. Sakila and J. Saputra, "Implementasi Metode Economic Order Quantity Untuk Persediaan Roti Di Rotte Bakery Dumai Mini, dan Donat Coklat. Pengumpulan data awal dalam penelitian ini adalah wawancara dengan metode observasi data persediaan roti pada januari 2019 sampai dengan Agus," vol. 17, pp. 11–22, 2022.
- [5] C. A. Suhendra, M. Asfi, W. J. Lestari, and I. Syafrinal, "Sistem Peramalan Persediaan Sparepart Menggunakan Metode Weight Moving Average dan Reorder Point," *MATRIK J. Manajemen, Tek. Inform. dan Rekayasa Komput.*, vol. 20, no. 2, pp. 343–354, 2021, doi: 10.30812/matrik.v20i2.1052.
- [6] F. Ustadatin, A. Muqtadir, and A. Arifia, "Implementasi Metode Weighted Moving Average (WMA) Pada Prediksi Harga Bahan Pokok," *Komputika J. Sist. Komput.*, vol. 12, no. 2, pp. 83–90, 2023, doi: 10.34010/komputika.v12i2.10304.
- [7] I. Solikin and S. Hardini, "Aplikasi Forecasting Stok Barang Menggunakan Metode Weighted Moving Average (WMA) pada Metrojaya Komputer," *J. Inform. J. Pengemb. IT*, vol. 4, no. 2, pp. 100–105, 2019, doi: 10.30591/jpit.v4i2.1373.
- [8] A. Fitri, R. Yesputra, and A. Nasution, "Pendekatan Metode Weighted Moving Average Untuk Meramal Jumlah Penjualan Keripik," *Indones. J. Comput. Sci.*, vol. 11, no. 2, pp. 663–671, 2022, doi: 10.33022/ijcs.v11i2.3086.
- [9] D. A. Hidayanti, H. Syafwan, and A. Akmal, "Penerapan Metode Weighted Moving Average pada Sistem Peramalan Stok Bahan Laundry," *Edumatic J. Pendidik. Inform.*, vol. 8, no. 1, pp. 153–162, 2024, doi: 10.29408/edumatic.v8i1.25636.
- [10] S. Nurhayati and A. Syafiq, "Sistem Prediksi Jumlah Produksi Baju Menggunakan Weighted Moving Average Clothing Production Amount Prediction System using Weighted Moving Average," *J. Manaj. Inform.*, vol. 12, no. 1, pp. 14–24, 2022.
- [11] S. Rifadli and R. Sari, "Implementasi Metode Weighted Moving Average (WMA) Pada Prediksi Penjualan Gas Elpiji Berbasis Website," *J. Desain Dan Anal. Teknol.*, vol. 3, no. 2, pp. 88–95, 2024, doi: 10.58520/jddat.v3i2.47.
- [12] A. A. Muti and R. Iaina, "Peramalan Penjualan Bubuk Kopi Di Pt. Xxx Dengan Penerapan Metode Wma Dan Exponential Smoothing," *J. Ekliptika*, vol. 2, no. 2, pp. 1–7, 2021.
- [13] R. E. Erlinda, U. Yudatama, and E. R. Arumi, "IMPLEMENTASI SISTEM PERAMALAN PENGADAAN KEBUTUHAN BAHAN IMPLEMENTATION OF FORECASTING SYSTEM FOR PROCUREMENT OF RAW," vol. 9, no. 2, 2022, doi: 10.25126/jtiik.202294700.
- [14] I. Setiawan, "Rancang Bangun Aplikasi Peramalan Persediaan Stok Barang Menggunakan Metode Weighted Moving Average (Wma) Pada Toko Barang Xyz," *J. Tek. Inform. Vol. 13, No. 3, Agustus 2021*, vol. 13, no. 3, pp. 1–9, 2021.
- [15] I. Padiku, Lillyan Hadjaratie, Dizky Ramadani Putri Papeo, and Muh. Fikri F. Walahe, "Penerapan Metode WMA dan EOQ pada Sistem Informasi Pengendalian Persediaan Stok Obat di Apotek Damhil," *J. Tek.*, vol. 21, no. 2, pp. 155–167, 2023, doi: 10.37031/jt.v21i2.419.