

Stock Forecasting using Daily Sales Transaction at Hundred Smoke Outlets with the Trend Moment Method

Aditya Prakasa*¹, Sentot Achmadi², Joseph Dedy Irawan³

1, 2, 3 Software Engineering Department, Malang National Institute of Technology, Indonesia

*Corresponding author

E-mail address:

2118110@scholar.itn.ac.id

Keywords:

Bill of materials, forecasting, MAPE, trend moment, website

Abstract

Hundred Smoke Outlet is a culinary business experiencing fluctuating customer demand that changes weekly, creating a risk of imbalance between raw material inventory and actual needs. This research aims to develop a web-based forecasting system using the Trend Moment method that processes daily sales data and converts it into a Bill of Materials (BOM) structure to more accurately predict raw material requirements. The system is designed with two user types: admin and staff, who can manage sales data, inventory, and run the forecasting process. Based on black-box testing results for 11 scenarios across various system features, all functions performed as expected with a 100% success rate. Forecast accuracy was evaluated using the Mean Absolute Percentage Error (MAPE), which showed a maximum error of 0.50, a minimum error of 0, and an average error of 22.62%. These results indicate that the system can provide a fairly good level of accuracy in supporting raw material requirement planning.

1. Introduction

The development of information technology over the past few decades has transformed the way organizations conduct their business processes. In an era of increasingly fierce competition, companies can no longer rely solely on manual record-keeping or intuition for decision-making. Information technology acts as a strategic enabler that can improve operational efficiency, accelerate information flow, and support data-driven decision-making [1]. The use of appropriate information systems has been proven to improve data management accuracy while minimizing the risk of errors that impact business losses [2].

This issue is increasingly crucial in the food and beverage (F&B) sector, which is characterized by fluctuating demand, fast product cycles, and perishable raw materials. Inaccurate inventory planning can lead to two main risks: overstocking, which leads to waste and losses, or understocking, which results in lost sales opportunities and decreased customer satisfaction. Therefore, raw material inventory management in the F&B industry requires timeliness, quantity accuracy, and a decision support system that can anticipate dynamic changes in demand.

Raw material inventory management in the food and beverage industry presents more complex challenges, especially for semi-cooked and fresh ingredients with limited shelf lives. Inaccurately estimating stock requirements can lead to two main risks: overstocking, which leads to decreased quality and even raw material waste, and understocking, which results in menu unavailability and potentially reduced customer satisfaction [3]. This situation demonstrates that inventory management can no longer be done conventionally; instead, it requires a system capable of predicting raw material requirements more measurably and accurately.

Previous research has shown that applying forecasting to inventory management can improve stock planning accuracy and reduce operational costs. For example, a study by Panda et al. (2023) applied time series methods to predict stock requirements in the food industry using regression analysis [4]. Another study by Naresh and Somasundaram (2025) compared multiple regression models to predict time series demand in the food supply chain, demonstrating the effectiveness of statistical and machine learning approaches in improving forecasting accuracy [5]. These findings suggest that using historical data-based forecasting techniques is an effective strategy for improving inventory performance in the culinary industry.

One approach that can be used to address this problem is a forecasting technique based on historical sales data. Forecasting is a method for estimating future value based on past data patterns. In the F&B business context, forecasting plays a crucial role in determining stock requirements based on estimated customer demand [6]. Implementing an appropriate forecasting system can help businesses reduce potential losses due to wasted raw materials while minimizing lost sales opportunities due to stock shortages. However, in practice, many small and medium-sized businesses still use manual inventory management, making them vulnerable to recording errors, delays in data updates, and inaccurate decision-making.

This problem is also experienced by Hundred Smoke Outlet, a culinary business offering a variety of menu options such as Personal, Combo, and Platter dishes. The manual inventory recording process is not only time-consuming but also increases the risk of discrepancies between actual stock levels and sales volume. This discrepancy directly impacts raw material quality, production efficiency, and customer satisfaction levels. Therefore, a system capable of automatically and systematically integrating daily sales transaction data with raw material requirement calculations is needed [7].

