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Web-Based F&B Lazatto Product Sales and Stock Prediction System with Double Moving Average (DMA) Method

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ABSTRACT

This study aims to develop a web-based sales and stock prediction system for Lazatto, a Food and Beverage (F&B) company, using the Double Moving Average (DMA) method. The background of this research is based on issues stock requirement planning is still done conventionally, where the head of the restaurant places stock orders solely based on personal experience and intuition, without utilizing past sales data as a basis for decision-making, which often result in overstocking or stockouts. By implementing a web-based forecasting information system, the company can obtain real-time and structured data. This study uses sales data from April 2024 to March 2025. The prediction results show a downward trend in sales for the "Kentang" (Potato) product, with a forecasted value of 107.33 for April 2025, compared to an actual value of 95. Model evaluation indicates an average MAPE of 21.19%, which is considered a "fair" level of forecasting accuracy. Additionally, the time required for weekly stock planning was reduced, and interviews with staff revealed increased user satisfaction and ease of use. The developed system has proven to support more accurate and efficient decision-making in inventory management.

I. INTRODUCTION

The use of information systems today continues to experience a significant increase. Data from Statista (2023) shows that the application of information technology in the global business sector increases by 12.5% manually. This increase drives demands for everything to be done quickly and accurately, so that information can be accessed quickly and accurately to provide the convenience needed by business actors [1]. However, even though information technology has developed, there are still significant problems in predicting sales accurately, which has an impact on operational efficiency and customer satisfaction [2].

In Indonesia, a survey by the Central Bureau of Statistics (2022) revealed that 65% of small and medium businesses have difficulty in predicting their sales, resulting in overstock or shortages of 30% of total inventory. Developments in the business world, especially in the retail sector, are increasingly encouraging businesses to rely on the power of information systems as a tool to improve operational efficiency and competitiveness [3].

Sales forecasting or prediction is a crucial process in predicting the number of products that will be sold in a certain period of time in the future [4]. Research by the Market Research Institute (2023) shows that companies that implement accurate sales forecasting methods can increase inventory efficiency by up to 25% and reduce operating costs by up to 15%. This makes sales forecasting an important aspect for companies to manage inventory, set marketing strategies, and make better business decisions [5].

Web-based information systems have been proven to enable real-time data access from multiple locations, providing convenience in processing and analyzing sales data more efficiently and effectively [6]. According to a Deloitte report (2023), 78% of companies that switched to web-based systems experienced an increase in decision-making speed of up to 40%. This certainly helps companies make faster decisions based on accurate data [7].

One of the methods used in predicting sales and stock of goods is *Double Moving Average* (DMA), a statistical method that takes into account the moving average of two time periods. Research by the Journal of Business Forecasting (2023) found that using DMA on sales data with clear seasonal patterns or trends can increase prediction accuracy by up to 20% compared to other prediction methods [8][9]. Lazatto is a company engaged in the Food and Beverages (F&B) sector with various superior products such as *Fried Chicken, Burger, Spaghetti, French Fries*, as well as the menu *signature* such as Sadazz, Ayam Geprek, and Ayam CLBK. In addition, stock requirement planning is still done conventionally, where the head of the restaurant places stock orders solely based on personal experience and intuition, without utilizing past sales data as a basis for decision-making. This often causes a mismatch between the amount of stock and actual demand. As a result, it is not uncommon for there to be excess stock (which has the potential to cause waste or damage to food ingredients) or shortages (which causes customers to not be served optimally).

Therefore, the implementation of a web-based information system with the DMA method is expected to help Lazatto in optimizing food product inventory management, reducing risks, *overstock* or *stockout*, and increase customer satisfaction. The implementation of this system will not only provide a clearer view of future market demand, but is also expected to improve Lazatto's operational efficiency. Thus, Lazatto can develop better business strategies and be responsive to market changes. Based on the above problems, the author raises the title "Lazatto F&B Product Sales and Stock Prediction System Based on Web Using the *Double Moving Average* (DMA)". Based on this research, it is expected to provide significant added value for the company.