One relevant forecasting method to implement is Trend Moment. This method is used to identify upward or downward trends in data over a certain period by analyzing changes in average data values [8]. The Trend Moment method's ability to capture trend patterns makes it suitable for processing dynamic sales data. By implementing this method in a web-based forecasting system, Hundred Smoke Outlet is expected to minimize stock discrepancies, improve the accuracy of raw material planning, and support sustainable operational efficiency.

2. Research Method

2.1. Use Case

The use case design demonstrates a clear separation of access rights (role-based access control) [9] between Admin and Staff, thereby improving data security, reducing the potential for system misuse, and clarifying the responsibilities of each user. Figure 1 shows a system use case diagram that illustrates the interactions between actors and features available in the system. There are two types of users involved in managing sales and transaction data: Admin and Staff. Admin has access to all system features, except the cashier feature, thus playing a role in overall data management, including inventory management and forecasting processes. Meanwhile, Staff is responsible for managing daily sales and transaction data which will later become the basis for the calculation of raw material requirements.

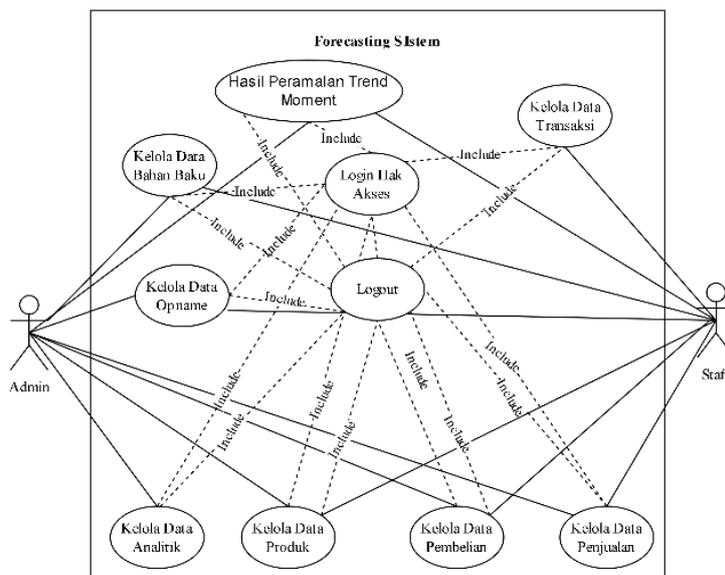


Figure 1. Use case diagram

2.2. Block Diagram System

Figure 2 shows the process of forecasting raw material inventory requirements using the trend moment method. The Trend Moment method has been widely researched and shows relatively superior performance compared to several other forecasting methods [10]. The block diagram of the raw material forecasting system illustrates the integrated system workflow, from input to storage of forecast results. In the Input Layer, the system receives data from users (Admin and Staff), raw material stock data, and the Bill of Materials (BOM) structure. Incoming sales data is then processed in the Processing Layer, converting sales into raw material requirements based on the BOM, followed by forecasting using the Trend Moment method. The forecast results are displayed in the Output Layer as graphic visualizations on the dashboard, making it easier for users to monitor stock requirement trends. The entire process is executed through a Laravel-based Web App with assigned access rights according to role (Admin and Staff). In the Database layer, the system stores sales data, stock data, product and BOM data, and forecasting data. The final output, predicted raw material requirements data, is stored as a reference for making procurement decisions in the next period.

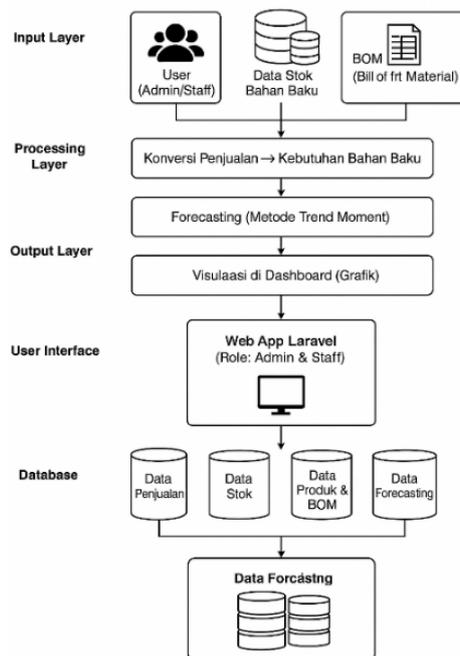


Figure 2. Block diagram system

2.3. Method Flowchart

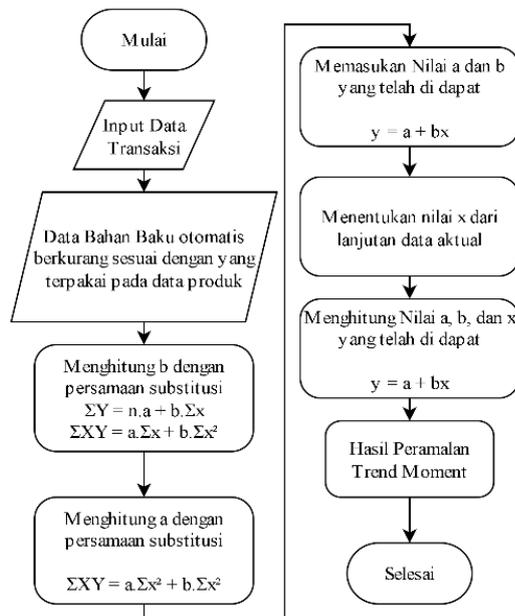


Figure 3. Method flowchart

The method flowchart shown in Figure 3 illustrates the algorithm flow that uses the Trend Moment method to predict raw material stock requirements. The forecasting process begins by taking historical raw material stock data, then calculating the constant value (a) and trend coefficient (b) [11] using Equations (1) and (2).

$$\sum Y = n \cdot a + b \sum X \quad (1)$$

$$\sum XY = a \sum X + b \sum X^2 \quad (2)$$

These two equations are derived from the simple linear regression method using the least squares approach, which aims to determine the best trend line based on the relationship between the time variable (X) and the stock requirement (Y). This equation is used to obtain the parameter values a (intercept) and b (slope), where a indicates the initial value when X = 0, while b indicates the rate of change or the upward or downward trend of the data over time.

$$Y = a + bX \tag{3}$$

Equation 3 generates an estimate of raw material stock requirements for the upcoming period. This process enables the system to quantitatively and objectively identify demand trends based on historical data. This approach supports more strategic, planned, and data-driven raw material procurement decisions, minimizing the risk of overstocking or understocking.

2.4. Menu Structure

The menu structure created is used to group menus into appropriate categories to simplify application development. There are two menu structures: the Admin Menu Structure and the Staff Menu Structure. Figure 4 shows the menu structure for the Admin, who has full access to all system functions. The Admin's role is strategic because they are responsible for comprehensive data management and control. Accessible features include user data management, stock and sales data management, product data processing, raw material stock requirement calculations, and stock and sales report generation. With this scope of access, the Admin functions not only as a system manager but also as a decision-maker utilizing the information generated by the system.

This menu structure is designed hierarchically and integrated, so that each module is interconnected within a complete business process flow. For example, inputted sales data will automatically influence raw material requirement calculations and subsequently be reflected in the stock report. This integration enables real-time data synchronization, minimizing information redundancy and inconsistency. Furthermore, the reporting feature supports operational performance monitoring and evaluation. Admins can analyze sales patterns, raw material usage levels, and potential stock discrepancies to determine future procurement strategies. Thus, the Admin menu structure not only supports administrative functions but also strengthens the control, analysis, and data-driven decision-making functions within the raw material inventory forecasting system.