II. METHOD

A. Research Stages

The creation of this prediction system involves several main steps, as shown in Figure 1 below:

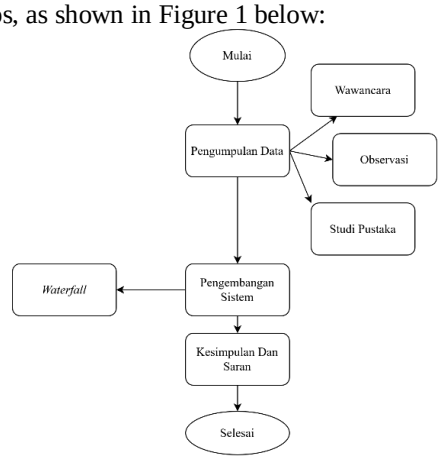

Figure 1. Research Stages

The image above shows the flow of the research stages used in the development of a web-based Lazatto sales and stock prediction system using the Double Moving Average (DMA) method. This research begins with the data collection stage, which aims to obtain relevant information as a basis for the analysis and design process of the system. The data collection technique is carried out through three main methods, namely:

1) *Interview*: conducted with related parties, such as Lazatto management and staff, to explore information about workflow, system requirements, and obstacles faced in the stock recording and planning process.

2) *Observation*: researchers directly observe the sales recording and stock management process in the field, in order to obtain a real picture of operational activities.

3) *Studies Literature*: conducted by reviewing literature, journals, and relevant documents to support theoretical foundations, including an understanding of methods. *Double Moving Average* and information systems.

After the data is collected and analyzed, the next stage is system development. Development is carried out using the approach *Waterfall*, which is a sequential and systematic software development model, consisting of several stages such as requirements analysis, system design, implementation, testing, and maintenance.

After the system is developed and tested, the research continues to the conclusion and suggestion stage, which contains an evaluation of the results of the system implementation and input for further development. This stage is the end of the series of research stages described in the flow diagram.

B. Method System Development

The development of the system in this study uses the SLDC method, namely the waterfall method. It is called a waterfall because you have to wait until the stages are completed. The previous phases must run sequentially. The waterfall model (*waterfall*) provides a sequential or ordered software lifecycle approach starting from analysis, design, coding, testing, and maintenance stages [10][11].

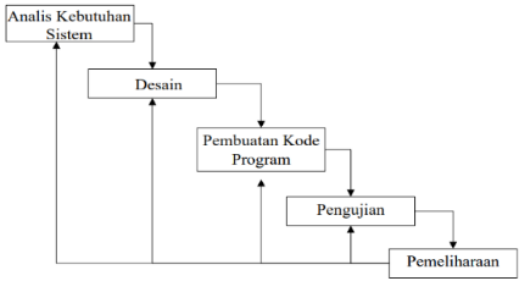

Figure 2. Waterfall Methode Flow

The stages in the Waterfall method are as follows:

1) System Needs Analysis, at this stage, data is collected to analyze system needs. This stage produces user needs or user requests in system creation.

2) Design, the goal is to provide an overview of the appearance to be created and the steps to be taken. For system modelling, UML (*Unified Model Language*) including diagrams *use case*, activity diagrams, sequence diagrams, and class diagrams. In addition, Microsoft Visio 2019 is used as a reference for designing databases and interfaces.
3) Program Code Creation, this stage involves translating the design into a programming language that can be executed by a computer. In this study, the author uses the CSS programming language for the user interface using the Visual Studio Code text editor, and the Hypertext Preprocessor (PHP) programming language for implementing the algorithm in the database using the local server XAMPP Version 8.1.2.
4) Testing, then in the fourth stage, testing is carried out on the program in order to ensure that the system created can run as desired and to find out if there are any bugs or errors that may occur. The accuracy of the system calculations will also be tested so that the level of accuracy of the system can be evaluated. Then the effectiveness of the product is also tested in order to assess the extent of the success of the system or product that has been built.
5) Maintenance, this stage involves the implementation of the system to the user and involves the process of maintaining or caring for the system by the user

C. *Double Moving Average Method*

The DMA method is a development of the method *Moving Average* (MA). What makes it different is the method *Double Moving Average* is usually used to consider trends.

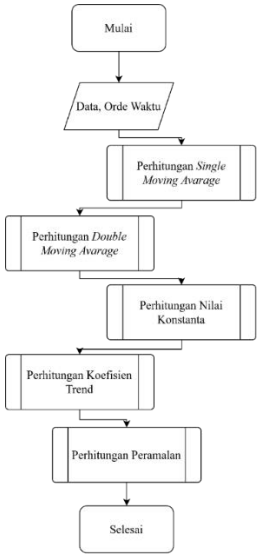

Figure 3. DMA Methode Stages

This method is called *Double Moving Average* because the values used in the forecast calculation are the result of double calculation of the method *Single Moving Average* (SMA) [12][13]. The calculation steps for the DMA method can be seen in Figure 3.