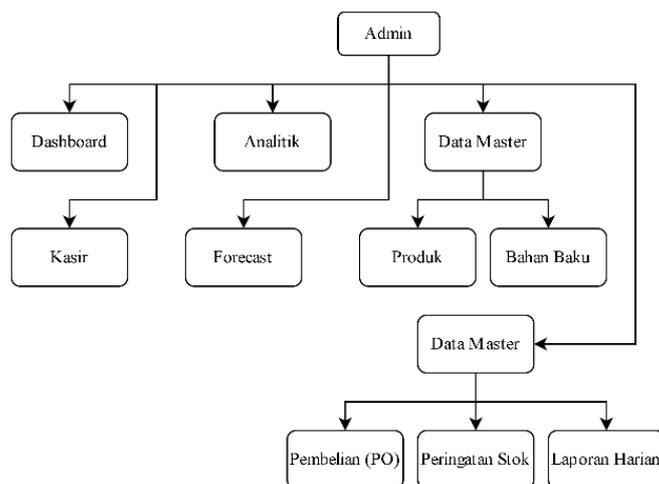


Figure 4. Admin menu structure

Figure 5 shows the menu structure for Staff, who focus on daily system operations, specifically managing raw material inventory data and sales transactions, as well as monitoring forecasting results. Staff have the authority to add, edit, and delete product and transaction data, thus playing a direct role in ensuring that data entered the system is accurate and up to date. This menu structure is designed to be simpler than that for Admin, to simplify use and reduce the complexity of features irrelevant to operational tasks. This restriction of access rights not only enhances system security but also minimizes the risk of errors in data management strategies. Transaction data input by Staff forms the primary foundation of the forecasting process, so accuracy in data management is crucial for the accuracy of raw material requirement predictions.

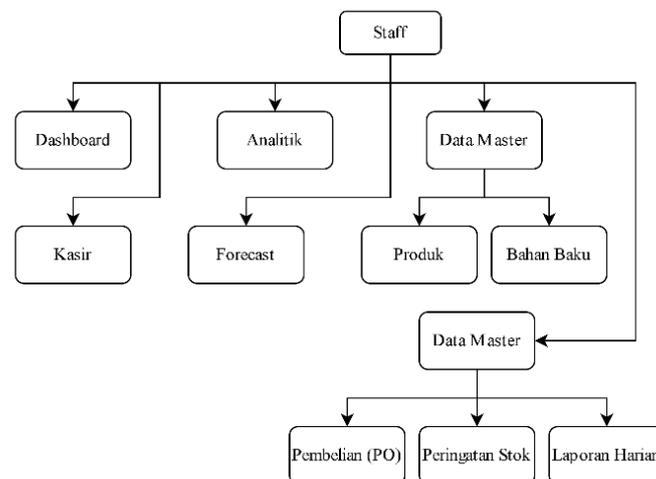


Figure 5. Staff menu structure

Furthermore, the forecasting monitoring feature allows Staff to determine estimated stock requirements for the following period, allowing them to prepare before the Admin initiates the procurement process. Thus, the Staff menu structure supports smooth operations while ensuring the integrity of the data used in the forecasting system.

2.5. Functional and Non-Functional Requirements

Functional requirements encompass all the key processes that must be implemented by the system to meet user needs [12]. These requirements describe the services, features, and functions that must be available to support optimal system operation. With a clear definition of functional requirements, the system development process can be carried out in a focused and measurable manner, ensuring that each feature built truly meets user needs. The description of the system's functional requirements is as follows:

- a. Welcome Pages introduce the application to be used.
- b. Login with admin or user access rights to determine whether you are registered with the system and have access to the web application.
- c. The dashboard displays the main page, which contains the number of daily transactions, daily revenue, and displays best-selling products. It also provides quick access to the cashier (<http://127.0.0.1:8000/kasir>) and purchase orders (<http://127.0.0.1:8000/purchases/create>).
- d. The system can record product data, raw material stock requirements, sales data, and transaction data, including creating, editing, and deleting data.
- e. The system can forecast the amount of raw material stock needed by using momentary trends to help predict raw material inventory management.
- f. Analytics displays forecasting analysis or graphs and actual data.
- g. Products contain product details and a Bill of Material (BOM) that serves as a reference for forecasting.
- h. The Raw Materials menu provides information on raw material requirements, available stock levels, and raw material shortages.
- i. Purchase Orders (POs) are used to order raw materials that are out of stock or about to run out.
- j. Stock alerts will display a warning if stock falls below the outlet's minimum stock availability limit.
- k. Daily reports display buttons for reporting daily transactions and remaining raw materials.

In addition to functional requirements, the system has non-functional requirements that support its overall quality and performance [13]. Non-functional specifications are not directly related to the system's primary function, but instead address aspects such as performance, security, noise, usability, and system compatibility. Meeting these requirements is crucial to ensuring the system runs optimally, stably, and meets user operational needs. The following is a description of the non-functional requirements required by the system:

- a. The system must be sufficiently responsive to the device used to access it.
- b. The system must have a simple UI to make it easier for users to understand its functions.
- c. The application can be accessed and run on various platforms (Windows, macOS, and Android) through a built-in web browser like Chrome.

3. Results and Discussion

This section will discuss the results of the system implementation, including the interface display, the Trend Moment method testing process, and functional testing of the system using the Black Box method. This discussion aims to demonstrate the alignment between system design and implementation, assess the accuracy of the forecasting method, and convey the developed features.

3.1. The Interface Display

Figure 6 displays the login page, which identifies and verifies a user's identity before accessing the system. After successful authentication, the user is automatically directed to the dashboard based on their role, ensuring security and access rights management. Figure 7 shows the Admin Dashboard, which presents a comprehensive summary of operational information, including daily revenue data, the number of transactions for the day, best-selling products, low stock alerts, and quick access to cashier and purchasing features. This display is designed as a control center to help Admins monitor business performance in real-time and support quick, accurate decision-making. Figure 8 displays the Cashier Page, used to record all sales transactions. Recorded transaction data is automatically saved daily in summary form and accumulated as historical data. This historical data is then used as the basis for forecasting raw material requirements.

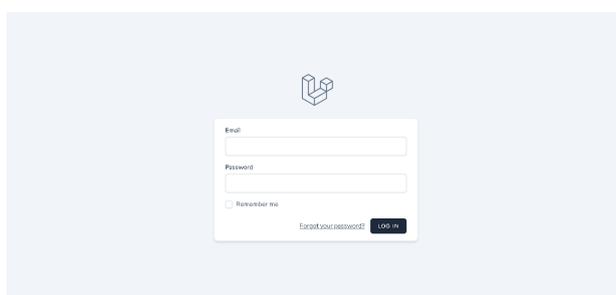


Figure 6. Login page

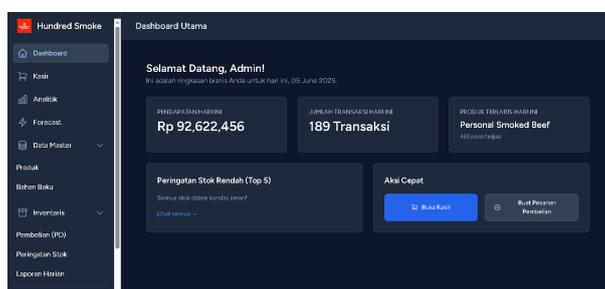


Figure 7. Admin dashboard

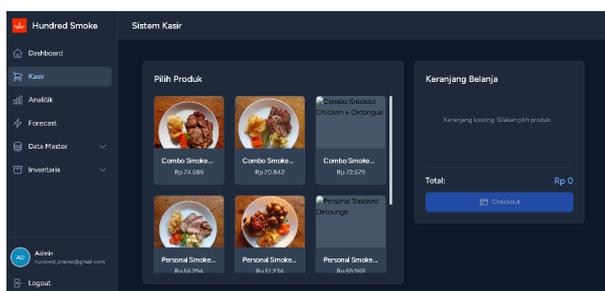


Figure 8. Cashier page

Figure 9 shows the Analytics Page, which presents a graphical visualization of actual raw material usage based on a selected period. This feature allows users to analyze raw material usage patterns over time, making it easier to identify consumption trends. Figure 10 displays the Forecasting Page, used to predict future raw material stock requirements. The system provides flexible forecasting periods, such as daily, weekly, or custom periods tailored to specific needs, such as long seasons or periods of high demand. This feature is a key component in supporting more structured and data-driven inventory planning. Figure 11 shows the Daily Report Page, which presents detailed historical raw material

usage data, including grammage information and total costs. This report serves as an evaluation tool to control the efficiency of raw material use and monitor operational expenses periodically.