The steps used in the DMA method start by calculating SMA using the following formula equation:

$$S' = \frac{Xt+Xt-1+Xt-2+\cdots+Xt-N-1}{N} \quad (1)$$

The next step is DMA from the forecast results generated from SMA using the following formula equation:

$$S'' = \frac{S't+S't-1+S't-2+\cdots+S't-k-1}{k} \quad (2)$$

After getting the value*S*", the next step is to determine the constant value (at) using equation (3) and continue by determining the trend coefficient value (bt) using equation (4):

$$at = 2St' - St'' \quad (3)$$

$$bt = \frac{2}{k-1}(St' - St'') \quad (4)$$

The final step taken in the method *Double Moving Average* is to determine the value of the forecast using equation (5), namely by adding the results of the constant value (at) and the trend coefficient (bt) [13][14].

$$ft+p = at + bt\text{m} \quad (5)$$

Where equations (1), (2), (3), (4), (5) are:
S't: single moving average
S'' t: double moving average
Ft+m: forecast for m periods ahead
at: adjustment single moving average
bt: estimate of the next time period
m: predicted future period
N: data in period t
t: present time

III. RESULT AND DISCUSSION

A. *Double Moving Average*

In this discussion, the author uses data from permenu sales for the period April 2024 – March 2025. The more data used, the more detailed the results will be [15]. This prediction system is designed to be used on all Lazatto F&B products which amount to 277 product menus, but for the purpose of illustration and discussion, the author uses sales data examples on several products, namely "Potatoes" and "Chicken Breasts". To predict calculations with short and medium periods, the Double Moving Avarage method is quite suitable [16].

The following is the actual data of one of the permenu sales products, namely "potato" and "Chicken Breast" as samples, with the period April 2024 – March 2025.

TABLE 1
ACTUAL SALES DATA FOR THE MENU

No.	Periode	Quantity	
		Potato	Chicken Breast
1	Apr-2024	230	77
2	May-2024	175	131
3	Jun-2024	136	51
4	Jul-2024	135	26
5	Aug-2024	128	36
6	Sep-2024	123	27
7	Okt-2024	149	72
8	Nov-2024	125	43
9	Des-2024	123	77
10	Jan-2025	100	44
11	Feb-2025	97	59
12	Mar-2025	85	132

Based on table 1 above, a prediction of menu sales with a sample of "Potato" products for the period April 2024 – March 2025 with the Double Moving Average method can be seen in the following table:

TABLE 2
OVERALL CALCULATION

No	Period	Quantity	SMA	DMA	At	Bt	MAPE SMA (%)	MAPE DMA (%)
1	Apr-24	230	-	-	-	-	-	-
2	Mei-2024	175	-	-	-	-	-	-
3	Jun-2024	136	-	-	-	-	-	-
4	Jul-2024	135	180,33	-	-	-	33,58	-
5	Agu-2024	128	148,67	-	-	-	16,15	-
6	Sep-24	123	133,00	154,00	112,00	21,67	8,13	25,20
7	Okt-2024	149	128,67	136,78	120,56	8,78	13,65	8,20
8	Nov-24	125	133,33	131,67	135,00	-1,00	6,67	5,33
9	Des-2024	123	132,33	131,44	133,22	-0,22	7,59	6,87
10	Jan-2025	100	132,33	132,67	132,00	1,00	32,33	32,67
11	Feb-2025	97	116,00	126,89	105,11	11,56	19,59	30,81
12	Mar-2025	85	106,67	118,33	95,00	12,33	25,49	39,22
Total							163,17	148,30

Using the time order k = 3 for the product data of the "Potato" menu

1) *Single Moving Average Calculation (S't)*:

$$S' = \frac{Xt + Xt-1 + Xt-2 + \cdots + Xt-N-1}{N}$$

a. April 2024 – June 2024
Not counted because it does not have three previous data.

b. July 2024
$S' = \frac{230+175+136}{3} = \frac{541}{3} = 180{,}33$

c. August 2024
$S' = \frac{175+136+135}{3} = \frac{446}{3} = 148{,}67$

d. September 2024
$S' = \frac{136+135+128}{3} = \frac{399}{3} = 133{,}00$

e. October 2024
$S' = \frac{135+128+123}{3} = \frac{386}{3} = 128{,}67$

f. November 2024
$S' = \frac{128+123+149}{3} = \frac{400}{3} = 133{,}33$

g. December 2024
$S' = \frac{123+149+125}{3} = \frac{397}{3} = 132{,}33$

h. January 2025
$S' = \frac{149+125+123}{3} = \frac{397}{3} = 132{,}33$

i. February 2025
$S' = \frac{125+123+100}{3} = \frac{348}{3} = 116{,}00$

j. March 2025
$S' = \frac{123+100+97}{3} = \frac{320}{3} = 106{,}67$

2) *Double Moving Average Calculation (S''t)*:

$$S'' = \frac{S't + S't-1 + S't-2 + \cdots + St-k-1}{k}$$

a. September 2024
$S'' = \frac{180,33+148,67+133,00}{3} = \frac{462}{3} = 154,00$

b. October 2024
$S'' = \frac{148,67+133,00+128,67}{3} = \frac{410,34}{3} = 136,78$

c. November 2024
$S'' = \frac{133,00+128,67+133,33}{3} = \frac{395}{3} = 131,67$

d. December 2024
$S'' = \frac{128,67+133,33+132,33}{3} = \frac{394,33}{3} = 131,44$

e. January 2025
$S'' = \frac{133,33+132,33+132,33}{3} = \frac{398}{3} = 132,67$

f. February 2025
$S'' = \frac{132,33+132,33+116,00}{3} = \frac{380,66}{3} = 126,89$

g. March 2025
$S'' = \frac{132,33+116,00+106,67}{3} = \frac{355}{3} = 118,33$

3) *Constant Calculation (At)*:

$at = 2St' - St''$

a. September 2024
at $= 2(133,00) - 154,00 = 266 - 154 = 112,00$

b. October 2024
at $= 2(128,67) - 136,78 = 257,34 - 136,78 = 120,56$

c. November 2024
at $= 2(133,33) - 131,67 = 266,66 - 131,67 = 134,99$

d. December 2024
at $= 2(132,33) - 131,44 = 264,66 - 131,44 = 133,22$

e. January 2025
at $= 2(132,33) - 132,67 = 264,66 - 132,67 = 131,99$

f. February 2025
at $= 2(116,00) - 126,89 = 232 - 126,89 = 105,11$

g. March 2025
at $= 2(106,67) - 118,33 = 213,34 - 118,33 = 95,01$

4) *Coefficient Calculation Tren (Bt)*:

a. September 2024
bt $= 2(133,00 - 154,00) = 2(-21) = -42,00$

b. October 2024
bt $= 2(128,67 - 136,78) = 2(-8,11) = -16,22$

c. November 2024
bt $= 2(133,33 - 131,67) = 2(1,66) = 3,32$

d. December 2024
bt $= 2(132,33 - 131,44) = 2(0,89) = 1,78$

e. January 2025
bt $= 2(132,33 - 132,67) = 2(-0,34) = -0,68$

f. February 2025
bt $= 2(116,00 - 126,89) = 2(-10,89) = -21,78$

g. March 2025
bt $= 2(106,67 - 118,33) = 2(-11,66) = -23,32$

Generally, there are three types of calculations used to assess the magnitude of errors in prediction results, here are three types of calculations used [17]:

5) *MAD* (*Mean Absolute Deviation*): The calculation used to calculate the absolute mean of error, with the formula:
MAD = ∑ | Aktual -Forecast | / n (6)
6) *MAPE* (*Mean Absolute Percent Error*): Measures the average of the absolute error as a percentage of the average value of the absolute error of the actual data period. The smaller the error value, the more accurate the prediction results we get. with formula:
MAPE = ∑ (| Aktual -Forecast | / Aktual) *100 / n (7)

The average MAPE value in table 2 is:
MAPE SMA Average: 163,17% / 9 = **18,13%**
MAPE DMA Average: 148.30% / 7 = **21,19%**

The range of MAPE values to find out the ability of the prediction model is as follows [18]:
< 10% = Excellent Predictive (Forecasting) Model Capabilities.
10% - < 20% = Good Predictive Model (Forecasting) Ability.
20% - < 50% = Predictive Model Capability (Forecasting) Feasible.
> 50% = Poor Predictive (Forecasting) Model Ability.