Figure 9. Analytics page

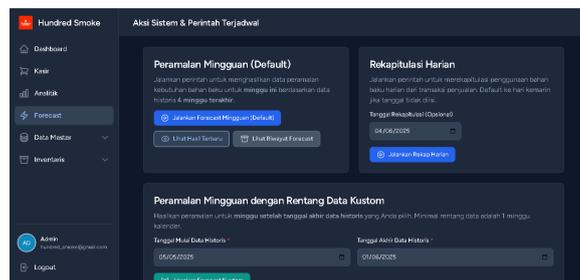


Figure 10. Forecast page

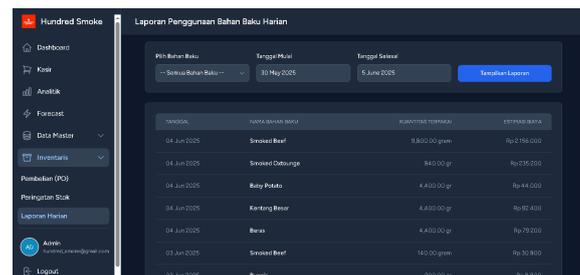


Figure 11. Daily report

3.2. Trend Moment Method Testing

Table 2 presents weekly chicken stock data at Hundred Smoke Outlet for 8 weeks in September 2023. This data is used as the basis for forecasting using the Trend Moment method. Furthermore, Table 3 shows the calculations of the components required in this method, namely the values of the variables Y , X , X^2 , dan XY . After all components are obtained, the next step is to calculate the constant parameters (a) and regression coefficients (b) using Equations (1) and (2). Based on the results of these calculations, the trend equation model obtained is:

$$Y = 16,125 + 14X$$

This equation is then used to calculate the predicted value (Y) in the next period according to Equation (1). The results of the predicted stock calculation for the next period are shown in Table 4 as an estimate of the need for raw chicken materials.

Table 2. Chicken stock data

No	Period	Stock
1.	Week 1	34
2.	Week 2	40,5
3.	Week 3	47,75
4.	Week 4	31
5.	Week 5	25,75
6.	Week 6	24,75
7.	Week 7	27
8.	Week 8	32,25

Table 3. Chicken calculation

No	Period	y	x	x ²	xy
1.	Week 1	34	0	0	0
2.	Week 2	40,5	1	1	40,5
3.	Week 3	47,75	2	4	95,5
4.	Week 4	31	3	9	93
5.	Week 5	25,75	4	16	103
6.	Week 6	24,75	5	25	123,75
7.	Week 7	27	6	36	162
8.	Week 8	32,25	7	49	225,75
Σ		263	28	140	843,5

Table 4. Moment trend

No	Next period	x	Stock
1.	$y = 16,125 + 14x$	9	20,175
2.	$y = 16,125 + 14x$	10	156,125
3.	$y = 16,125 + 14x$	11	170,125
4.	$y = 16,125 + 14x$	12	184,125
5.	$y = 16,125 + 14x$	13	198,125
6.	$y = 16,125 + 14x$	14	212,125
7.	$y = 16,125 + 14x$	15	226,125
8.	$y = 16,125 + 14x$	16	240,125

After obtaining the actual and forecasted data, the next stage is to evaluate accuracy using the Mean Absolute Percentage Error (MAPE), as presented in Table 5. The test results show variations in the prediction error level, with the highest error value being 0.50 and the lowest error value being 0.00. Overall, the average error value (MAPE) obtained was 22.62%.

Comparative evaluation between different time series forecasting models helps determine the most appropriate model for a given dataset, including with accuracy evaluation metrics such as MAPE [14]. Based on the MAPE evaluation criteria commonly used in forecasting literature, a MAPE value <10% is categorized as very accurate, 10%–20% is categorized as good, 20%–50% is categorized as sufficient (reasonable forecasting), and >50% is categorized as less accurate [15]. Thus, the MAPE value of 22.62% indicates that the applied Trend Moment model is included in the good category and is suitable for use as a basis for stock planning decisions, although there is still room for accuracy improvement in further research.