Then to get the predicted value of permenu sales in the next month (April 2025), it can be done with the following calculations:

Ft = at + bt (m)

Menu "Potatos":
Ft = 95.01 - 12.33 = 107,33
Menu "Chicke Breast":
Ft = 60.44 - 0.22 = 60,67

So the result of the prediction of permenu sales for the "Potato" product is 107.33 and for the Chicken Breast product is 60.67. This prediction provides an estimate of the number of permenu sales in the following month based on the data

analysis carried out. Then the author compares the actual data on the sales of the menu for "Potato" products in April 2025 is as many as 95 and for "Chicken Breast" products is as many as 174.

In April, actual data showed that the number of potato needs was 95, while forecast results showed a figure of 107. From this comparison, the MAPE (Mean Absolute Percentage Error) value for potatoes is 12.63%, which is still quite good because it is within the margin of forecast error tolerance. However, in contrast to the chicken breast, the actual data shows a need of 174, while the forecast results are only 60. This resulted in a very high MAPE value of 65.52%, which indicates a significant prediction error. To follow up on this, I conducted further analysis of the conditions in that month. The results show that in April there is a moment of Eid al-Fitr as well as other national holidays such as collective leave, which has an impact on the sudden and unpredictable surge in demand for chicken breasts by the model.

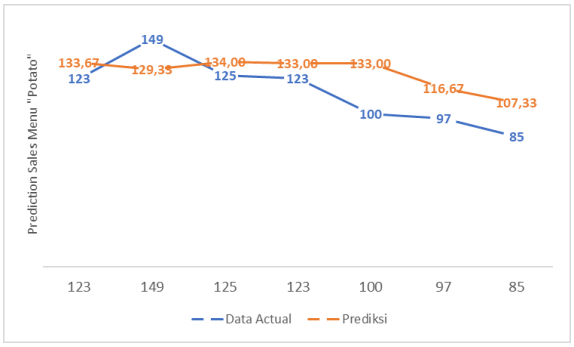

Figure 4. Curva actual vs prediksi menu “Potato”

Figure 4 illustrates the sales prediction of the "Potato" menu item, comparing actual sales data with forecasted values over several periods. The blue line represents the actual sales data, while the orange line shows the prediction results generated by the forecasting model. It can be observed that the prediction line follows a relatively smooth downward trend, maintaining consistency with the actual data despite some fluctuations. Notably, even during periods that may coincide with public holidays or festive events, the sales of the potato menu item did not experience significant spikes or drops. This indicates that consumer demand for this menu item remains relatively stable, and the forecasting model effectively captures this smooth trend over time.

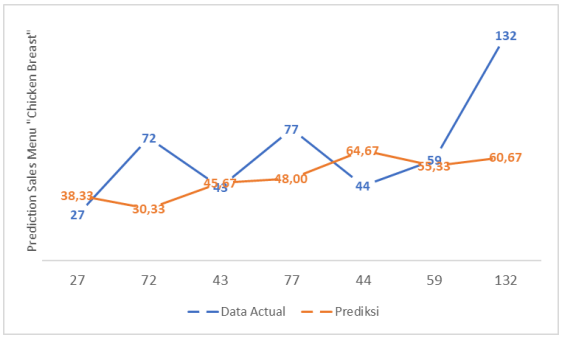

Figure 5. Curva Actual vs prediction menu “Chicken Breast”

Figure 5 displays the sales prediction for the "Chicken Breast" menu item, comparing actual sales data with forecasted values. The blue line represents the actual sales, while the orange line indicates the predicted values. Unlike the "Potato" menu, the sales trend for chicken breast shows significant fluctuations over time. These sharp increases and decreases in actual sales suggest that demand for this product is highly sensitive to external factors. In particular, the presence of public holidays or festive seasons appears to greatly influence customer purchasing behavior, leading to sudden spikes or drops in sales. This highlights the importance of considering seasonal or event-based variables in forecasting models for this menu item.

In making predictions, there are various methods that can be used, but not all methods are suitable for every case [19][20]. In this study, the author chose the Double Moving Average (DMA) method after comparing it with other methods. The selection of this method was based on the consideration that DMA is capable of producing smoother and more stable forecasting patterns, especially for data with short- to medium-term fluctuations. Thus, DMA is considered appropriate for the characteristics of the sales data used in this study.

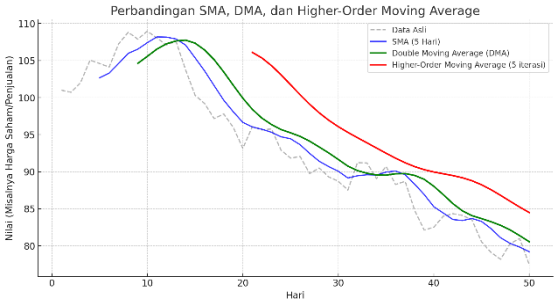

Figure 6. Comparison of Prediction Methods

B. *System Implementation*

The development of this system aims to build an application for predicting individual menu sales (per menu) that can help decision making in stock management and marketing strategies. The system is designed to be able to predict sales based on historical data, with flexible time scales that include daily, weekly, and monthly. With this feature, management can obtain more accurate demand projections according to specific time needs.

Figure 7. Login Pages

Figure 4 shows the page interface *login* of this system. This display consists of two main parts, namely the company logo on the left side and *form login* on the right side. *Form login* loading input for *Username* or *Email, Password*, as well as the Log in button, which is designed with a clean and modern look to make it easier for users to access the system.

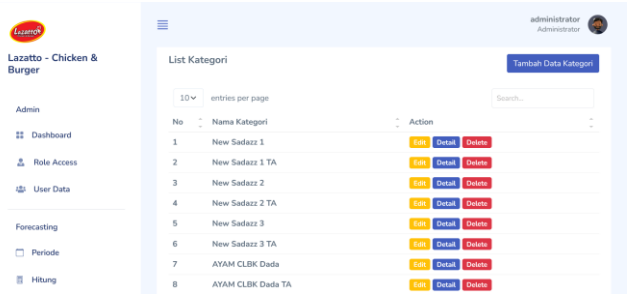

Figure 8. Category Pages

Figure 5 shows the category menu interface, this view is in the admin section, with the main function of managing product category data. On the left side there is a navigation panel with menus such as Dashboard, Role Access, and User Data. The main section displays a table containing a list of categories, including category names and action options such as "Edit", "Details", and "Delete" for each entry. There is also an "Add Category Data" button at the top of the table, which makes it easy for administrators to add new categories. The layout of this interface is designed to be simple and responsive to facilitate data management by users acting as administrators.

Figure 9. Prediction Pages

Figure 6 shows the prediction feature interface. This feature is located in the "Calculate" menu under the "Forecasting" section, which is designed flexibly to predict sales for each menu item in Lazatto, either on a daily or monthly basis. In this example, the system displays a daily sales forecast for the "Potato" menu item using historical data from April 20, 2024 to April 25, 2024. At the bottom of the table, the system displays the prediction results for the next date, which is April 26, 2025, with a prediction value of 1.

Figure 10. Actual and Predicted Data Graph

Figure 7 shows a graphical visualization of the comparison between actual and predicted data. Two colored lines, blue for actual data and green for predicted data, show the sales trend over time. The horizontal axis shows the date range, while the vertical axis shows the sales amount. This graph makes it easy for users to evaluate the accuracy of the prediction model by comparing the actual data with the system's prediction results. There is also an option to download the graph in PNG and PDF formats, which is useful for documentation or reporting purposes.

IV. CONCLUSION

Based on the research results, the implementation of a web-based information system using the Double Moving Average (DMA) method has proven effective in helping Lazatto predict product sales with greater accuracy and efficiency. The forecasting model's accuracy evaluation shows that the average MAPE using the DMA method was 21.19%, with the MAPE for the “Kentang” product in April 2025 being 12.63%, which falls into the "good" prediction category. Furthermore, the time required for planning weekly stock needs was successfully reduced and accelerating the decision-making process. Interviews with three management staff revealed that the system improved access to historical data, simplified trend analysis, and enhanced stock estimation accuracy. With centralized, real-time data access and clear forecasting visualizations, this system not only increases operational efficiency but also provides a strong foundation for procurement strategy and customer service. Therefore, this forecasting system is feasible for broader implementation to support more precise and responsive business decision-making.

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