Table 5. MAPE Calculation Results

No	At	Ft	Error	Abs error	Abs error / act
1.	34	20,175	-14	14	0,06
2.	40,5	156,125	-115	115	0,24
3.	47,75	170,125	-122	122	0,36
4.	31	184,125	-153	153	0,07
5.	25,75	198,125	-172	172	0,20
6.	24,75	212,125	-187	187	0
7.	27	226,125	-199	199	0,50
8.	32,25	240,125	-208	208	0,09
Total					2,71
MAPE (%)					22,6

3.3. Black Box Testing

Based on Table 6, Black Box testing, which involved 11 tests on several website features, showed that all features functioned as expected and achieved 100% success. Each test scenario was conducted to verify the correspondence between user input and system output, regardless of the internal code structure. The 100% success rate in this test indicates that all key system functions, such as login, sales data management, stock management, forecasting calculations, and report presentation, operate in accordance with the previously designed functional requirements

specifications. This demonstrates that the system can handle input validation, data storage, data retrieval, and processing consistently.

Furthermore, the test results also demonstrate that the integration between modules, from transaction recording to forecasting, operates without functional errors. Therefore, the system is deemed suitable for implementation in an operational environment, as it meets the requirements of leanness (reliability) and functional suitability (functional suitability). However, Black Box testing focuses only on functional aspects. Therefore, for further development, additional testing, such as performance testing or load testing, is recommended to ensure the system remains stable when used on a larger transaction scale.

Table 6. Black Box Testing

No	Test	Expected	Test results	Test results description
1.	Login Page	Registered username and password can log in	The system can access the dashboard page	Successful
2.	Dashboard page	displays daily revenue and frequently ordered menus	The feature for displaying revenue and frequently ordered menus is successfully displayed	Successful
3.	Cashier page	CRUD and import product purchase data pages can be performed	The CRUD and import product purchase data systems are functioning properly	Successful
4.	Analytics page	Displays graphs of actual raw material data and forecast data	The system can display graphs of actual raw material data and forecast results	Successful
5.	Forecast page	Trend moment method calculations on the forecast page can be performed	The system can process trend moment method calculations and function properly	Successful
6.	Product page	CRUD for product data pages can be performed	The CRUD for product data is functioning properly	Successful
7.	Raw Material data page	CRUD for raw material stock pages can be performed	The CRUD for raw material stock data is functioning properly	Successful
8.	Purchase page	Create, Read purchase pages can be performed	The system can process purchases and function properly	Successful
9.	Stock Warning Pages	The page can display a list of raw materials that must be ordered immediately	The system can process raw material needs that must be met immediately and function properly	Successful
10.	Results Report Page	The page displays daily raw material usage	The system displays the raw material usage and is functioning properly	Successful
11.	Logout	Exit as a user and return to the Welcome page	The system can exit the website and return to the Welcome page	Successful

4. Conclusion

This study demonstrates that the Trend Moment method can be effectively applied to predict weekly raw material stock requirements at Hundred Smoke Outlet. Evaluation results using MAPE showed a maximum error of 0.50, a minimum error of 0.00, and an average error of 22.62%. Based on the MAPE evaluation criteria, these values are considered good enough and suitable for use as a basis for inventory planning decisions. The developed web-based forecasting system can process historical sales data into estimates of raw material requirements that are close to actual conditions, thus supporting efficient inventory management and minimizing the risk of overstocking or understocking. Furthermore, Black Box testing results for 11 test scenarios indicated that all system features performed according to functional requirement specifications with a 100% success rate, indicating that the system met performance and functional suitability requirements. For further development, the system is recommended to be updated regularly according to the dynamics of sales data, further integrated with the cashier and production modules so that the business flow is increasingly automated, and comparisons are made with other forecasting methods such as Moving Average, Exponential Smoothing, and ARIMA to improve prediction accuracy and strengthen the system's accuracy in supporting daily operations.

References

- [1] A. Fauzan, D. G. Rahayu, A. Handayani, I. Tahyudin, D. I. S. Saputra, and P. Purwadi, "Sales Forecasting Analysis Using Trend Moment Method: A Study Case of a Fast Moving Consumer Goods Company in Indonesia," *Journal of Information Technology and Cyber Security*, vol. 1, no. 1, pp. 1–8, Jan. 2023, doi: 10.30996/jitcs.7572.
- [2] J. Hutagalung, S. Nurarif, R. Kustini, S. Kusnasari, and R. Gunawan, "PREDICTION OF DRUG SALES DURING A PANDEMI USING THE TREND

- MOMENT METHOD," *JURTEKSI (Jurnal Teknologi dan Sistem Informasi)*, vol. 9, no. 1, pp. 33–40, Dec. 2022, doi: 10.33330/jurteksiv9i1.1572.
- [3] H. Koesman, R. R. Sinaga, H. Hariyharan, and A. Anita, "SISTEM PREDIKSI KEBUTUHAN STOK BAHAN POKOK MENGGUNAKAN METODE TREND MOMENT," *Jurnal Teknik Informasi dan Komputer (Tekinkom)*, vol. 7, no. 2, p. 954, Dec. 2024, doi: 10.37600/tekinkom.v7i2.1534.
- [4] Panda, S. K., & Mohanty, S. N. (2023). Time Series Forecasting and Modeling of Food Demand Supply Chain Based on Regressors Analysis, *IEEE Access*, 11, 42679–42700, doi: 10.1109/ACCESS.2023.3266275
- [5] K. Naresh & M. M. Somasundaram (2025). Time Series Forecasting and Modeling of Food Demand Supply Chain Based on Regressors Analysis, *Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol.*, 11(3), 475–488.
- [6] Nasution, R. N. (2022). Sistem Analisis Prediksi Penjualan Vitamin di Apotek Menggunakan Metode Trend Moment. *JURIKOM (Jurnal Ris. Komputer)*, 9(5), 1356, doi: 10.30865/jurikom.v9i5.4715
- [7] Firmansyah, M. A., Sasmito, A. P., & Zahro, H. Z. (2021). Aplikasi Forecasting Penjualan Bahan Bangunan Menggunakan Metode Trend Moment (Studi Kasus Di Ud. Hasil Bumi). *JATI (Jurnal Mahasiswa Teknik Informatika)*, 5(2), 526-533, doi: 10.36040/jati.v5i2.3759
- [8] Putra, J. V. P., Mahdiyah, U., & Sanjaya, A. (2023, July). Penggunaan Metode Trend Moment Untuk Proses Peramalan Jumlah Stok Penjualan Snack. In *Prosiding SEMNAS INOTEK (Seminar Nasional Inovasi Teknologi)* (Vol. 7, No. 2, pp. 929-936).
- [9] E. B. Fernández and J. C. Hawkins, "Determining role rights from use cases," in *Proceedings of the Second ACM Workshop on Role-Based Access Control (RBAC '97)*, Fairfax, VA, USA, 1997, pp. 121–125, doi: 10.1145/266741.266767.
- [10] A. Fauzan, D. G. Rahayu, A. Handayani, I. Tahyudin, D. I. S. Saputra, and Purwadi, "Sales forecasting analysis using trend moment method: A study case of a fast moving consumer goods company in Indonesia," *Journal of Information Technology and Cyber Security*, vol. 1, no. 1, pp. 1–8, Jan. 2023, doi: 10.30996/jitcs.7572.
- [11] J. Adeputra, H. Pratiwi, and Wahyuni, "Optimization of spareparts stock data management at PT. Astra Motor Kaltim 2 using the trend moment method," *International Journal of Information System & Technology (IJISTECH)*, vol. 8, no. 6, pp. 326–332, 2025.
- [12] C. Dongmo, "A review of non-functional requirements analysis throughout the SDLC," *Computers*, vol. 13, no. 12, p. 308, Nov. 2024, doi: 10.3390/computers13120308.
- [13] V. De Martino and F. Palomba, "Classification and challenges of non-functional requirements in ML-enabled systems: A systematic literature review," *Information and Software Technology*, vol. 181, p. 107678, 2025, doi: 10.1016/j.infsof.2025.107678.
- [14] N. Maragkos and I. Refanidis, "A comparative evaluation of time-series forecasting models for energy datasets," *Computers*, vol. 14, no. 7, p. 246, 2025, doi: 10.3390/computers14070246.
- [15] A. Rokhmawati, V. Sarasi, and L. T. Berampu, "Scenario analysis of the Indonesia carbon tax impact on carbon emissions using system dynamics modeling and STIRPAT model," *Geography and Sustainability*, vol. 5, no. 4, pp. 577–587, 2024, doi: 10.1016/j.geosus.2024.07.003.